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Structural Transformation and Fiscal Policy in Botswana

Kelesego Mmolainyane

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Kelesego Mmolainyane is Research Fellow at the Botswana Institute for Development Policy Analysis

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ABSTRACT

This paper analyses impacts of fiscal policy on structural transformation in Botswana using structural vector autoregression (SVAR) model over the period of 1990 to 2015. The study uses an inclusive sustainable transformation (IST) index and government expenditure as proxies for structural transformation and fiscal policy respectively. Results show that prudent fiscal policy can be used as a major strategic tool for structural transformation in Botswana. Most evidently, IST index responds positively to government expenditure shocks over time. In addition, fiscal policy innovations dominantly account for movements in structural transformation in Botswana. Notwithstanding, Botswana has a lot of potential and opportunity to use its fiscal policy more effectively and efficiently to promote an inclusive structural transformation that leads to sustainable economic growth.

Keywords: Structural transformation; Fiscal policy shocks; SVAR; Botswana

JEL classification codes: L16; E62

1. INTRODUCTION

The need for economic structural transformation as a mechanism to enhance people's standard of living and create inclusive prosperity cannot be overemphasised. Structural transformation is a process of gradual redistribution of productive resources across various economic activities (from low to more productive sectors) as well as a continuous improvement of infrastructure and institutions for the purpose of growing any given economy to modern standards (Herrendorf et al., 2014; De Vries et al., 2015; Lin et al., 2017; UNCTAD, 2018). Thus, economies that graduated from being poor to being rich applied a sustained structural transformation approach to move from primary to secondary and tertiary sources of economic growth (Lin, 2011; Sarangi et al., 2017). Structural transformation can occur mainly as a result of three happenings; resource endowment changes, competitive advantages and deliberate government policies aimed towards a calculated economic path (Hausmann and Rodrik, 2003; Hausmann and Klinger, 2006; Lin, 2011; Rodrik, 2016; Sarangi et al., 2017). It is evident though, that natural endowments alone do not guarantee economic success but competitiveness is key to economic success. According to Lin (2011), in order for a given country to be successfully competitive, when its markets identify comparative advantages, the respective government must play a pivotal role of human and industrial development facilitation.

Unlike the traditional structural transformation of moving from primary to secondary economic activities, strong and current debates internationally in development economics point towards new structural transformation that is all inclusive (Lin, 2011; Kelbore, 2014; Lin et al., 2017; Sarangi et al., 2017). The arguments are that structural transformation must be socio-economic, demographic as well as environmentally inclusive in order for it to promote a sustainable economic prosperity for all. Some of the identified means to achieve an inclusive structural transformation are trade (industrial) policy, fiscal policy, monetary policy, financial development, foreign capital and human resource development (Lin, 2011; ECA, 2016; Sarangi et al., 2017; UNCTAD, 2018). Through trade and finance policies, incentives (for example, tax incentives, easy financial access, research and development, patent systems, large public procurements and export subsidies) can be used to attract investments from the private sector and might result in profitable public-private partnerships (Sarangi et al., 2017). Furthermore, ensuring infrastructural developments (hard & soft), industrial upgrading, efficient market mechanisms and continuous technological innovations may help transform economies for the good of all (Lin, 2011). Fundamentally, human capital development is a necessity for any economy to experience sustainable growth. Fiscal policy in particular has a dual role in economic structural transformation of providing public goods and mobilizing resources and therefore critical for advancing an inclusive structural transformation (ECA, 2016; Sarangi et al., 2017).

There are some previous studies on Botswana's structural transformation (for example, Leith, 1997; De Vries et al., 2015; McCaig et al., 2015). The studies done by McCaig

et al. (2015) and De Vries et al. (2015) relates structural transformation to productivity whilst Leith (1997) discussed growth and structural transformation in Botswana. However, there seems to be dearth of work that specifically relates shocks in fiscal policy (financial resource accumulation, management and allocation) to economic structural transformation in Botswana yet fiscal policy is very pivotal to Botswana's development.

1.1 GENERAL OBJECTIVE

The objective of this study is to analyse the link between structural transformation and fiscal policy in Botswana. Specific objectives are: (i) to investigate the role of fiscal policy in promoting structural transformation in Botswana and (ii) to test the reaction of economic structural transformation index to fiscal policy shocks in Botswana. To achieve its objective, this paper applies both descriptive and empirical analysis approaches based on secondary data from various sources.

The paper is structured as follows: Section 2 presents a brief review of literature. Section 3 discusses evolvement of structural transformation in Botswana over the years. Section 4 relates fiscal policy to structural transformation in Botswana. Empirical methodology is presented in Section 5. Section 6 displays empirical findings and discussions. Finally, Section 7 draws policy implications and recommendations of this study.

2 BRIEF LITERATURE REVIEW

Theoretically, structural transformation calls for formulation of economic policies that accounts for both inclusive growth patterns and social development issues. In connecting such development targets, one of the most powerful tools that can be used is fiscal policy (Sarangi et al., 2017). Moreover, it is argued that prudent fiscal policy promotes macroeconomic stability and helps economic recovery for sustainable developments (Boiciuc, 2015). According to Lin (2011), resource-rich economies are advised to ensure that a major share of their commodities revenue is allocated towards human capital, infrastructure, social capital and compensation for first movers in new non-resource sectors in order to facilitate an inclusive structural transformation.

Structural transformation can be measured through various ways. A number of old studies and even most recent ones (Benhamouche, 2018; UNCTAD, 2018) followed McMillian and Rodrick (2011)'s approach of measuring structural transformation using changes in sectoral contribution shares to economic growth. On the contrary, several studies argue that McMillian and Rodrick (2011)'s formula of structural transformation is not inclusive since it does not capture the socio – demographic and environmental friendly elements that are associated with sustainable economic growth (Lin, 2011; Kelbore, 2014; Lin et al., 2017; Sarangi et al., 2017). In order to fill the measurement gap, multidimensional structural transformation index (STI) was created by Kelbore (2014) and an inclusive sustainable transformation index (IST) was later generated by

Lin, et. al. (2017). For its empirical analysis, this study uses IST index as structural transformation proxy because it is user-friendly, it covers 200 countries, it is popular in current literature, it has a wider periodic coverage from 1990 to 2015 and also IST index includes more components (manufacturing, technology, exports, innovation, employment, research and development, patents, human capital, gender, enviroment, energy, and resource management) than STI index.

Fiscal policy dynamics are very extensive and well documented in literature. Fiscal policy is mainly measured by government expenditure, tax revenue, debt and budget deficits (Masson, 1996; Patel, C.K. 1997; Debrun and Kapoor 2010; Fatás and Mihov 2012). Fiscal policy should be equitable, effective and efficient in order to enhance optimal distribution of limited financial resources to all sectors of the economy and avoid allocation distortions (Aspe and Armella 1993). Thus, governments have power to change public spending allocations and enact various revenue collection instruments that they deem fit for any given economic era.

Notwithstanding, announcements of new fiscal reforms and implementation thereof have potential to induce shocks that can transform the economic structure of any given country both in the short and long run. Literature shows evidence regarding the impacts of fiscal policy shocks on popular macroeconomics variables like GDP, private consumption, prices, interest rates, exchange rate, inflation, stock market, credit, real wages and employment (Perotti, 2002; Mountford and Uhlig, 2002; Caldara and Kamps, 2008; Deskar-Škrbić et al. 2013).

Despite extensive empirical research on fiscal policy shocks to macroeconomic factors, literature still fails to provide systematic facts on this relationships (Caldara and Kamps, 2008) owing to the application of different methodological approaches. Several empirical studies that applied the most popular SVAR methodology, differ on conclusions regarding the reaction of macroeconomic variables (including GDP) to fiscal policy shocks. SVAR methodology is preferred because it is considered the best economic approach to analyse impacts of various policy shocks (Blanchard and Perotti, 2002). A positive effect of fiscal policy shocks on macroeconomic variables is documented by some SVAR studies (for example, Ravn and Spange, 2012; Deskar-Škrbić et al. 2013). Other SVAR studies found that fiscal policy shocks have weak and negative impacts to the economy (Perotti, 2002; De Castro and De Cos, 2006; Hur, 2007) whilst other SVAR studies reveal mixed reactions (Auerbach and Gorodnichenko, 2012). Thus, internationally, debates are still ongoing regarding impacts of fiscal shocks on macroeconomic factors that inform structural transformation.

Lin (2011) argues that most often, commodities revenues for resource-rich countries are often stored in sovereign funds and invested in foreign equity markets instead of using a large portion of such commodities revenues for financing domestic or regional projects that stimulate developments of new manufacturing industries, economic diversification,

provide employment and have potential for continuous upgrading. Similarly, Botswana's sovereign fund is mainly invested in off-shore markets. It remains to be seen if significant withdrawals will be made from this fund and invested domestically to achieve the envisaged structural transformation mainly driven by knowledge and innovation towards a high income status by 2036.

# 3   EVOLVEMENT OF STRUCTURAL TRANSFORMATION IN BOTSWANA

In our brief assessment of structural transformation trend in Botswana, we attempt to answer some basic yet very important questions; (i) How far is Botswana in achieving structural transformation? and (ii) What did Botswana do to achieve such transformation? Findings from this study will suggest what Botswana can do differently to achieve better results from structural transformation.

3.1   HOW FAR IS BOTSWANA IN ACHIEVING STRUCTURAL TRANSFORMATION?

The success story of Botswana's economic structural transformation, to a larger extent, can be traced to the country's prudent trade and fiscal policies (Leith, 1997) which contributed to Botswana escaping the 'resource curse' largely associated with mineral based economies in the continent. Proceeds from international trade of diamonds led to accumulated foreign reserves and cash balances which enabled the realisation of Botswana's national development plans over the years.

We first use the current measure of an inclusive sustainable transformation index (IST), as displayed in Figure 1, to track how far Botswana has gone in achieving structural transformation. IST index measures the extent to which a given country (compared to other countries in the same level of economic development) has modernised its economy based on industry or service such that the economy is environmentally protective and gender inclusive (Lin et al., 2017). The IST index ranges from zero to one. A score of one means that a country under observation outperforms its peers and the reverse holds true for a zero score. Botswana's peers from the SADC region included in the IST index measurement are South Africa and Namibia. Botswana's index generally, shows a downfall from 0.52 in year 1990 to 0.50 in 2015. This trend implies a decreased achievement level of inclusive structural transformation by Botswana compared to its counterparts. However, IST index grew significantly from 0.51 in 1993 to the highest peak of 0.55 in 2002 and fell thereafter. These trends are explained in detail under section 3.2 below.

Figure 1: Trends in Inclusive Sustainable Transformation Index in Botswana
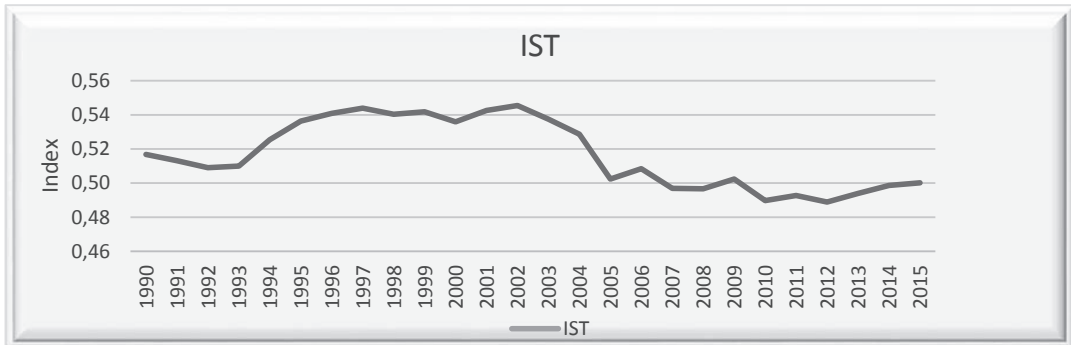
Source: Lin et al., 2017

Secondly, we observe structural transformation trends based on sectoral value addition as a share of GDP (demonstrated in Figure 2) as given by World Bank (WB, 2017) database. It is very apparent that service sector contribution in Botswana grew more than both agriculture and industry sectors between the years 2006 and 2016. In 2006, the industry and service sector value added as a share of GDP stood at 48% and 50% respectively but in 2016, industry value added decreased to 35% whereas service value added grew to 63%. Agriculture sector only contributed around 2% throughout the period under observation.

Figure 2: Sectoral Value Added Percentage of GDP
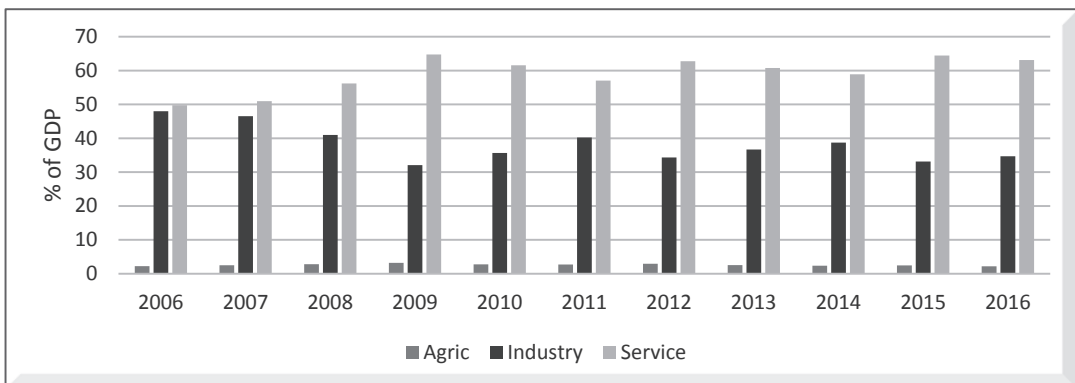
Source: WB, 2017

3.2 WHAT DID BOTSWANA DO TO ACHIEVE SUCH TRANSFORMATION?

Botswana's structural transformation growth between 1993 and 2002 as measured by IST index depicted in figure 1, can be explained by decomposing the IST index. Apparently, the index grew because of increases in manufacturing sector employment from 0.48 to 0.63 points; share of medium to high tech industry (% value added) from 0.20 to 0.60 points; and human capital contribution from 0.45 to 0.60 points. The downfall of the IST index from years 2002 to 2015 was a result of decreased access to improved water sources, manufacturing employment, exports of manufactured goods and commercial services, expenditure on research and development, share of medium and high tech industry value added as well as the poor performance of gender inclusiveness, climate and environmental protection measures amongst others. In response to these negative contributors, Botswana Government through its National Development Plan (NDP) 10, introduced some development programmes (for example, Private Sector Development Strategy, Botswana Innovation Hub and the Environmental and Cultural Resource Management Strategy).

Sectoral value added as a share of GDP, depicted in figure 2, shows that Botswana's service sector has positively transformed the economy over the years compared to other sectors. The growth of the services sector is mainly a result of spill over effects from the mining sector. Recently, in 2012, a diamond hub was relocated to Botswana from London (United Kingdom) and this move has led to increased need for services especially in the hotels and restaurants by foreign buyers and investors. Growth in the services value added to GDP was also driven by employment increase of locals in diamond sorting and sales; activities which were previously done abroad. Thus, Botswana's efforts to achieve positive results from structural transformation (though not sufficient) can be explained by its added value chains in the mining sector that significantly led to the growth of the services sector.

Agriculture sectoral value added appears stagnant in the years under observation. However, it should be noted that agriculture actually sustained Botswana's economy prior to and past the independence era. Unfortunately, the value addition of agriculture to economic growth in Botswana was seriously hampered by prolonged drought seasons and foot and mouth disease attack. These two persistent setbacks led to poor yields and decreased beef exports over time. The industry sector contribution was significant in 2006 but it was hard hit by the global recession period. Nonetheless, the trend shows a recovery in value added which is a sign of a resilient industry sector.

Notwithstanding, the country's over reliance on mineral proceeds exposes Botswana's economy to unpredictable external shocks and it is worrisome especially in the wake of 2008 global recession when demand for luxury goods like diamonds hit an all-time low. Prior to and post-independence era, Botswana's economic structural transformation has

been government led as opposed to being market led. This is evidenced by the fact that government policies play a pivotal role in the country's structural transformation process through human capital development, industrial development facilitation (by ensuring both hard and soft infrastructural developments), industrial upgrading, efficient market mechanisms (regulations) and continuous technological innovations.

4   FISCAL POLICY IN RELATION TO STRUCTURAL TRANS-FORMATION IN BOTSWANA

Fiscal policy is yet another strategic and powerful tool that the Botswana Government used, is using and can still use to transform its economy through financial resource collection and allocation across different sectors. This section gives evidence on how structural transformation was achieved via fiscal policy in Botswana. Historically, Botswana was a very poor and an undeveloped nation with very limited infrastructure necessary for production. Years after its independence in 1966, Botswana went through a great economic structural transformation. The country's economic structural transformation can mainly be defined by its diamond discovery, exploration and exportation. After 1966, the appointed government's vision was to set up infrastructure and provide a public service system that would deliver basic economic activities to all while leaving some room for private sector participation. This situation necessitated the instigation of an efficient and effective fiscal planning that would balance revenue and expenditure; conditions required for sustainable growth. Thus, Botswana used its fiscal policy to ensure that the limited available revenue resources are allocated prudently to deserving expenditure items for both social and economic infrastructure developments. Government began to build schools, roads, hospitals and accommodation. Therefore, government became the largest employer and investor.

The fiscal policy in Botswana is guided by the national constitution, national vision, national development plans (NDPs) and international agreements (like the United Nations Sustainable Development Goals, also known as SDGs). Nonetheless, the strength of Botswana's fiscal policy in influencing structural transformation lies in the connectivity between the country's NDPs and the annual budgets. Whilst NDPs are strategic project plans of six to seven years, the budget apportions these projects' expenditures annually for ease of implementation. A prudent fiscal expenditure policy converts wealth from natural-resources into productive assets such as finance, human capital and infrastructure for the benefit of all stakeholders (ECA, 2016).

Fiscal policy indicators are mainly expenditure allocations, revenue collections and debt management. Composition shifts of these indicators can be used to explain structural transformation. In Botswana, there are specific fiscal measures taken by government to monitor public spending and to manage revenue. These measures are: (i) annual total government expenditure must be 40% of GDP; (ii) recurrent budget should not exceed 70% of total expenditure whilst development budget is limited to 30% and (iii) annual

public debt is limited to 40% of GDP of which 20% must be internal debt and 20% must be external debt.

Botswana has over the years complied with the 40% rule of government expenditure as a share of GDP, demonstrating management discipline, responsibility, accountability and expenditure sustainability. In 1998, the rate was high at 30% but gradually decreased to a low of 17% in 2006 before rising to 20% in 2008 but then dropped to 18% in 2016. This demonstrates that Botswana's fiscal policy is responsive enough to cater for difficult times like the introduction of a stimulus package during the 2008 recession period. The stimulus package was meant to resuscitate the local economy which was showing negative GDP growth from 8% in 2007 to negative 8% in 2009. Next sub-sections illustrate compliance to the total expenditure and debt limits.

4.1 DEVELOPMENT AND RECURRENT EXPENDITURE AS A SHARE OF TOTAL EXPENDITURE

Total expenditure is divided into recurrent and development expenditures in Botswana. Figure 3 shows both the recurrent and development expenditure trends as a percentage of total expenditure from 1990 -2016 as reported by Bank of Botswana (BoB, 2017). Prior to the 2006 introduction of the 30% and 70% expenditure limit (development and recurrent respectively), a highest rate of 51% was recorded in 1990 for development expenditure. Recurrent expenditure was almost equal at 49% during the same year. Before 1990, the Government of Botswana had embarked on major infrastructural development expenditures which were necessitated by the country's poor state at independence. Development expenditure kept reducing down to 21% in 2006 and this reduction was strategically done in order to create space for recurrent expenditure associated with maintenance and administration costs of the existing infrastructure, as well as personal emoluments of the growing public sector. This turn of events increased the recurrent expenditure to a highest of 81% in 2006; way above the 70% fiscal limit. This upward trend was not sustainable in the long run given economic downturn in 2008.

In order to survive the recession, government deliberately cut down on consumption expenditure and increased investment expenditure which had potential to stimulate economic growth through job creation and poverty reduction. Thus in 2008 and 2009, recurrent expenditure was below the 70% rule. Compliance to the recurrent fiscal limit was short lived since the recurrent expenditure remained above 70% since 2010 to 2016. Government is currently engaged in seeking efficient and sustainable ways that can lower the recurrent expenditure, for example, working towards a lean public service structure in order to reduce personal emoluments costs associated with large public establishments.

Figure 3: Recurrent and Development Expenditure as a % of Total Expenditure
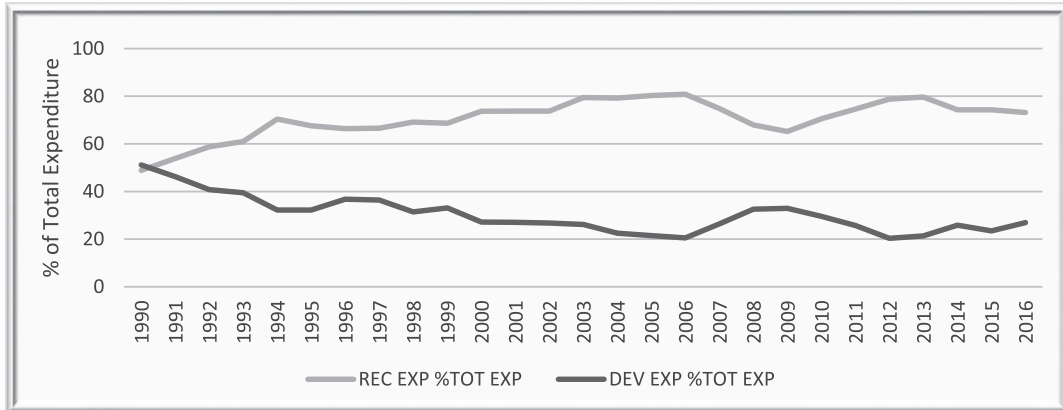
Source: BoB, 2017

Significant expenditure allocations from 1990 to 2016 have been made towards general services including defence and security, education, health, infrastructure and social welfare. General services (including defence) allocation grew from 25% to 28% of total expenditure from 1990 to 2016 respectively. This expenditure allocation demonstrates Botswana Government's commitment to service delivery and national security as enshrined in the national Vision. A secure economy has an advantage of attracting foreign investors since they are assured of their human and property rights enforced by the rule of law. Education expenditure share was 17% in 1990 and 23% in 2016 whilst expenditure on health stood at 4% in 1990 and 11% in 2016. Both expenditures in education and health are a testimony to Botswana's commitment to its human capital development. Botswana has provided free access to education and health to its citizens since independence and continues to advocate for an inclusive quality education and health systems. Notwithstanding, such huge investment is expected to payback higher returns to the local economy in the long run.

Expenditure allocations towards infrastructure (electricity and water) moved from 3% in 1990 to 9% in 2016. Public infrastructural investment enables growth of economic activities from both government and private sector. Social welfare expenditure on the other hand grew from 1% in 1990 to 3% in 2016 implying an inclusive growth. Expenditure in this sector is towards social welfare programs to the less privileged members of the society. Such social development expenditure contributes towards enhancing standard of living and to a larger extent reduce abject poverty mainly related to remote area dwellers in Botswana.

A worrisome trend of insignificant expenditure allocations towards environment, research and development, innovation and creativity in Botswana is observed. There is need to increase financial commitment towards these economic activities in order to promote a sustainable and inclusive growth. Another challenge is that Botswana Government is

faced with project implementation capacity issue which results in under and or over-expenditures of annual budgets. This trend of poor project implementation might be an indication of a weak public project planning and management system in Botswana and needs urgent attention by all stakeholders.

4.2   REVENUE TRENDS

Botswana's public expenditure sustainability is totally dependent on the country's revenue collection and management systems. Botswana's revenue base is made up of three major categories; tax, non-tax and grants revenue. Tax revenue is categorised into customs and exercise, mineral revenue, non-mineral revenue (property, vehicle and licence) and value added-tax. Non-tax revenue includes property income, interest, fees, charges and reimbursements. Grants are funds received from donors and development partners. From year 1990 to 2016, of the total revenue, tax accounted for 70%, non-tax revenue was 27% and the remaining 3% was from grants.

Figure 4 depicts revenue collected from different tax bases. It is evident that total tax revenue doubled over the years under observation (2007-2016) from P25, 831 million in 2007 to P50, 847 million in 2016. The growth in total tax revenue can mainly be attributed to mineral tax revenue which also shows a double growth from P11, 012 million in 2007 to P22, 496 million in 2016. The resilience of mineral revenue can be seen by its quick recovery after the recession from the lowest P9,088 million in 2009 to P22,496 million in 2016. VAT increased from P2, 852 million in 2008 to P6,643 in 2016. Revenue from customs and exercise also increased significantly especially in 2012 and 2015 when it exceeded mineral tax revenue. We observe that Botswana is highly reliant on mineral and customs revenue and a shift in these sources may expose the country's revenue position to external shocks which may impact the country's economic development negatively. ECA (2016) argues that in order to succeed, a nation should have a high quality tax collection system and information processing capability that engage with the private sector. Botswana should therefore, continue to strengthen its tax collection mechanisms in order to maximise revenue collection especially from the private sector.

Figure 4: Tax Revenue (Pm)
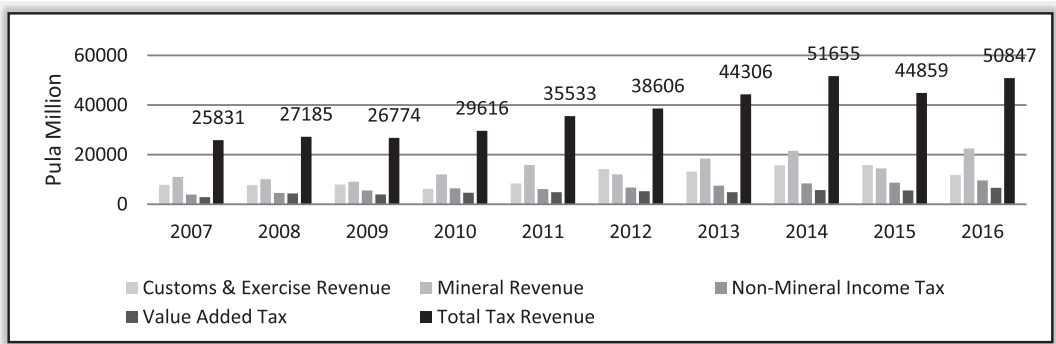
Source: BoB, 2017

4.3 DEBT TRENDS

Like any other country in the world, Botswana uses debt as one of its financing mechanisms. Botswana's debt position reported by the Ministry of Finance and Economic Development (MFED, 2018), illustrated in Figure 5, shows that government complied with its 40% debt to GDP ratio over the years. The highest debt to GDP ratio was recorded in 2010/2011 and stood at 27%. Thereafter, debt ratio reduced to the lowest of 21% in 2016. The downward trend of the debt to GDP ratio implies a strong economy which is self-sustaining to a larger extent. Interestingly, it is evident that Botswana has predominantly financed her deficits through external debt funding instead of domestic debt. One of the reasons why Botswana uses external debt the more, is because of the advantage the country has, of huge accumulated foreign reserves which provide security. External debt actually reached the maximum limit of 20% in 2012/13 financial year before lowering to 15% in 2018/2019 in comparison to a flat domestic debt trend between 7% to 8% during the same period.

As one of its fiscal strategies, Government intends to finance deficits through domestic debt (using domestic markets) more than external debt. This fiscal position is a most welcome development since it will promote the growth of the local financial and capital markets and induce price stability. Domestic debt is less volatile since it is protected from foreign exchange fluctuations mainly associated with external funding. Nevertheless, the domestic market should offer competitive debt prices to Government in order to persuade it away from external offers.

After all, Botswana's credit rating of A, as measured by Standard & Poor's and Moody's credit rating agencies, demonstrates the country's ability to pay back its debts. It also proves that Botswana belongs to a group of stable economies across the world with an upper medium grade. This credit rating further gives Botswana an added advantage of attracting both domestic and foreign investors, which can positively affect economic growth.

Figure 5: Debt Formation
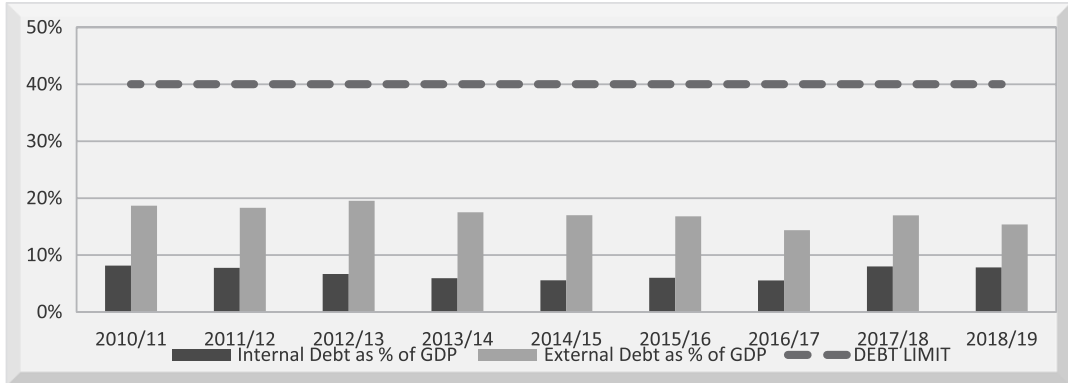
Source: MFED, 2018

5   EMPIRICAL METHODOLOGY

In this section we seek to empirically test the impact of fiscal policy shocks on structural transformation index in order to get a clearer understanding of this relationship. Since this is an individual country study, we use time series data in a structural VAR approach as proposed by Blanchard and Perotti (2002) because of its popularity in related literature (Caldara and Kamps, 2008; Mumtaz and Rummel, 2015).

This study uses IST index (structural transformation measure) as the dependent variable. Government expenditure as a share of GDP (GOVT) is the independent variable since the main focus of this paper is on the impact of fiscal policy on structural transformation. Following current studies (Sarangi et al., 2017; Benhamouche, 2018; UNCTAD, 2018), other macroeconomic variables used in this study are entered as control variables; credit to private sector as a share of GDP (CR) and exchange rate (EXC). Including these control variables in the model is necessary since they demonstrate the macroeconomic environment effect on structural transformation. Data on CR and EXC is from World Bank (WB, 2017). GOVT data is from Bank of Botswana (BoB, 2017) and IST index is derived from Lin et al. (2017). All data used in this study runs from 1990 to 2015.

5.1   MODEL SPECIFICATION

We begin with the SVAR model for this study as,

$$AX_t = \beta_0 + \beta_1 X_{t-1} + \mu_t \tag{1}$$

where A is a matrix of the system variables, X is a vector of the system variables, β_0 and β_1 are coefficients vectors of the constants and variables respectively. μ_t represents

normally distributed structural shocks. Following previous studies (Deskar-Škrbić et al. (2013), a one lag criteria is applied since we are using a short-time series.

A matrix can be represented as,

$$A = \begin{bmatrix} IST & \alpha_{12EXC} & \alpha_{13CR} & \alpha_{14GOVT} \\ \alpha_{21IST} & EXC & \alpha_{23CR} & \alpha_{24GOVT} \\ \alpha_{31IST} & \alpha_{32EXC} & CR & \alpha_{34GOVT} \\ \alpha_{41IST} & \alpha_{42EXC} & \alpha_{43CR} & GOVT \end{bmatrix}$$

Assuming A is invertible, we then multiply equation (1) by A^{-1} matrix to get the reduced-form VAR,

$$A^{-1}AX_t = A^{-1}\beta_0 + A^{-1}\beta_1 X_{t-1} + A^{-1}\mu_t \tag{2}$$

where;

$$A^{-1}A = I, \quad A^{-1}\beta_0 \text{ is } g_0, \quad A^{-1}\beta \text{ is } g_1, \text{ and } A^{-1}\mu_t = e_t$$

Equation 2 can then be re-specified as;

$$X_t = g_0 + g_1 X_{t-1} + e_t \tag{3}$$

Equation 3 can be expanded to be;

$$IST_t = g_{10} + g_{11}IST_{t-1} + g_{12}EXC_{t-1} + g_{13}CR_{t-1} + g_{14}GOVT_{t-1} + e_{ISTt}$$

$$EXT_t = g_{20} + g_{21}IST_{t-1} + g_{22}EXC_{t-1} + g_{23}CR_{t-1} + g_{24}GOVT_{t-1} + e_{EXTt}$$

$$CR_t = g_{30} + g_{31}IST_{t-1} + g_{32}EXC_{t-1} + g_{33}CR_{t-1} + g_{34}GOVT_{t-1} + e_{CRt}$$

$$GOVT_t = g_{40} + g_{41}IST_{t-1} + g_{42}EXC_{t-1} + g_{43}CR_{t-1} + g_{44}GOVT_{t-1} + e_{GOVTt} \tag{4}$$

5.2 MODEL IDENTIFICATION

We then identify the reduced SVAR model 4 by imposing short run restrictions on A and B matrices of the error terms in order to reveal an underlying structure. Short run restrictions are imposed based on both economic theory and available Botswana economic information (Bernanke, 1986; Sims, 1986; Mumtaz and Rummel, 2015). Since our model has 4 (n) endogenous variables, we impose 22 restrictions in total (6 zero restrictions, calculated as $(n^2 - n)/2$ in A matrix, 4 normalisation restrictions on the

diagonal of A matrix plus 12 zero restrictions on the B matrix). According to economic theory (Sarangi et al., 2017), structural transformation is a result of changes in economic policies. Therefore, all the three IST index coefficients in the A matrix are restricted to zero. Elements α_{23CR} and α_{24GOVT} of the A matrix are also set to zero because shocks to both credit and government expenditure are not expected to immediately change the current exchange rate in Botswana. Government expenditure in Botswana is mainly funded through government revenue and not through bank credit, therefore, a zero restriction is given to α_{43CR}.

Thus, matrices A and B will appear as:

$$
A = \begin{bmatrix} 1 & * & * & * \\ 0 & 1 & 0 & 0 \\ 0 & * & 1 & * \\ 0 & * & 0 & 1 \end{bmatrix} \quad B = \begin{bmatrix} * & 0 & 0 & 0 \\ 0 & * & 0 & 0 \\ 0 & 0 & * & 0 \\ 0 & 0 & 0 & * \end{bmatrix}
\tag{5}
$$

where, 0 and 1 represents the value of the respective variable in the matrix. * shows variables that the model should estimate.

5.3 MODEL ESTIMATION

The estimation of the SVAR relies on the concentrated log likelihood fraction which is defined as,

$$
\ln L\left(\theta;\varepsilon\right) = \ln\left[\prod_{t=1}^{T} f\left(\varepsilon_t|\theta\right)\right]
$$

$$
= -\frac{T}{2}\left(k\ln\left(2\pi\right) + \ln\left[S(\theta)S(\theta)'\right] + tr\left(\hat{\Sigma}_\varepsilon\left(S(\theta)S(\theta)'\right)^{-1}\right)\right)
\tag{6}
$$

where f is the probability density function of the multivariate normal distribution with zero mean and is the matrix trace operation. S contains the short run matrix.

5.4 MODEL TESTING

The output from equation (5) is used to estimate both impulse responses and error variance decompositions. Analysis of impulse responses and variance decompositions are argued to be more informative than estimates of the SVAR parameters' coefficients themselves (Mumtaz and Rummel, 2015). Impulse responses and error variance decompositions measure effects of changes in the value of the explanatory variables on the dependent variable. That is, in order to analyse the behavior of structural transformation to fiscal policy shocks (innovations) in Botswana using the impulse responses test, a unit shock

is applied to the error of GOVT variable and then the response of IST variable to such a shock is observed. Moreover, impulse response tests will reveal the length of time such effects take to be realized in the system. On the other hand, variance decompositions reveal how much of IST movements are caused by its own shocks rather than shocks transmitted to the explanatory variables.

6   EMPIRICAL RESULTS AND DISCUSSIONS

6.1 SPECIFICATION

We begin by specifying a standard VAR with five variables (Table 1 in Appendix 1 refers). From this standard VAR we move on to an SVAR which is just-identified.

6.2 ESTIMATION RESULTS

From Table 1, we can observe that the model is well specified because all the variables are significant with very high R-squared. The SVAR which followed is also obtained by Maximum likelihood via Newton-Raphson. The estimated A, B, S and F matrices are obtained and they have the following structure,

Estimated A matrix:

1.000	–0.002	0.000	0.000
0.000	1.000	0.000	0.000
0.000	–0.199	1.000	–0.160
0.000	0.244	0.000	1.000

Estimated B matrix:

0.007	0.000	0.000	0.000
0.000	0.544	0.000	0.000
0.000	0.000	1.462	0.000
0.000	0.000	0.000	1.707

Estimated S matrix:

0.007	0.001	0.000	0.001
0.000	0.544	0.000	0.000
0.000	0.087	1.462	0.273
0.000	–0.133	0.000	1.707

Estimated F matrix:

|			
–0.020	0.069	–0.006	0.013
3.096	–9.221	–1.015	3.738
12.404	–35.357	0.388	8.113
–6.730	13.787	1.138	–0.145

6.3   ADEQUACY

In order to check the adequacy of the model, we used different tests (autocorrelation test, normality test and heteroskedasticity test displayed in Appendix 1 Tables 3, 4 and 5 respectively). They all indicate that the residuals are white-noise. Since the model has good performance, it can be used for policy analysis.

6.4   IMPULSE RESPONSES ESTIMATION

Estimates of IST impulse responses to other variables are generated and presented in Figure 6. Other impulse responses for the independent variables are depicted in Figure 7, Appendix 1. Our major finding is that government expenditure promotes structural transformation in Botswana. A one-standard deviation shock to GOVT increases IST by 0.06 percent at the highest. Our results are consistent with several studies, exceptionally documented by Deskar-Škrbić et. al (2013), which concluded that fiscal policy shocks via government expenditures have a positive and robust effects on economic activities. EXC innovations increase IST by 0.02% whilst CR shocks negatively impacts IST in the short term which proves that credit does not significantly promote structural transformation in Botswana.

Figure 6: Impulse Responses

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.
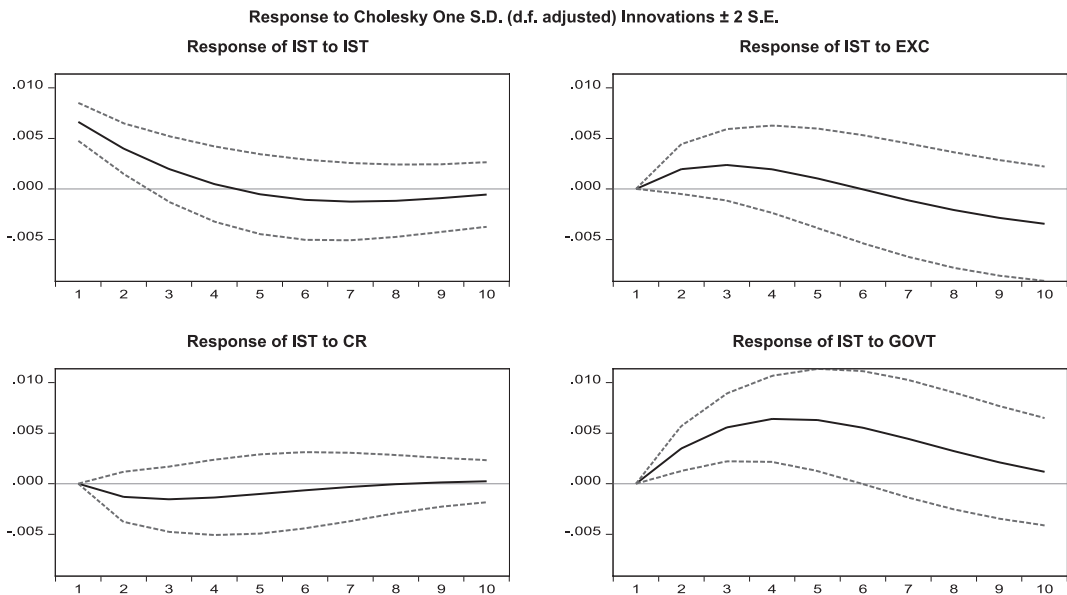
6.5 VARIANCE DECOMPOSITIONS

Forecasts of the error variance decomposition is depicted in Table 2. Other variance decompositions for the explanatory variables are depicted in Table 6, Appendix 1. Results in Table 2 show that the largest share of about 77 percent of IST movements, are explained by its own shocks. This impact from IST shocks to itself diminishes down the time line. On the other hand, more than 50 percent of movements in IST are explained by GOVT shocks. During the entire period under observation, it is evident that at its highest, EXC shocks accounts for less than 13 percent movements in IST whilst CR shocks contributes the least (below 4%) to IST movements. Thus, government expenditure is the main contributor to structural transformation in Botswana. These results are as expected and they are a reflection and confirmation of Botswana's economic landscape. Government of Botswana is the main driver of structural transformation through its fiscal reforms (expenditures) hence the variance decomposition results are accepted.

Table 2: Variance Decomposition of IST

Period	S.E.	IST	EXC	CR	GOVT
1	0.007	100.000	0.000	0.000	0.000
2	0.009	77.271	4.956	2.156	15.617
4	0.013	38.291	7.922	3.502	50.285
6	0.016	27.101	5.940	3.025	63.935
8	0.017	24.400	7.107	2.642	65.851
10	0.018	22.614	12.987	2.435	61.964

7 CONCLUSIONS AND POLICY IMPLICATIONS

Descriptive analysis of the Botswana's economic structural transformation shows that deliberate government development policies, to a lager extent, play a major role in promoting structural transformation. In particular, fiscal policy shifts, as depicted by changes in expenditure, revenue and debt positively enhance structural transformation in Botswana. As a matter of confirmation, empirical estimates in this study also establish that structural transformation responds positively to fiscal policy shocks. Moreover, amongst all the explanatory variables in this paper, government expenditure explains more than 50 percent of changes in structural transformation. These positive outcomes are not without challenges of undiversified revenue base away from diamonds and growing budget deficits.

Policy implications drawn from this study are that, amongst other tools used to transform the structure of Botswana's economy, prudent fiscal policy can be used as a major strategic tool. Given her significant mineral proceeds and various economic development policies, Botswana should strategically transform the economy towards industrialisation, services,

technology and innovation whilst ensuring climate and environmental protection. This transformation may be achieved through efficient public-private partnerships (that cushions government funding) and diversified revenue base away from the diamonds. Moreover, emphasis on deriving return on investment should be placed on service delivery, especially from public sector infrastructure investments, which get the biggest share of the budget like education and health. All in all, Botswana should continue to promote fiscal prudence since it has proven resilient over time to transform the country's economy.

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APPENDIX 1

Table 1: Standard VAR

Dependent Variable: IST
Method: Least Squares (Gauss-Newton / Marquardt steps)
Sample (adjusted): 1991 2015
Included observations: 25 after adjustments
IST = C(1)*IST(-1) + C(2)*EXC(-1) + C(3)*CR(-1) + C(4)*GOVT(-1) +C(5)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.492	0.132	3.726	0.001
C(2)	0.005	0.002	2.360	0.029
C(3)	-0.001	0.001	-1.994	0.060
C(4)	0.002	0.001	3.509	0.002
C(5)	0.217	0.069	3.156	0.005
R-squared	0.912			
Adjusted R-squared	0.894			
F-statistic	51.692			
Prob(F-statistic)	0.000			

Table 3: Autocorrelation Tests

VAR Residual Serial Correlation LM Tests
Sample: 1990 2015
Included observations: 25
Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	18.693	16	0.285	1.221	(16, 40.4)	0.295

Null hypothesis: No serial correlation at lags 1 to h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	18.693	16	0.285	1.221	(16, 40.4)	0.295

*Edgeworth expansion corrected likelihood ratio statistic.

Table 4: Normality Tests

VAR Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)

Null Hypothesis: Residuals are multivariate normal

Sample: 1990 2015

Included observations: 25

Component	Skewness	Chi-sq	df	Prob.*
1	-0.215	0.193	1	0.660
2	-0.597	1.486	1	0.223
3	0.242	0.244	1	0.622
4	-0.034	0.005	1	0.944
Joint		1.928	4	0.749
Component	Kurtosis	Chi-sq	df	Prob.
1	1.910	1.238	1	0.266
2	4.278	1.701	1	0.192
3	2.141	0.769	1	0.381
4	2.351	0.438	1	0.508
Joint		4.146	4	0.387
Component	Jarque-Bera	df	Prob.	
1	1.432	2	0.489	
2	3.187	2	0.203	
3	1.012	2	0.603	
4	0.443	2	0.801	
Joint	6.074	8	0.639	

*Approximate p-values do not account for coefficient estimation

Table 5: Heteroskedasticity Tests

VAR Residual Heteroskedasticity Tests (Levels and Squares)
Sample: 1990 2015
Included observations: 25

Joint test:

	Chi-sq	df	Prob.		
	84.680	80	0.339		

Individual components:

Dependent	R-squared	F(8,16)	Prob.	Chi-sq(8)	Prob.
res1*res1	0.708	4.842	0.004	17.692	0.024
res2*res2	0.426	1.484	0.238	10.648	0.223
res3*res3	0.198	0.495	0.842	4.959	0.762
res4*res4	0.234	0.611	0.756	5.852	0.664
res2*res1	0.489	1.914	0.128	12.224	0.142
res3*res1	0.526	2.217	0.084	13.143	0.107
res3*res2	0.321	0.944	0.509	8.014	0.432
res4*res1	0.162	0.386	0.912	4.048	0.853
res4*res2	0.262	0.709	0.681	6.543	0.587
res4*res3	0.216	0.552	0.801	5.405	0.714

Figure 2: Impulse Responses

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.
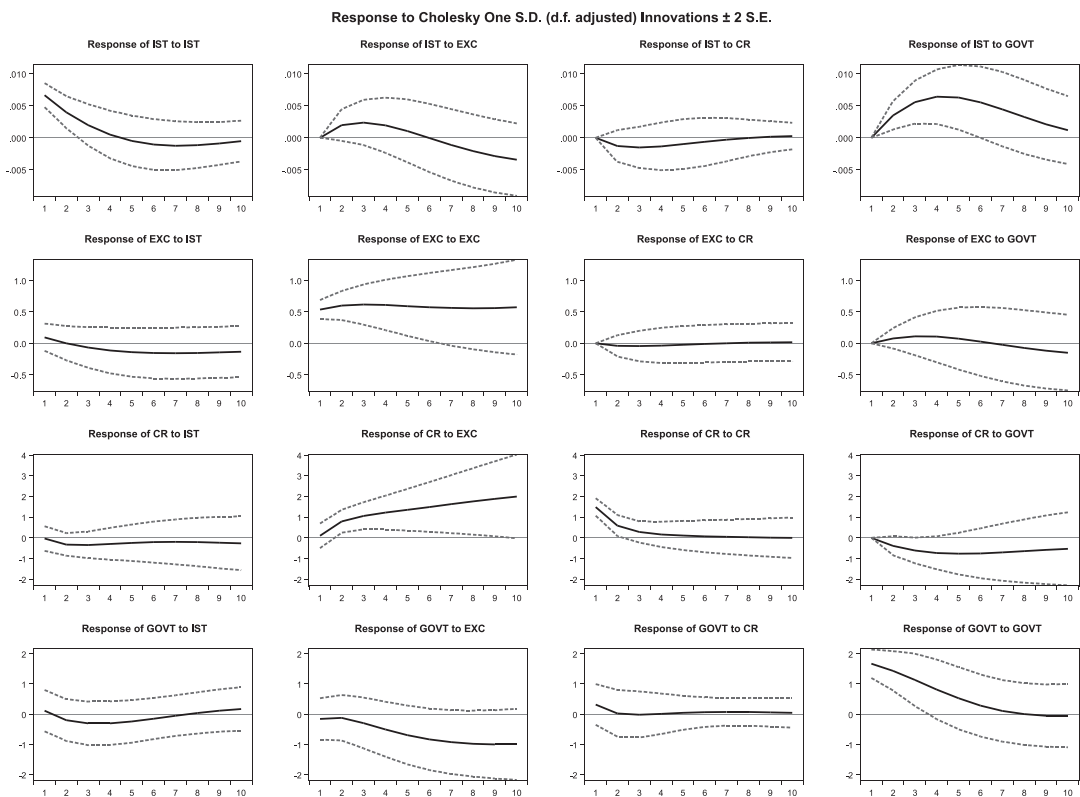
Table 6: Variance Decompositions

| | Variance Decomposition of IST: | | | | |
Period	S.E.	IST	EXC	CR	GOVT
1	0.007	100.000	0.000	0.000	0.000
2	0.009	77.271	4.956	2.156	15.617
4	0.013	38.291	7.922	3.502	50.285
6	0.016	27.101	5.940	3.025	63.935
8	0.017	24.400	7.107	2.642	65.851
10	0.018	22.614	12.987	2.435	61.964
	Variance Decomposition of EXC:				
Period	S.E.	IST	EXC	CR	GOVT
1	0.544	3.104	96.896	0.000	0.000
2	0.816	1.381	97.424	0.252	0.942
4	1.210	1.835	95.771	0.338	2.056
6	1.482	3.239	94.848	0.251	1.662
8	1.697	4.151	94.183	0.195	1.472
10	1.897	4.405	93.247	0.168	2.180
	Variance Decomposition of CR:				
Period	S.E.	IST	EXC	CR	GOVT
1	1.490	0.063	0.408	99.530	0.000
2	1.857	3.131	18.482	74.012	4.375
4	2.696	4.326	44.502	36.536	14.636
6	3.545	3.321	57.743	21.258	17.677
8	4.390	2.601	67.261	13.876	16.261
10	5.245	2.282	74.341	9.719	13.659
	Variance Decomposition of GOVT:				
Period	S.E.	IST	EXC	CR	GOVT
1	1.712	0.461	0.827	3.469	95.242
2	2.245	1.070	0.768	2.034	96.128
4	2.741	3.172	5.055	1.369	90.404
6	3.020	3.473	16.994	1.198	78.335
8	3.311	2.928	30.683	1.098	65.292
10	3.609	2.798	41.222	0.969	55.011
Cholesky Ordering: IST EXC CR GOVT					

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