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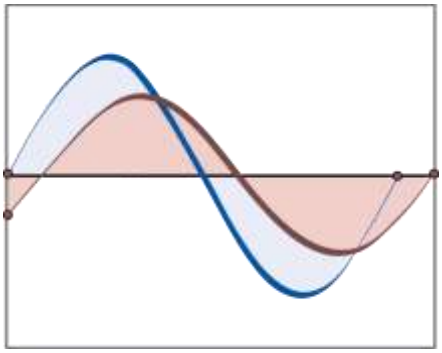

Coordination of Monetary and Fiscal Policies in Trinidad and Tobago

Avinash Ramlogan and Sandra Sookram
Research Department

Abstract

The purpose of this paper is to investigate the extent of coordination between monetary and fiscal policies in Trinidad and Tobago from 1993 to 2016. To achieve this objective, the paper first adopts the Granger causality/Block Exogeneity Wald test (and cointegration test if necessary) to determine whether these policies are implemented independently. Testing for independence is necessary since only independent institutions are in a position to engage in economic policy coordination. If independence is observed, the extent of coordination is then estimated using: (i) the Set-Theoretic Approach (STA); and (ii) the vector autoregressive (VAR) modelling framework. The analysis reveals that policy coordination has been weak throughout the review period. Coordination improved following the 2008/09 global financial crisis as both fiscal and monetary authorities came together to revive the economy. The results point to the need for the policy-making authorities to improve coordination to enable sustainable long-term growth with low inflation in the country.

JEL Classification: E61, H30

Keywords: Monetary Policy, Fiscal Policy, Coordination, Low Inflation, Sustainable Growth

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1. Introduction

Policy coordination is an often overlooked element of macroeconomic management yet developments occurring internationally frequently highlight its importance for countries and regions. One such event was the 2008/09 global financial crisis. The crisis, which began in the United States (US) 'subprime' mortgage market, was quickly transmitted to the rest of the world. The crisis left policymakers in many countries struggling to foster growth and price stability. Research has shown that many of them engaged in some degree of coordination between monetary and fiscal policies to revive their economies (Gomes da Silva and Vieira (2014)). Across the globe, central banks adopted highly accommodative monetary policies (including unconventional monetary policies in the case of advanced economies) to stabilize financial markets while governments' fiscal policies became expansionary with the aim of stimulating aggregate demand.

Policy coordination is a timely and relevant topic from the perspective of the economic challenges facing Trinidad and Tobago (TT) in recent years. It is clear that the domestic economy has been experiencing a negative terms-of-trade shock as a result of the substantial decline in international energy prices since mid-2014. This shock also coincided with a fall-off in local energy production. The impact of these developments is already evident in terms of the challenges facing government's revenue and the deterioration in the country's balance of payments. Since energy revenue is a major source of government's expenditure, the spillover effects have been felt throughout the non-energy sector. There is also a high degree of uncertainty surrounding when energy prices are likely to recover from their current levels.

In the case of TT, macroeconomic management is carried out using two key types of policies. One is fiscal policy, which involves the collection of public revenues through taxation and allocating the same through spending in various sectors of the economy. National budgets prepared by the fiscal authority (Ministry of Finance of Trinidad and Tobago) reflect the fiscal policy of the government. The main aim of fiscal policy is to achieve high growth with low unemployment. Monetary policy, on the other hand, involves controlling the country's financial resources (such as foreign exchange reserves and credit) by operating on the monetary aggregates or interest rates. This is the function of the monetary authority (i.e. the Central Bank of Trinidad and Tobago (CBTT)). The main aim of monetary policy is to ensure low and stable inflation. Given the uncertainty surrounding energy prices, it is crucial that the country's macroeconomic policies (in particular monetary and fiscal policies) are implemented to achieve the greatest possible success in terms of output and inflation by ensuring that resources are allocated in the most efficient manner.

The theoretical literature has produced a number of studies on the benefits of policy coordination. High levels of coordination implies a reduction in the potential for policy conflicts that could result in the economy operating at a lower than optimal level, a greater ability to respond to adverse external shocks, a sustainable growth path alongside low inflation, and an overall improvement in the economic well-being of citizens of the country. However, coordination may not always be desirable and also extremely difficult to achieve in practice Blinder (1982). In his paper, Blinder (1982) noted that a lack of coordination may be due to three main reasons: (i) different objectives of monetary and fiscal authorities on the economy; (ii) different opinions on the implications of policy actions on the economy; and (iii) different forecasts on the state of the economy used by the two authorities.

The available studies related to the issue of monetary and fiscal coordination in TT are few. Measuring policy coordination and understanding the interaction is a key step in addressing potential problems of weak policy coordination in the economy. This paper attempts to quantify the extent of the coordination over the period 1993 - 2016. The rest of the paper is organized as follows: Section 2 provides a review of related theoretical and empirical literature. Section 3 describes some of the stylized facts focusing on issues relating to recent policy behaviors in TT. Section 4 describes the methodology used to assess the extent of the relation between the monetary and fiscal policies. Section 5 is a presentation of the results along with an analysis of the findings. Finally, Section 6 will conclude with some brief policy implications.

2. Literature Review

Coordination refers to the necessary arrangements between the monetary and fiscal authorities which ensure that policy actions are taken in a consistent manner (Haleim, 2016). The issue of policy coordination has been given much attention in the economic literature over the years. Below is a review of the important theoretical and empirical literature on this issue.

The interactions and potential conflicts associated with these two types of policies can be found in the traditional Mundell-Fleming model which requires both internal and external balance to be met (Fleming, 1962, Mundell, 1962). Later, Sargent and Wallace (1981) described the interaction of these policies as a game of chicken which requires coordination in order to achieve Pareto efficiency in an economy. According to Sargent and Wallace (1981), the fiscal authority being the agent for fiscal policy, dominates the policy environment and makes the first move which effectively dictates the actions of the monetary authority - like a game of chicken. The authors noted that when fiscal policy operates in a dominant way the ability to effectively carry out monetary policy is compromised and inflation objectives are unable to be met. The potential for policy dominance was also noted in Togo (2007) who pointed out the need to have these two policies coordinated and carried out independently so as to avoid an inappropriate mix of policies.

Other studies viewed the interaction between monetary and fiscal policies as a game between the monetary and fiscal authorities. For example, Tabellini (1985) found that coordination of policies in response to shocks increases the economy's speed of convergence to the steady state and planned target outcomes. Further, Nordhaus (1994) explained that non-cooperative policies played by monetary and fiscal authorities will result in a Nash equilibrium with higher interest rates and lower economic growth, but a strategy that involves coordination between authorities can yield a Pareto outcome with low inflation and higher economic growth. Dahan (1998), studying the budgetary implications of central bank actions and monetary implications of fiscal actions, also stressed the need for coordination of both polices. Recently, Bianchi and Milosi (2017) studied the effects of the lack of policy coordination with particular emphasis on the zero-bound period. They found that the lack of coordination can lead to an explosive dynamics of inflation and large output losses.

Policy coordination is also viewed as crucial for macroeconomic management within a monetary union. In a monetary union whereby monetary policy is carried out by a single central bank but fiscal policy is the work of individual member countries, fiscal policies (e.g. government deficits) in one country can have adverse spillover effects on other member countries and lead to inefficient outcomes for the monetary union (Cabral and Diaz, 2015). The possibility of spillover implications justifies the need for all members to engage in fiscal policy coordination in the European Monetary Union (EMU) (Ferre, 2008).

Several empirical studies devoted to policy interaction found that, in practice, there is evidence of a lack of strong coordination in many economies. This is especially so in small open economies, emerging markets and developing economies (EMDEs), including oil-producing economies. There are several reasons for the lack of policy coordination in these economies. Some of these can be found in Worrell (2000) where a high degree of coordination is often absent in small open economies due to: (i) the limited effectiveness of monetary policies, (ii) fiscal indiscipline; (iii) the lack of well-developed financial markets; (iv) uncertainty about monetary policy transmission; and (v) potential conflicts between monetary policy and other central bank objectives. Jayaraman (2016) also explained that small open economies are particularly vulnerable to external shocks, such as commodity prices (e.g. energy and food prices). In some oil-producing countries, governments often display fiscal indiscipline (or adopt highly pro-cyclical spending behaviors). These economies are also plagued by budgetary planning challenges including issues relating to inter-generational equity and fiscal sustainability. These issues may contribute to the lack of policy coordination which results in weak long-run growth performances and high inflation among oil-producers (Sturm et al. (2009)).

Muscatelli et al. (2002) investigated the response of monetary and fiscal policy to macroeconomic targets in G7 countries, using a VAR modelling technique. The results showed that monetary and fiscal policies were used as strategic complements. The form of interaction is asymmetric and differs across countries. In the US and UK, monetary policy reacted (i.e. through a decline in the interest rate) significantly to a fiscal expansion. In the case of Italy, Germany, and France, the study did not find any clear monetary policy reaction.

In terms of developing economies, the degree of policy coordination was investigated in Tarawalie et al. (2013) for the West African Monetary Zone (WAMZ) countries. The study employed a Set Theoretic Approach (STA) and VAR modelling technique using data covering the period 1980 – 2011. The study revealed the existence of weak policy coordination in all the WAMZ countries over the period, contributing to the non-compliance with respect to inflation and fiscal deficit criteria of the WAMZ. The STA results showed a policy coordination of less than 50% with Gambia attaining a score of 41.6%, Ghana (35.4%), Guinea (31.8%), Liberia (37.9%), Nigeria (46.6%) and Sierra Leone (41.3%).

Also, Arby and Hanif (2010) studied the extent of policy coordination for Pakistan. The sample period covered by the study is 1965 – 2009. The methodology involved the Granger causality test and cointegration analysis to determine the independence of both monetary and fiscal authorities. The STA approach was used to calculate the extent of policy coordination. The STA was calculated at 27% which suggests weak policy coordination. Andlib et al. (2012) also empirically analyzed this issue for Pakistan. The approach adopted is the unrestricted VAR model and data utilized covered the period 1980 – 2011. The results of the VAR test showed evidence of weak policy coordination and that shocks to monetary and fiscal variables have an insignificant impact on each other.

Policy coordination was also explored in Haleim (2016) for Egypt. The study covered the period 1974 - 2015, and adopted the approach of Arby and Hanif (2010). The results showed that policy coordination was weak over the period. The weak coordination is due to high fiscal deficits that put pressure on monetary policy to conduct its objective in stabilizing prices. The study indicated that there is further room to improve coordination between policies.

The interaction between monetary and fiscal policies in India was examined in Sethi (2016). The study used the VAR/VECM modelling technique and monthly data covering the period April 2010 to March 2015. The study found that fiscal policy responds well to changes in monetary policy but the reverse is not taking place. The study indicated that coordination of monetary and fiscal policies is a sufficient condition to achieve financial stability in the Indian economy.

Valdivia and Perez (2013) studied monetary and fiscal policy coordination in the Latin American region (i.e. Bolivia, Brazil, Chile, Colombia, Peru, Uruguay, Venezuela) during the periods 2007-2008 and 2009-2010, through the application of a dynamic stochastic, general equilibrium model specified in parameters for each country and comparable in structure to each other. The results showed that there is effectiveness in the implementation of coordinated policies. The results also revealed that the degrees of policy coordination are very important in explaining the fundamentals of the economies.

In light of the dearth of research in this area, our study will be a meaningful addition to the existing literature particularly in relation to the Caribbean region.

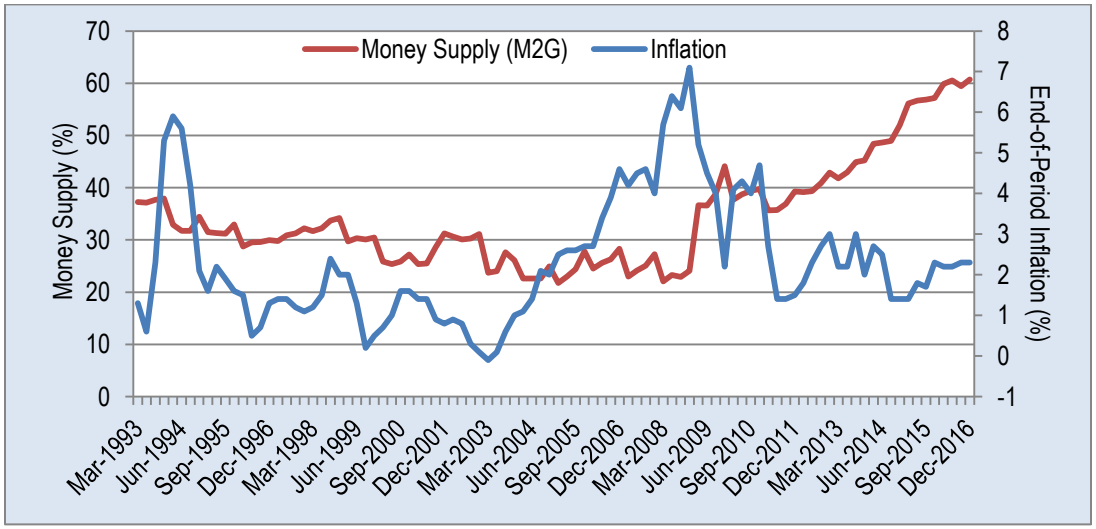
3. Improving Policy Coordination in the Current Economic Climate

TT is a small, open, energy-based economy with a managed float exchange rate regime and free capital flows. These characteristics have applied to the economy since April 1993 when the country embarked on financial liberalization measures. These characteristics also play an important role in the context of possibilities for policy coordination since there is more room for monetary and fiscal policies to achieve their desired goals without one compromising the ability of the other.

The main objective of monetary policy in TT is price stability. Achieving price stability is essential to achieving low and stable inflation in the economy. Under the current arrangement, price stability is achieved through changes in the Central Bank's policy interest rate; the Repo rate; but also through ensuring exchange rate stability.

Figure 1 shows the trends in inflation (core) and the money supply over the period 1993 – 2016. It can be seen from the graph that inflation increased moderately between 2003 and 2008 although the Central Bank took measures to tighten monetary policy by increasing interest rates and mopping-up excess liquidity. The Central Bank, however, was unable to fully address the excess liquidity in the system which came from high government fiscal injections at the time. Over this period the money supply did not contract but remained relatively stable. With the advent of the 2008/09 global financial crisis, the Central Bank moved to ease monetary policy by lowering its policy interest rate. This monetary stance was adopted within the context of relatively low domestic inflation and the need to stimulate non-energy sector growth. This period also saw a substantial increase in the money supply.

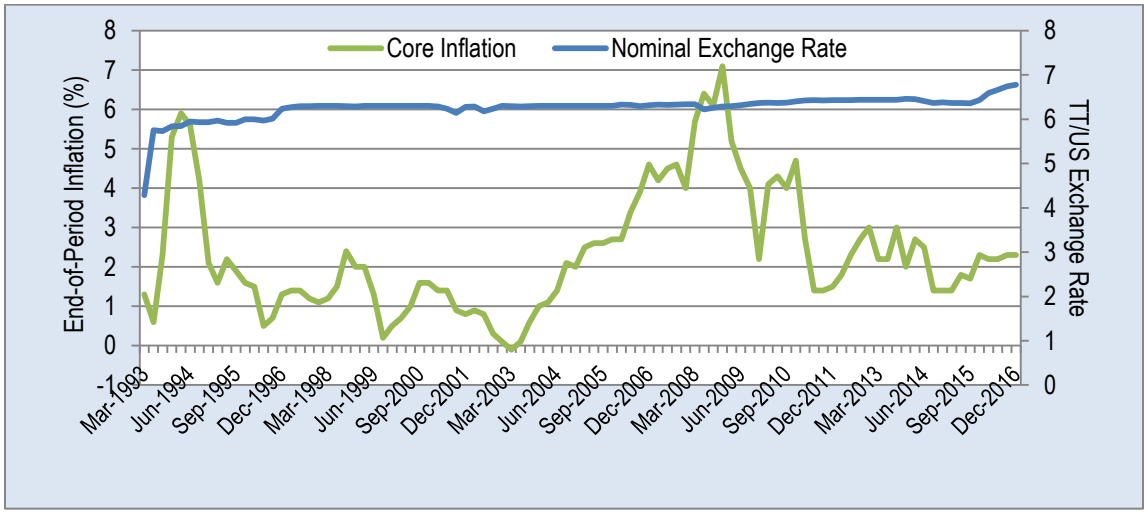
Figure 1: The Money Supply and Inflation Link (1993-2016)



Note: M2G refers to the money supply-to-GDP ratio
Sources: Central Bank of Trinidad and Tobago and the Central Statistical Office

Exchange rate stability is an important element of monetary policy formulation in TT given the high degree of openness of the domestic economy. Significant depreciations can potentially lead to increasing prices for imports which form a major part of local consumption. Possible significant exchange rate depreciations can also trigger speculative demand for foreign exchange which can put pressure on the country's gross official reserves. Figure 2 shows the trends in the nominal exchange rate which depreciated significantly soon after floatation in April 1993, but remained relatively stable throughout most of the review period. In line with the stable exchange rate, core inflation, which excludes the more volatile component food inflation rate, grew moderately during the period Q2: 1993-QIV: 2016.

Figure 2: Moderate Inflation and Exchange Rate Stability (1993-2016)



Sources: Central Bank of Trinidad and Tobago and the Central Statistical Office

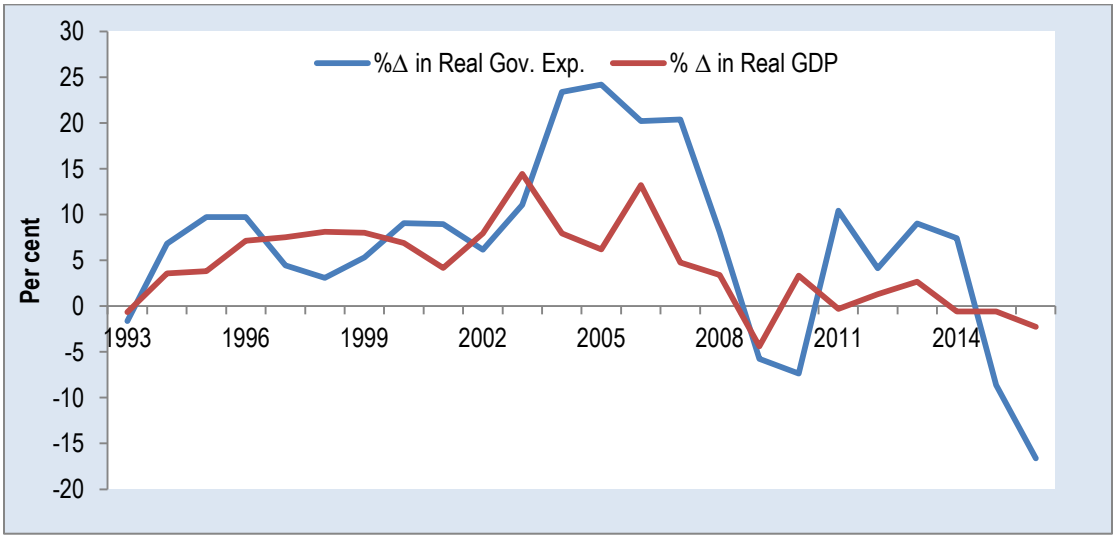
Since the decline in energy prices in mid-2014 and the fall in foreign exchange inflows into the country, maintaining the exchange rate at the current level has become a topical issue on both the economic and political fronts. From an economic standpoint, there is much debate as to whether the exchange rate should be allowed to depreciate to relieve the frequent build-up of demand pressures in the local foreign exchange market. The excess demand, which cannot be met by market purchases, has been met thus far by heightened Central Bank interventions which have led to a downward trend in the country's gross official reserves in recent years. The depreciation of the exchange rate has potential economic benefits in terms of improving the balance of payments position and curtailing the drawdown of the foreign exchange reserves. However, from a political perspective, the government would tend to be cautious of the potential adverse consequences of a depreciation on the economy, especially on domestic inflation, living standards, and the potential political fall-out.

Fiscal policy, on the other hand, plays a major role in the economy since it has a direct impact on economic activity, especially through public sector capital spending on infrastructure such as bridges, highways, hospitals and other public goods. Capital spending has spillover effects on the non-energy sectors such as construction, distribution, and finance, insurance and real estate. Various industries strive on contracts issued by the government either through ministries or the large number of state enterprises. Also, the government is the single largest employer, accounting for 26% of the labour force in 2016. Further, the local energy sector has traditionally been a major source of government's revenue. Therefore, a major share of government spending comes from revenue derived from the energy sector. Over the last 10 years, about 38% of the government's total revenue was from the energy sector[1]. However, with the recent decline in energy prices, government's revenue from the energy sector has fallen to about 16.1% in FY2016/17.

Fiscal policy has generally been challenged over the review period. It is clear from the graph that fiscal policy has been highly pro-cyclical (Figure 3). It can be observed from the graph that an increase in oil prices is associated with widening non-energy fiscal deficits and lower prices are associated with relatively high fiscal deficits. This implies that fiscal policy is not amended in a timely manner in response to adverse energy price shocks. Both the prices of crude oil and natural gas are also closely correlated as is illustrated in Figure 4, which also demonstrates the exposure of the government's fiscal policy to swings in crude oil prices. Apart from generally high and persistent fiscal deficits, the structure of government spending has been heavily directed towards recurrent expenditures to meet the social needs of the population. To a relatively lesser extent, government's spending has been directed towards capital projects which are essential to building the productive capacity of the economy.

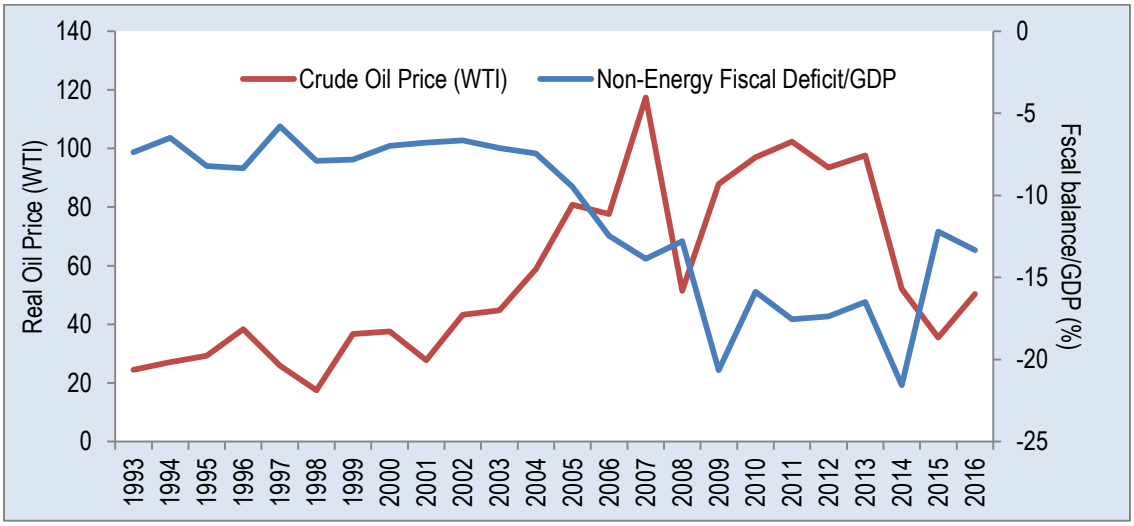
[1] Represents an average for the period 2006-2016

Figure 3: Pro-cyclical Fiscal Policy and GDP Growth: 1993 – 2016



Sources: Central Bank of Trinidad and Tobago, Ministry of Finance and Authors' calculations

Figure 4: Real Oil Price and Non-Energy Fiscal Deficit: 1993 – 2016



Note: WTI – West Texas Intermediate Crude Oil Price
Sources: Central Bank of Trinidad and Tobago, Ministry of Finance and Authors' calculations

Following the decline in energy prices in mid-2014, the government has been taking steps towards fiscal consolidation by reducing subsidies especially on gasoline, as well as reducing spending in various ministries (such as on contract employment and on goods and services). Several tax changes have been introduced to bolster non-energy revenue, such as higher corporation tax, and the proposed introduction of a property tax. Fiscal consolidation has however, been slow, given the downward sticky nature of certain recurrent expenditure. In the context of lower revenues, financing of fiscal deficits has led to rising public debt (60.2% of GDP at end-September 2017). TT's credit rating was also downgraded by two major international credit rating agencies in 2017. These conditions have resulted in a reduction in the fiscal space of the government in generating economic activity.

The decline in energy prices has revealed some major weaknesses in the economy as well as in fiscal and monetary policy behaviors. The present situation reveals that the current economic structure of the TT economy, which is heavily reliant on the energy sector, has not led to sustainable economic growth but rather major fluctuations in economic cycles in the past. The effect of adverse price shocks can quickly move the economy from prosperity and growth to recession, which has severe negative economic implications for the country. More recently, when the cycle is on a downward path, both monetary and fiscal policy appears to be constrained in stimulating economic growth.

Since the severe terms-of trade shock in mid-2014, monetary policy has been accommodative in an effort to stimulate non-energy economic growth. Monetary policy, however, has to balance a range of considerations especially the need to stimulate growth and prevent potential capital outflows that may stem from rising foreign interest rates. Also, the transmission mechanism for monetary policy has tended to be weak, which has limited the ability of the Central Bank to ensure a full and timely pass-through from its policy rate to banking sector interest rates[2].

In the context of constrained monetary policy, fiscal policy can be a potential source for stimulating economic activity under the current economic conditions. However, due to the continued fiscal deficits, and the need to borrow, expansionary fiscal policy may only provide a limited boost to activity. This is because, high domestic borrowing by a government, especially from the local commercial banks can potentially have a crowding out effect or increase the level of domestic interest rates. This may have the effect of further hindering the private sector's ability to borrow for investment purposes.

With the current economic scenario facing TT, monetary policy will have to maintain a sharp focus on ensuring price stability. Fiscal policy, on the other hand, needs to move to a more sustainable position (i.e. a much lower deficit or surplus) as soon as possible. This could be achieved via a faster pace of reduction in payments on recurrent spending such as on transfers and subsidies. A reduction in expenditure implies a smaller fiscal deficit to be financed by borrowing which will constrain the increase in public debt. In the medium term, the reversion to fiscal surplus is likely to provide more fiscal space to be able to implement an economically viable monetary-fiscal policy mix via greater coordination. While under the current circumstances where lower revenue has prompted higher deficits and financing needs, it is important that the government streamlines its expenditure to avoid increasing the public debt which could undermine the potential for policy coordination.

[2] The Central Bank of Trinidad and Tobago Monetary Policy Report (November 2017) estimated the speed of the pass-through of policy rate changes to commercial bank interest rates to be 12 months.

4. Measuring Policy Coordination

The potential for healthy policy coordination exists when the two policy-making authorities are independent and have the ability to pursue their own objective without compromising one for the other. Many economists have endorsed independency of both of these authorities on the basis that a lack of independence can lead to inappropriate policy mixes that can undermine growth and inflation. One of the riskiest forms of interaction is when a central bank, due to a lack of independence, gives in to the demands of the fiscal authority and persistently engages in the financing of budget deficits. This has tended to be a major cause of hyper-inflation, low investment and inadequate growth in many countries.

Testing for independence is therefore a necessary first step in our exercise. Although the institution may not possess a high degree of legal independence, as is the case in many countries, the execution of monetary policy should at least be carried out independently[3]. As regards to the test of independence, we apply the Granger causality test to explore the existence of any true correlating relationship between the variables. The ratio of money supply-to-GDP (M2G) is used as an indicator of monetary policy stance and the non-energy fiscal deficit to GDP (FBG) is used as a proxy for fiscal policy[4]. The changes in these indicators represent changes in the policy stance. The data on money supply are obtained from the CBTT and both GDP and non-energy fiscal deficit are sourced from the Ministry of Finance. Both data sets are quarterly and cover the period QI: 1993 – QIV: 2016.

We first conduct stationarity tests on the variables to determine the order of integration at the 5% and 1% significant levels. While the Granger causality test determines the impact of past information on one variable on the current value of another variable, the cointegration test establishes if there is an equilibrium relationship between the two variables over the long-run. The two institutions are considered independent if there is no cointegration between the two variables. No coinetgration suggests that government spending is not influenced by borrowing from the CBTT. To test for cointegration we apply (if necessary) the single equation residual based Phillips-Ouliaris (1990) test on money supply and (LGM2G) and government spending (LGFBG) [5,6].

If independence is observed between the two institutions, the next step is to compute the extent of coordination between them given different macroeconomic shocks. We do this using the set-theoretic approach (STA) similar to Arby and Hanif (2010) and Haleim (2016). A fundamental advantage of this method is that the information contained in the primary data is sufficient for analysis, which unlike other statistical methods, require additional data to exist. Also, it is well suited for analysis of data constructs that are categorical and dimensional.

[3] Dincer and Eichengreen (2014) measured the degree of legal independence of a sample of central banks through an analysis of relevant central bank legislation. The study found that TT scored 0.25 (CBIW) and 0.28 (CBIU) on a scale from 0 to 1 (lowest and highest levels of independence, respectively), suggesting a relatively low degree of legal independence.

[4] Since May 2002, the CBTT began to utilize the Repo rate as its main policy instrument but still maintained its use of direct policy instruments (reserve requirements and special deposits etc.). The CBTT also utilized open market operations to manage liquidity (i.e. the money supply) and market interest rates. This paper therefore takes the traditional approach by using the money supply-to GDP ratio to gauge the monetary policy stance over the entire sample period. The money supply is assumed to be inversely related to interest rates in the economy. Hence, an increase in the money supply implies a fall in interest rates, while a fall in the money supply suggests an increase in interest rates in the economy. For oil-based economies, the non-energy fiscal deficit-to-GDP ratio is a relatively more reliable indicator of the policy stance of the central government than other measures such as the overall primary balance-to-GDP ratio which can be a potentially misleading indicator of the fiscal stance.

[5] The Phillips-Ouliaris (1990) test for co-integration is based on adjusting the conventional statistic using the Newey-West estimator of error variance which is robust to serial correlation and time-dependent heteroscedasticity.

[6] The variables were converted to logarithmic form (LG).

The STA involves the use of set theory. Under this approach two matrices are constructed, a macroeconomic environment shock matrix and a policy response matrix, which indicate the various paired outcomes. Both of these matrices can be compared to estimate the coordination coefficient between both policies. We define the coordination in Table 1 below. Given that the real GDP growth rate and inflation rate are major indicators of economic performance, shocks to both indicators represent the macroeconomic imbalances that necessitate proper coordination of policies to address them. There are four possible combinations of positive (P) and negative (N) shocks to growth or inflation. For instance, the upper left corner cell refers to positive shocks to both growth rate and inflation, while the lower left corner cell refers to negative shocks to growth rate and positive shocks to inflation.

Table 1: Macroeconomic environment matrix

		Shocks to Inflation	
		Positive	Negative
Shocks to Real Output Growth	Positive	PP_t	PN_t
	Negative	NP_t	NN_t

Another matrix is constructed which represents the coordinating responses of monetary and fiscal policies. In this policy response matrix, policies are assumed to be countercyclical to different shocks as shown in Table 2. Each cell in the policy response matrix represents the appropriate policy coordination to respond to the given shocks in the corresponding cell in the macroeconomic environment matrix. To clarify, the proper countercyclical response to positive shocks to both growth and inflation is simultaneous contractionary fiscal and monetary policies (CC_t). Similarly, negative shocks to both GDP and inflation require simultaneous expansionary monetary and fiscal policies (EE_t).

The extent of coordination (ρ) is obtained through the following equation:

$$\rho = \omega/\sigma$$

$$\omega = n(PP_t \cap CC_t) + n(PN_t \cap CE_t) + n(NP_t \cap EC_t) + n(NN_t \cap EE_t) \quad \text{eq.(1)}$$

σ is the number of years in the analysis.

Based on the above formula, a perfect coordination exists when the policy response matrix is harmonized with the macroeconomic environment matrix, i.e. ρ equals 1, while coordination is absent when ρ = 0. In addition, policy coordination is considered weak when $\rho \leq 0.50$ and is therefore the minimum benchmark for adequate policy coordination.

Table 2: Policy Response Matrix			
		Change in Monetary Policy	
		Contractionary	Expansionary
Change in Fiscal Policy	Contractionary	CC_t	CE_t
	Expansionary	EC_t	EE_t

The strength of the coordination can also be tested using a vector autoregressive (VAR) modelling approach (Lutkehpohl, 2005). Similar studies have also employed VAR modelling techniques (e.g. Tarawalie et al. (2013), Sethi (2016). The VAR modelling technique is very powerful for analyzing multivariate economic time series data. It can also provide a clearer understanding of the dynamic relationship among policy variables and their impact on the economy. However, VAR models can produce results that can be counterintuitive or contradicts economic theory.

The VAR model to be estimated is as follows:

$$Y_t = \alpha_1 + \sum_{s=1}^{n} \theta_s Y_{t-s} + \beta Z_s + \varepsilon_t \qquad \text{eq.(2)}$$

In the above, Y and Z are the vectors of endogenous and exogenous variables, respectively. Also, θ and β are the vectors of corresponding coefficients to be estimated, α is the vector of constants, ε is the error term which is assumed to be a white noise process, and n is the optimal lag length of the model and is determined using the lag length criteria testing. The variables of the VAR model are the output gap, the inflation deviation, non-energy fiscal balance ratio, broad money ratio, and the nominal exchange rate. Additional variables include the real crude oil price, and a dummy variable to represent the 2008/09 global financial crisis. The impulse responses of the money supply, non-energy fiscal deficit variables to innovations in the output gap, inflation and the exchange rate are analyzed to determine the strength of the coordination. Table 3 below provides a list of the variables and their description. Note that since the switch to a managed float regime, it is possible that monetary policy may have had greater autonomy to respond to domestic inflation. Although, this may not necessarily be the case, since countries with more flexible exchange rate regimes continue to take global interest rates in account when setting domestic interest rates to avoid significant movements in their exchange rates. The VAR model data covers the period QI: 1993 to QIV: 2016 and is of a quarterly frequency.

Table 3: List of Variables and Description			
Variables	**Notation**	**Description**	**Source**
Output Gap	GAP_t	(Potential Total Real GDP - Actual Total GDP) / Potential GDP.	CBTT, CSO, Potential GDP - Authors calculation using the H-P filter in Eviews 8.0
Inflation Deviation from Threshold	$INFD_t$	Core Inflation - Inflation Threshold The inflation threshold is calculated using a similar method to Mubarik (2005).	CSO, CBTT Threshold Inflation - See Footnote 4 for authors' calculation.
Non-energy Fiscal Deficit	FBG_t	(Total Non-Energy Revenue - Total Expenditure) / Total GDP	Ministry of Finance of Trinidad and Tobago, CBTT.
Money Supply	$M2G_t$	Broad Money / Total GDP	CBTT
Nominal Exchange Rate	NEX_t	Nominal Exchange Rates is the price of the US Dollar in domestic (TT) currency.	CBTT
Real Oil Price	$ROIL_t$	Nominal Crude Oil Price (WTI) x US CPI/TT RPI	International Financial Statistics, CBTT.

5. Empirical Results and Discussion

Figure 5 shows the trends in the money supply and the non-energy fiscal deficit. The graph indicates no clear co-movement between the two variables. In a developing country like TT high deficits by the government could be associated with high budgetary borrowing from the Central Bank. However, the overall movement in the money supply through changes in the monetary base is important from the perspective of gauging the monetary policy stance. Figure 5 shows that the two variables trended quite differently during most of the period. For instance, during QI: 2002 to QIV: 2008 the money supply was stable while the non-energy fiscal deficit was declining. Between QI: 2009 and QIV: 2016 both variables diverged with the money supply increasing drastically compared to the non-energy fiscal deficit. The conflicting movements suggest that monetary and fiscal policies remained independent of each other in TT.

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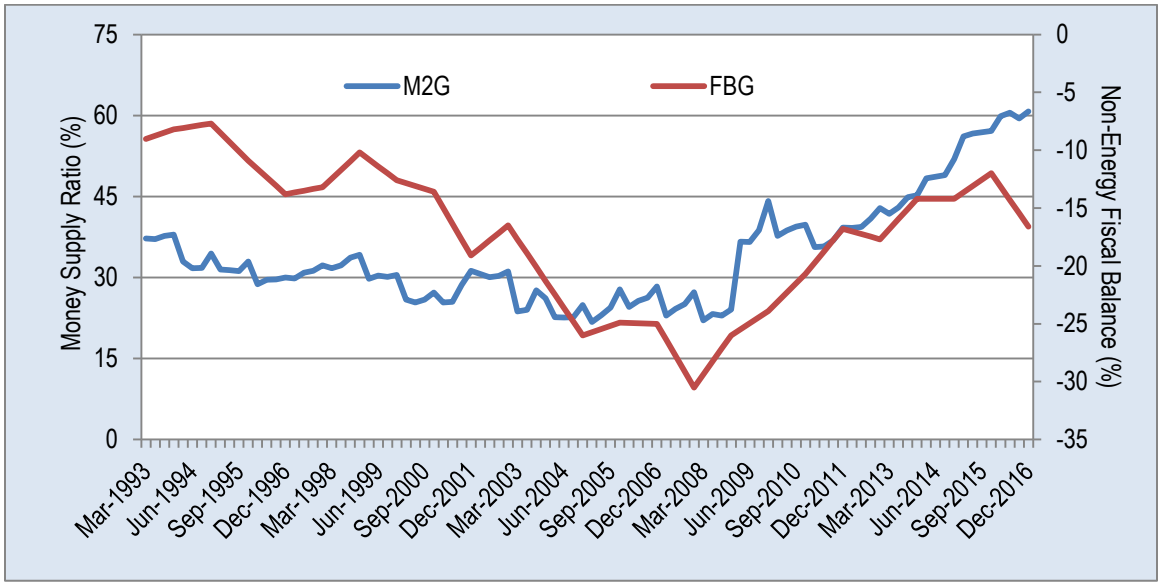
Figure 5: Trends in Money Supply and Non-Energy Fiscal Balance



Source: Central Bank of Trinidad and Tobago

(i) Testing for Independence (Granger Causality/Block Exogeneity Wald Test)

It is important to determine the order of integration of the indicators of monetary and fiscal policies before carrying out the Phillips-Ouliaris (single equation) cointegration test. In testing for stationarity, the unit root tests indicate that the monetary and fiscal policy variables were found to be I(0) variables (see Table 9). The results restrict further testing for a long-run relationship between the variables. However, we check for the existence of short-run relations between the variables.

We apply the Granger Causality Block Exogeneity test on the above indicators. The results of this test which are reported in Table 4 indicate that we cannot reject the hypothesis of no causality from LM2G to LFBG. Also, we cannot reject the null of no causality from LFBG to LM2G. So it appears that there is no causality between the two variables. The results provide confirmation that the monetary and fiscal policies are independent of each other.

Table 4: VAR Granger Causality/Block Exogeneity Wald Test

Dependent Variable	Excluded Variable	Null Hypothesis	Chi Sq. (Prob.)	Decision	Result
LM2G	LFBG	LFBG doesn't Granger cause LM2G	1.053557 (0.5905)	Accepted	LFBG doesn't Granger cause LM2G
LFBG	LM2G	LM2G doesn't Granger cause LFBG	0.022355 (0.9889)	Accepted	LM2G doesn't Granger cause LFBG

Note: Lag order was selected to be 2 according to the minimum values of the LR, FPE, AIC and SC.

(ii) Set Theoretic Model Results

Given the independence of both indicators in this study, we then measure the extent of coordination utilizing equation (1) described earlier which is based on the empirical information on the macroeconomic environment and policy response matrices. In the case of TT, the environment matrix is constructed based on shocks to real GDP and inflation for the country over the period (1993-2016). The shocks to growth rate are represented as deviations of the real GDP from potential GDP. Shocks to inflation are indicated as the divergence of inflation from the threshold level of inflation (6%) [7]

With regard to the policy response matrix, changes in the money supply and the non-energy fiscal deficit represent stances for both monetary and fiscal policies, respectively. The expansionary policies are defined as positive changes in the stances, whereas contractionary policies are identified by negative changes in the stances.

Table 6: Macroeconomic Shock Matrix for Trinidad and Tobago

		Inflation *(Deviation from the Inflation Threshold)*	
		Positive	Negative
Growth *(Dev. from Potential Output)*	Positive	2007, 2008	2004-2006, 2009, 2010, 2013
	Negative	1993-2003	2011, 2012, 2014-2016

Note: The numbers represent calendar years.

[7] This study utilizes the core inflation rate instead of the headline inflation rate since this measure excludes the more volatile food prices. To estimate the threshold inflation rate for TT, the paper follows an approach similar to Mubarik (2005) and Bhusal and Silpakar (2011). This Ordinary Least Squares (OLS) model is specified as: $RNGDPt = \beta_0 + \beta_1 INF_t + \beta_2 D_t(INF_t - K_t) + \beta_2 PCGt + \beta_3 RLR_t + E_t$…eq(a) where $RNGDP_t$ is the real non-energy GDP growth rate, INF_t is the core inflation rate, PCG_t is the private sector credit to GDP ratio, RLR_t is the real lending interest rate of commercial banks and K is threshold inflation rate. It is the rate of inflation at which structural break occurs and E_t is the random error term which represents measurement error in the explanatory variables. The dummy variable D is defined as follows: D = 1 if INF > K and D = 0 if INF < K. When the inflation rate is below the threshold, the effect of inflation on real GDP is estimated by the coefficient of inflation (β_1). However, when the inflation rate is at higher levels the coefficient of inflation is the sum of the betas ($\beta_1 + \beta_2$). In order to locate the threshold inflation rate we first allow for one break by varying the inflation threshold rate from a low to high level. Standard statistical tools are used to identify the threshold point and check the reliability of the regression estimates. Regressions were estimated for the values of K in an ascending order from low to high. The empirical analysis suggests that if inflation is above 6%, then economic growth performance could be adversely affected. It would be reasonable to conclude that policies that stabilize the inflation rate to a certain threshold level matters for long-run economic growth in TT.

Table 7: Policy Response Matrix for Trinidad and Tobago			
		Monetary Policy	
		Contractionary	Expansionary
Fiscal Policy	Contractionary	1995, 1996, 2000, 2003, 2004, 2007, 2011	2005, 2006, 2009, 2014, 2016
	Expansionary	1993, 1994,1995, 2002, 2008, 2010	2001, 2002, 2003, 2012, 2013, 2015

Note: The numbers represent calendar years.

From the above tables, the extent of coordination can be calculated as follows:

$$\omega = n(PP_t \cap CC_t) + n(PN_t \cap CE_t) + n(NP_t \cap EC_t) + n(NN_t \cap EE_t)$$

$$= 1 + 3 + 0 + 4 = 8$$

$$\rho = 8/25 = 0.32 \text{ (or } 32\%)$$

Results obtained from equation (1) suggest that coordination has been very low over the period under study. Weak policy coordination may have complicated macroeconomic management in the country over the last 25 years. The results indicate a score of less than the benchmark of 50% for minimum policy coordination. In looking at the boom period (2004 – 2008), coordination stood at 28%. However, a score of 38% was calculated for the period 2009 – 2016. This suggests an improvement in policy coordination during the period following the global financial crisis which was accompanied by volatility and severe adverse shocks to energy prices. Policy coordination improved as a result of the government's efforts to revive the domestic economy. While there was an improvement, the extent of coordination however remained weak during this sub-period.

(iii) Vector Autoregressive (VAR) Model Results

Use of VAR model for policy coordination analysis requires certain preconditions to be met. First, VAR models require that all the variables must be stationary and not co-integrated. If certain variables are non-stationary, these variables must be converted to stationary status. This can be done using the method of first differencing. If however, the variables are non-stationary, and are of the same order of integration, then cointegration should be tested for these variables and a more applicable model would be the Vector Error Correction Model (VECM). If no cointegration exists then a VAR model can be estimated.

Table 8 provides the results of three conventional unit root tests which are utilized to determine the order of integration of variables for econometric modelling purposes. The tests indicate that all variables are integrated of order one (i.e. I(1)). Conventional tests, however, cannot provide conclusive evidence of the order of integration of the variables in the presence of structural breaks. It is possible that the variables could have been affected by macroeconomic shocks such as the 2008/09 global financial crisis.

Table 8: Unit Root Testing (ADF, PP and KPSS)

		LEVEL			FIRST DIFFERENCE		
Variables (Logarithmic Form)*	**Notation**	**ADF**	**PP**	**KPSS**	**ADF**	**PP**	**KPSS**
Output Gap/Potential GDP (%)	$LGAP_t$	-2.38	-2.28	0.22	-5.69	-5.73	0.10
Non-energy Fiscal Deficit/GDP (%)	$LFBG_t$	-1.91	-1.71	0.39	-6.88	-6.89	0.07
Inflation Dev. from Threshold (%)	$LINFD_t$	-2.51	-2.71	0.33	-7.91	-8.35	0.03
Broad Money/GDP (%)	$LM2G_t$	-9.55	-9.55	0.09			
Nominal Exchange Rate	$LNEX_t$	-13.21	-9.75	1.03			
Real Oil Price	$LROIL_t$	-0.95	-1.20	0.31	-8.25	-8.24	0.08

Notes: * All variables were transformed in logarithmic form to correct for heteroscedasticity and to ensure that the data follow a normal distribution.
Critical values for ADF test are -3.50 (1%), -2.89 (5%), -2.58 (10%) - If T-stat > critical value, reject H_0:δ=0 (non-stationary)
Critical values for PP test are -3.57 (1%), -2.29 (5%), -2.60 (10%) - If T-stat > critical value, reject H_0:δ=0 (non-stationary)
Critical values for KPSS test are 0.739 (1%), 0.463 (5%), 0.347 (10%) - If T-stat > critical value, reject H_0:δ=0 (stationary)

Source: Authors' calculations using Eviews 8.0

Unit rooting testing, which accounts for possible structural breaks, are therefore conducted. Contrary to earlier findings of the conventional tests, the results of the breakpoint test shows that the $LGAP_t$ and the $LFBG_t$ variables are in fact stationary and the $LNEX_t$ is non-stationary (Table 9). The VAR econometric estimation is carried out given that not all the variables are of the same order of integration and because three of the variables were found to be stationary which restricts testing for cointegration.

Table 9: Unit Root Test with a Break Point

		LEVEL					
		Trend and Intercept			**Intercept Only**		
Variables (Logarithmic Form)	**Notation**	**Break Date**	**T-Stat**	**P-val**	**Break Date**	**T-Stat**	**P-val**
Output Gap/Potential GDP (%)	$LGAP_t$	Dec-04	-4.85	0.05	Dec-01	-6.05	<0.01
Non-energy Fiscal Deficit/GDP (%)	$LFBG_t$	Dec-07	-4.86	0.05	Dec-07	-2.52	0.90
Inflation Dev. from Threshold (%)	$LINFD_t$	Dec-04	-4.48	0.14	Mar-03	-3.69	0.29
Broad Money/GDP (%)	$LM2G_t$	Mar-13	-28.00	<0.01	Mar-13	-24.00	<0.01
Nominal Exchange Rate	$LNEX_t$	Dec-15	-4.53	0.11	Dec-15	-3.58	0.34
Real Oil Price	$LROIL_t$	Dec-15	-3.98	0.38	Mar-15	-4.010	0.15

Notes:
Critical values (Trend and Intercept) are -5.35 (1%), -4.86 (5%), -4.61 (10%) - If T-stat > critical value, reject H_0:δ=0 (Has a Unit Root)
Critical values (Intercept Only) are -4.95 (1%), -4.44 (5%), -4.19 (10%) - If T-stat > critical value, reject H_0:δ=0 (Has a Unit Root)

Source: Authors' calculations using Eviews 8.0.

Following the estimation, robustness tests are executed in order to determine the reliability of the model. These include: the optimal lag order selection criteria which was used to determine the number of lags necessary to remove serial correlation, the LM residual serial correlation test, heteroscedasticity, autocorrelation and the inverse AR roots tests. Results of the Lag Length test indicate that 4 lags are needed to minimize the AIC criterion. The results of the other tests are produced in the appendix.

The impulse response functions are based on the generalized decomposition approach which does not require the variables be placed in any specified order. This is specifically useful in cases where the degree of endogeneity of the variables is not clear so as to determine the proper ordering of the variables. Figure 6 below shows the impulse

response function of the non-energy fiscal deficit to a shock in the other variables[8]. The response of the non-energy fiscal deficit to a positive shock in the output gap is to worsen from quarter 3 and for the rest of the forecast period. This indicates a clear pro-cyclical behavior of government's fiscal policy. This could occur as a result of improving revenue conditions during an upswing in energy prices and production which encourage the government to spend more, but is inflexible to a downturn in the business cycle. Also evident in the chart is the response of the non-energy fiscal deficit to its own shock where an initial shock to the deficit triggers a worsening of the deficit over many periods (i.e. from quarters 1 to 10). The response of the fiscal deficit to a shock to inflation is also pro-cyclical as it worsens over the forecast horizon before improving from quarter 7. This implies a non-supportive fiscal policy to increases in inflation. The response of the non-energy deficit to a shock in the money supply is to worsen over the first four quarters but the effect tappers off towards the zero line from quarters 6 to 10. This indicates that an increase in the money supply creates more room for government spending, resulting in a temporary (i.e. approximately a one-year period) widening of fiscal deficits. A depreciation in the nominal exchange rate results in a small deterioration of the government's fiscal spending over the forecast horizon.

A positive shock to the output gap causes the money supply to decrease over the first five quarters before increasing from the sixth quarter and for the rest of the forecast period (Figure 7). The response of the money supply to a shock in the fiscal deficit is to increase slightly over the first six quarters but the effect dies off over the remainder of the forecast period. This suggests that following a fiscal expansion, the Central Bank moves to mop-up the excess liquidity which has a contractionary effect on the money supply. Also, a shock to inflation results in increases in the money supply initially, but declines from quarters 2 to 5, but then the effect dies-off from quarter 6. An own shock causes the money supply to increase significantly in the first quarter but the effect discontinues thereafter. A depreciation in the nominal exchange rate results in a small declining response in the money supply.

6. Conclusion and Policy Implications

This paper empirically investigates the extent of coordination between monetary and fiscal policies in TT. It shows evidence of independence of monetary policy over the review period under a managed exchange rate regime since April1993.

Having established the independence of both policies, the paper then calculates the extent of coordination (using the STA) in response to macroeconomic shocks over the period 1993 – 2016. The results of the analysis indicate that over the last 25 years coordination of monetary and fiscal policies has been weak. The results of the VAR model impulse response functions also indicate evidence of weak coordination of fiscal and monetary policies. Overall, fiscal policy appears to be conducted in a highly pro-cyclical manner, which implies that fiscal policy tends to be inflexible and therefore cannot be reversed quickly. The behavior of fiscal policy also seems to be non-supportive of inflation. With regard to monetary policy, it appears that while it moves to neutralize the impact of fiscal policy, especially by managing liquidity conditions, there are challenges associated with excess liquidity, which restricts the ability of this policy to respond effectively to inflation shocks.

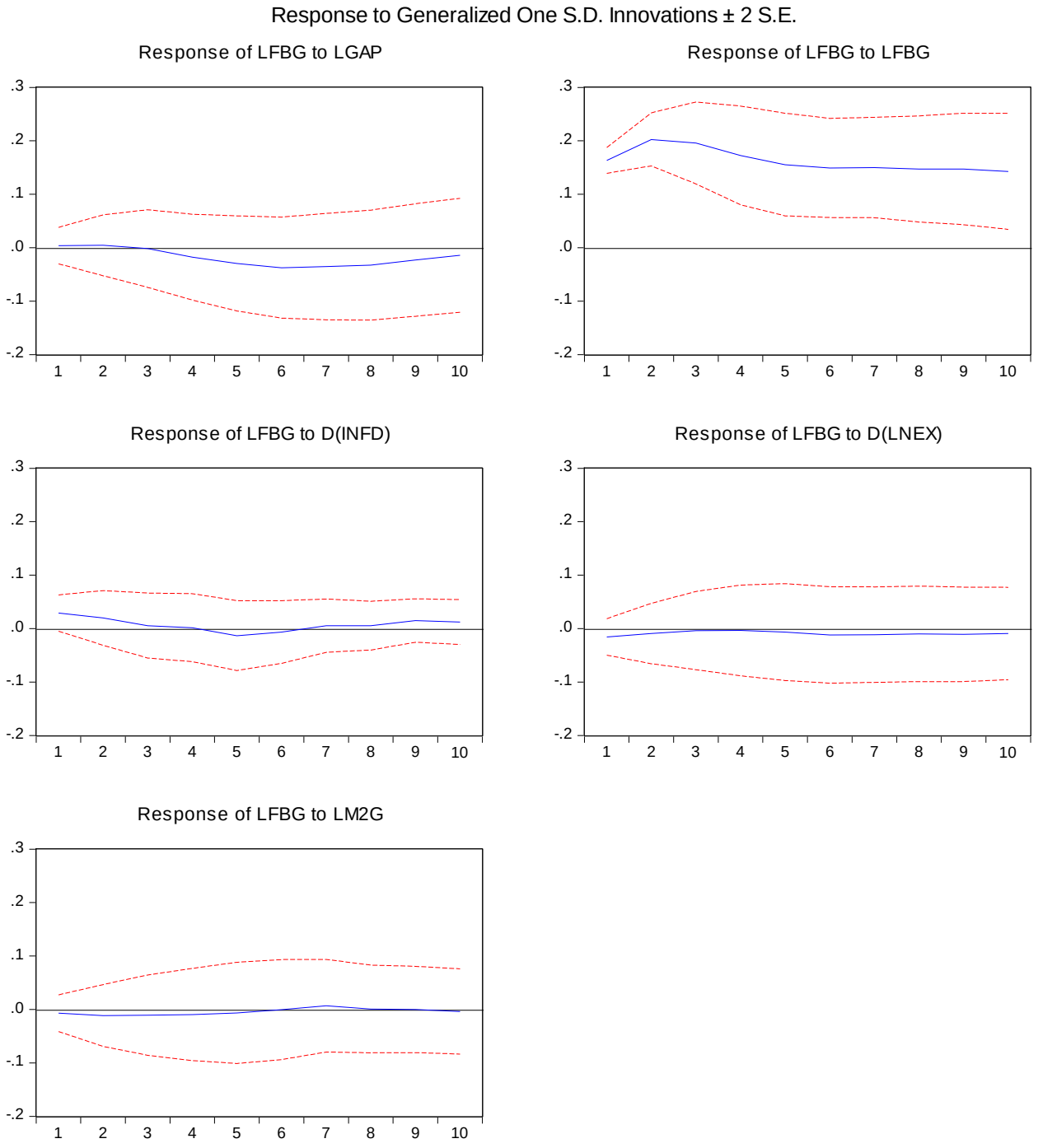
The structural changes that have occurred in the economy especially over the last two and a half decades (such as the liberalization of the foreign exchange market, interest rate liberalization, free capital flows and the shift towards indirect monetary policy) present an important opportunity for policies to coordinate. While policy coordination

[8] A positive (negative) shock to the non-energy fiscal deficit implies a smaller (larger) deficit or a contractionary (expansionary) fiscal policy.

increased somewhat in the period following the 2008/09 global financial crisis, based on the findings of this paper, a greater effort is needed by the authorities to ensure a higher degree of policy coordination in the country.

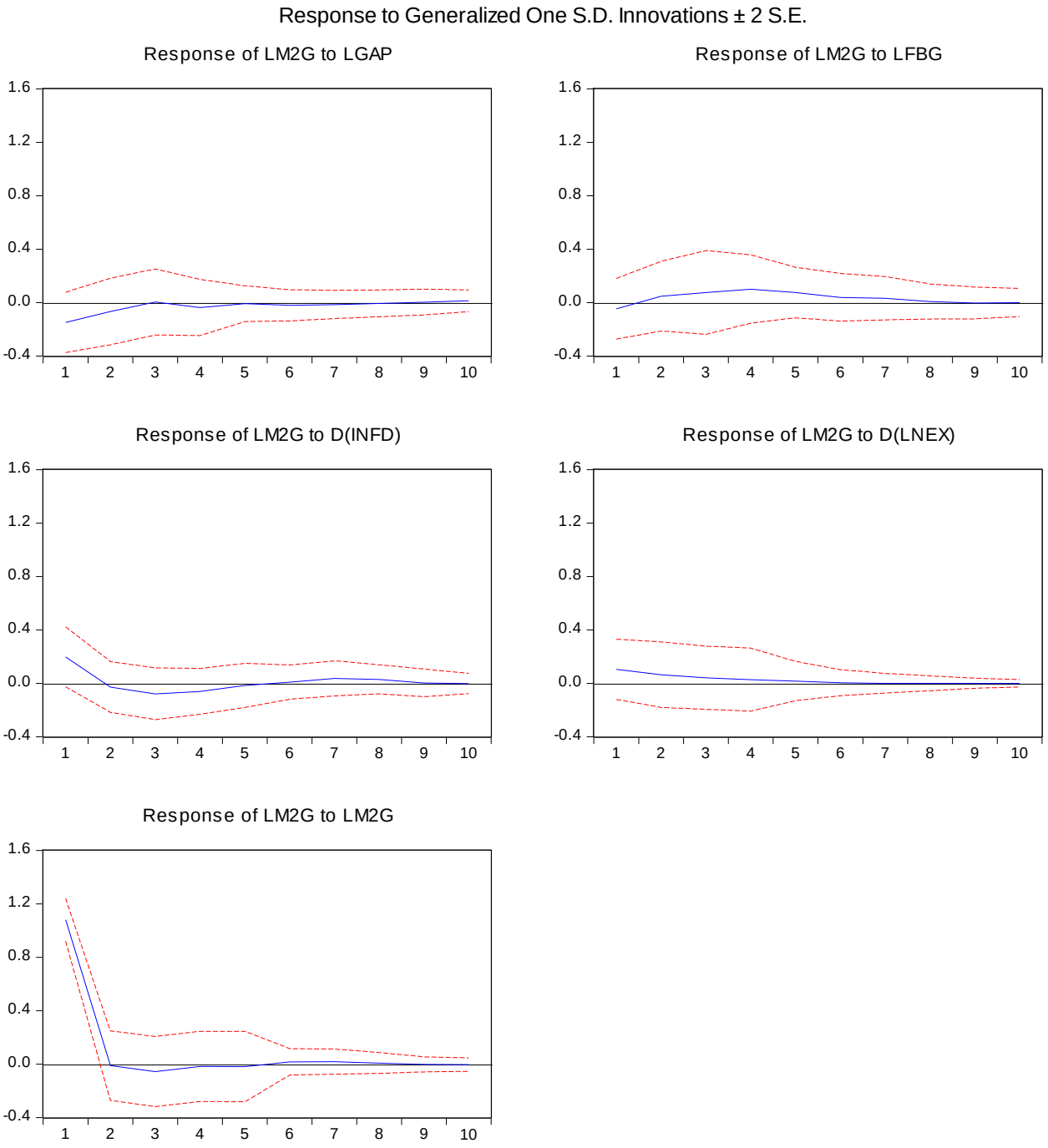
Greater policy coordination may be achieved through a formalized framework which details the policy objectives, institutional and operational arrangements for both authorities. Since such a framework does not exist for the country at the moment, there are two measures which can potentially facilitate greater policy coordination in the near future. Firstly, there is a need to further strengthen the relationship between the monetary and fiscal authorities as regards liquidity management. This is likely to reduce the incidence of large unplanned liquidity injections which require mopping-up by the Central Bank. Secondly, sound management of public debt is important if a higher degree of coordination is to be achieved going forward. High levels of public debt can reduce the fiscal space of the fiscal authority and hamper coordination with monetary policy.

Figure 6: The Response of Fiscal Policy in Trinidad and Tobago



Source: Authors' calculations using Eviews 8.0

Figure 7: The Response of Monetary Policy in Trinidad and Tobago



Source: Authors' calculations using Eviews 8.0

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Appendix

Table 1: VAR Residual Serial Correlation LM Tests

Null Hypothesis: no serial correlation at lag order h
Date: 01/15/18 Time: 14:31
Sample: 3/01/1993 12/01/2016
Included observations: 91

Lags	LM-Stat	Prob
1	14.86887	0.9444
2	30.78480	0.1962
3	26.03794	0.4056
4	27.92268	0.3114
5	21.03176	0.6908
6	16.01617	0.9143
7	13.09349	0.9753
8	26.90467	0.3607
9	8.304387	0.9993
10	8.178707	0.9994

Probs from chi-square with 25 df.

Chart 1

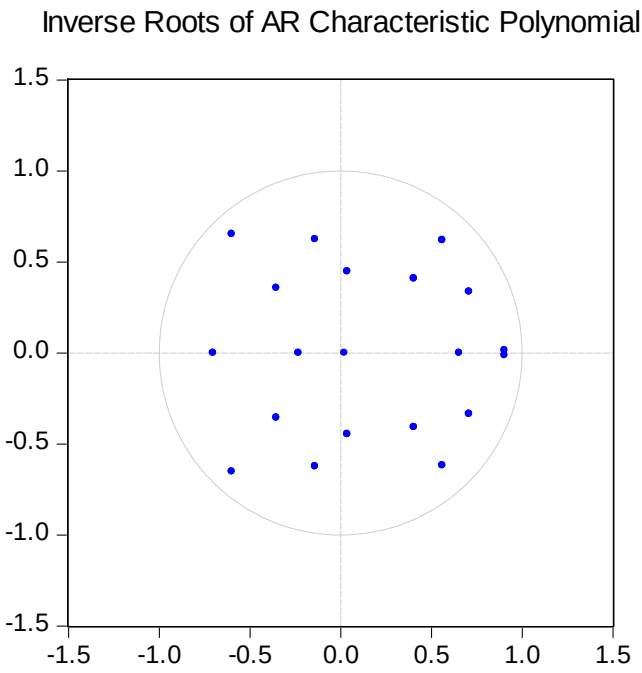

Table 2: VAR Lag Order Selection Criteria

Endogenous variables: LGAP LFBG D(INFD) D(LNEX) LM2G
Exogenous variables: C D(LROIL) DUM0809
Date: 01/15/18 Time: 14:32
Sample: 3/01/1993 12/01/2016
Included observations: 87

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-59.13618	NA	3.78e-06	1.704280	2.129437	1.875477
1	160.2665	398.4554	4.35e-08	-2.764747	-1.630996*	-2.308221*
2	190.0965	50.74525	3.92e-08*	-2.875781	-1.033436	-2.133926
3	210.0057	31.58019	4.49e-08	-2.758752	-0.207813	-1.731568
4	241.4040	46.19509*	4.01e-08	-2.905838*	0.353696	-1.593324
5	257.7211	22.13132	5.17e-08	-2.706232	1.261896	-1.108390
6	269.8205	15.01990	7.55e-08	-2.409666	2.267056	-0.526494
7	281.1342	12.74419	1.16e-07	-2.095039	3.290277	0.073462
8	298.1361	17.19736	1.64e-07	-1.911175	4.182735	0.542655

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 3: VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)
Date: 01/15/18 Time: 14:32
Sample: 3/01/1993 12/01/2016
Included observations: 91

Joint test:

Chi-sq	df	Prob.
618.1330	645	0.7704

Individual components:

Dependent	R-squared	F(43,47)	Prob.	Chi-sq(43)	Prob.
res1*res1	0.663629	2.156434	0.0054	60.39024	0.0410
res2*res2	0.889636	8.810761	0.0000	80.95686	0.0004
res3*res3	0.428313	0.818902	0.7453	38.97647	0.6464
res4*res4	0.252753	0.369709	0.9994	23.00048	0.9947
res5*res5	0.177021	0.235108	1.0000	16.10895	0.9999
res2*res1	0.524477	1.205547	0.2651	47.72739	0.2865
res3*res1	0.560819	1.395754	0.1323	51.03454	0.1871
res3*res2	0.540320	1.284769	0.2005	49.16914	0.2398
res4*res1	0.442545	0.867715	0.6800	40.27160	0.5903
res4*res2	0.473529	0.983107	0.5209	43.09111	0.4674
res4*res3	0.398691	0.724718	0.8563	36.28092	0.7559
res5*res1	0.165327	0.216500	1.0000	15.04476	1.0000
res5*res2	0.214925	0.299230	0.9999	19.55820	0.9992
res5*res3	0.214920	0.299220	0.9999	19.55768	0.9992
res5*res4	0.203283	0.278885	1.0000	18.49873	0.9996