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THE EFFECTS OF AID AND BORROWING ON FISCAL BEHAVIOUR: EVIDENCE FROM GHANA

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Abstract

Fiscal management is crucial for economic growth and development, particularly in developing countries where fiscal policy has a significant impact on their economic prospects. This study investigates the effects of government borrowing modes on government spending and revenue mobilization behavior in Ghana. We propose that the effects of borrowing modes on revenue streams may not be uniform. The study modifies the Franco-Rodriguez government utility maximization function and employs the vector autoregressive (VAR) system to establish dynamic links among borrowing modes, revenue channels, and government spending. The study analyzes two variants of the model, aggregated and disaggregated government expenditure models. The results indicate that there is one long-run equilibrium relationship in respect of government consumption expenditure for the disaggregated model. In the aggregate government expenditure model, two long-run relationships are established for government expenditure and external borrowing. The estimates show that government consumption expenditure is inversely related to government capital expenditure, direct taxes, indirect taxes, and domestic borrowing. In the short run, the impacts of borrowing modes on tax channels are different, and tax policy initiators should consider these differences while formulating policies. Our findings have implications for policymakers, particularly in developing countries, regarding the management of fiscal policies and the effects of borrowing on government spending and revenue mobilization. Keywords: Fiscal behavior, government borrowing, revenue mobilization, Ghana, vector autoregressive system, Franco-Rodriguez function.

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Introduction

Throughout the world, government expenditure remains an avenue that provides a strong impetus for spurring economic growth and indeed it is the government expenditure outlays in every economy that enable the state to create the necessary infrastructure and the relevant institutional mechanisms to support the multiplicity of economic activities across the spectrum. Whilst it is recognized that the government expenditure is critical in every economy, it must also be noted that such expenditures are usually greatly influenced by the financing channels through which the expenditures are derived. Much as it is true that the trajectory of government expenditure has riposte on the various financing modes, it is also equally an established fact that these financing modes can affect each other .In the literature, there is seem to be a general view that government expenditure must as much as possible be financed from the conventional sources- direct and indirect tax as well as non-tax revenues. However, in the developing world especially, it has become customary to leverage on borrowing modes as a way of meeting the government expenditure levels required in the budget plans as the conventional revenue raising mechanisms always fall way short of the intended targets sufficient enough for the government operations to be pursued seamlessly.

Within these contexts, there has emerged a strand of empirical research which seeks to examine the fiscal behaviours of governments and in particular how the availability of the borrowing modes dampens the resolve of the fiscal authorities to be up and doing and maximize revenues. This is well-articulated in the early studies in fiscal behaviours; Griffin (1970), Heller (1975) and Mosley *et al*.(1987) etc. One important aspect of this discussion centers on the aid effect on the other financing modes and government expenditure itself. According to Osei, Morrissey and Lloyd (2005), studies on the effects of aid on fiscal behaviour can generally be categorized into those which direct their attention at investigating the effects of aid on the composition of government expenditure and those which in addition to examining the effect of aid on the allocation of government expenditures also assess aid effect on tax effort and government borrowing.

In Ghana, just as in a lot of the developing countries, the pressure on successive governments to meet the aspirations of the citizenry has meant that government has to go out of the way to find the needed resources to ensure that programmes and projects are duly executed even against the backdrop of insufficient revenue generated and this situation has persisted for a long time. There are some who believe strongly that this has continued to exist because of the opportunity which is always open for the government to look anywhere to fund its activities even though government could be more prudent in staying reasonably within its revenues limits or aggressively pursuing the much needed tax reforms which could result in enhanced revenue collection. A number of questions thus arise. Does the availability of other government expenditure financing modes encourage government to continue to increase expenditure? Do aid and borrowing dampen tax revenue generation? Do grants and borrowing trigger differential fiscal behaviour by government? Again, how does the availability of the non-tax government expenditure financing modes influence the allocation of government expenditure?

Gleaning the literature, it is obvious that contemporary studies in this arena have moved forward the frontiers of knowledge established by the earlier ones, eg Griffin (1970), Heller (1975) and Mosley *et al* (1987) and Khilji and Zampelli (1994).

The most recent study conducted within the Ethiopian context by Mascagni and Timmis (2014) develops a model of fiscal behaviour encompassing tax and non-tax revenues, government expenditure, grants and loans which modifies Osei *et al* (2005) and Lloyd *et al* (2009) which include government (capital and recurrent), total tax revenue and domestic borrowing for the former and foreign financing, capital expenditure, recurrent expenditure, tax revenue and domestic borrowing in the case of the latter. In these studies, the researchers did not avert their minds to the fact that the dynamics may not possibly be the same if the tax financing source is disaggregated into direct and indirect tax channels. In other words, in this study apart from categorizing aid as grants and loans, we also include direct and indirect tax financing as separate variables. This is because we believe that aid and borrowing may not necessarily have the same effects on direct and indirect taxes. Thus the main difference between the present study on one hand and that of Osei *et al* (2003) and other previous but related studies on the other hand is that it we introduce the hypothesis that the responses of direct and indirect taxes respectively to borrowing-both external and domestic are different and also have the benefit of current data for the analysis to determine whether prevailing circumstances deviates from Osei *et al*(2003). The rest of the paper would be arranged in the following manner; Section II is devoted to examining the fiscal policy environment, trends in fiscal management and borrowing by the government of Ghana over the years. In section III, we proceed to discuss the theoretical and empirical issues relating to fiscal behaviour by government especially focusing on aid and borrowing and their effects on government fiscal management. Section IV sets out the econometric approach and a brief description of the data set for the empirical analysis whilst Section V reports the results of the data analysis and proceeds to discuss them. Finally, section VI covers the synopsis and conclusions from the study.

Section II: **Trends in Fiscal management in Ghana**

When one does a careful study of fiscal policy in Ghana, one can identify clear, distinct periods of unique fiscal behaviours? In the main, the periods the early 1960s to the late 1960s, 1969-1972, 1972-1983, 1983-1991 and from 1992 to the present can be associated with peculiar fiscal behaviours though in some of the periods the fiscal management approaches appear similar. In the sixties, with the emergence of the country from colonial rule there was an urgent need for the government to put in place structures of state and build critical infrastructure like educational and health institutions while also embarking on rapid industrialization and modernization and as such, government committed massive public expenditures into achieving these objectives. During this period, a good chunk of the expenditures were financed from domestic sources with very little coming by way of aid inflows.

The succeeding period however saw a modification of fiscal behaviour as government substantially disengaged from the previously pervasive role of the government in the economy, in line with the philosophy of the people in authority at the time and by virtue of the programme that they entered into with the Bretton Woods institutions, government at the time embarked on privatization of a good number of the state enterprises. Osei et al(2003) submit that from the 1960s to early 1970s , aid inflow was relatively insignificant and constituted about 2% of GDP and roughly around 12% of all revenues available to government. In the middle to the late 1970s, there was a shift in the behaviour of the government as government activities were driven essentially by monetary expansion through borrowing from the Bank of Ghana as domestic revenues sharply reduced on account of the decline in the real side economic activities precipitated by inappropriate policies introduced by the then military rulers coupled with adverse economic and external trade climate. The situation was compounded by the repudiation of loans which had been contracted by previous governments leading to the virtual drying up of the foreign aid inflows.

In early 1980s, even though the country had returned to constitutionalism, the country continued to suffer from the decline in economic activities as result of the deterioration of the macroeconomic environment. According Durdonoo's (2000) calculations, taxes on income and property fell from 2.8% of GDP to a mere 0.98% of GDP in 1983 whilst tax revenue from domestic activities was down to sub one percent in 1983 from approximately 5% of GDP. Proceeds from international transactions also dropped from 12% in 1970 to 2.7% in 1983.The precarious revenue situation in the country is illustrated by Osei *et al*(2003) when they intimate that overall the tax levels took a nosedive between 1970 and 1983,plummeting from a high level of about 700 million USD to 160million USD. The fiscal situation in the country however improved dramatically after the Economic Recovery Programme (ERP) was launched. Indeed it is estimated that between 1983 and 1998, tax revenue collections shot up in dollar terms to 1.3 billion USD representing a more than six fold increase of the 1983 level. Generally speaking, total government revenue is measured in some calculations to have increased twenty-six times between 1983 and 1990. Osei et al (2003), suggest that since this period was largely marked by good amount of aid inflows, it appears that the aid flows did not undermine government's tax revenue mobilization. During the period whilst tax revenue and aid inflows were increasing, government expenditure also continued to increase though at a slower pace, on account of the some of the ERP measures which had been introduced to stem rapidly increasing government expenditure experienced in the period before ERP. The post 1992 period has generally been characterized by rapidly expanding government expenditure largely fueled by the people across the country making demands on politicians and indeed some actually using the provision of certain projects and infrastructure as a tool for cajoling and blackmailing functionaries of government. However, revenue mobilization during the period has not kept pace with government expenditures and the peoples aspirations for that matter. Indeed for a long time now total government revenue is consumed largely by payment of emoluments, statutory obligations and then interests payments, which itself is a product of the increasing imperative for borrowing by government. The argument that the political structure in Ghana has tended to reinforce fiscal behaviours by successive governments in the fourth republic is amplified when one considers Ghana’s fiscal position in election years. Election cycles have generally exacerbated the problem and this is evidenced by the fiscal deficits which were recorded in the years 2008, 2012 and 2016 respectively. One major development which has also to a great extent influenced fiscal behaviours especially post 2012 has been the reclassification of Ghana as a middle income country .This has restricted the country's access to concessionary loans and grants and compelled governments to syndicate relatively expensive loans from the international commercial markets on account of the fact that Ghana's tax to GDP ratio is woefully below the average middle income levels. Indeed it is very instructive to note that in the West Africa sub region, Ghana's tax collections as a percentage of GDP is the lowest. Against this background, the issuances of Euro bonds have become an important feature of government strategy for financing projects and programmes of government as missing revenue targets have become a constant feature of fiscal management in Ghana.

Section III :Theoretical, conceptual issues and empirical underpinnings

Fiscal policy formulation is one of the basic functions of every government in the sense that it primarily involves the strategies that governments use to raise income to be able finance government's activities. In the main, most governments rely on revenues generated from taxation as the most reliable source of income. However, in most parts of the world particularly the developing world because of the demands on government to ensure rapid development and the exigencies of the time, they are unable to stick to the incomes available to them through taxation and therefore have to resort to other means of financing their programmes and projects. These come in the form of foreign aid- loans and grants and domestic borrowing.

According to Njeru (2004), one of the most critical issues which has been a subject of debate by economists in this area of research is whether or not the aid process is undermined by the ability of the aid receiving country to alter the their spending patterns to subvert the sectoral distribution of expenditure for designated projects. The general contention is that the ability of the recipient country to reallocate the aid can usually affect the intended economic performance envisaged under the aid structure. This is particularly the case when aid earmarked for developing critical infrastructure in a given economy is diverted into financing government consumption like catering for emoluments of workers and buying goods and services for government machinery rather than creating the required infrastructural overheads which then provide the necessary platform for increasing the level of economic activities. This is what economists usually refer to as aid fungibility. This is reinforced by Bwire *et al* (2017) who contend that fungibility arises when aid recipients do not use the aid for purposes for which they were given by the donors. Thus in many respects, a lot of the developing countries employ resources from aid to able to be able to deal with the deficits usually associated with their budgetary processes (Devarajan et al, 1998, Ali *et al* , 1999). These views are very replete in the fiscal response studies. For example Matins (2007) asserts that one of the most fundamental issues which relate to the effectiveness of aid is how aid influences the government fiscal accounts. In particular, Martins (2007) stresses that one critical pillar of the fiscal response studies is assessing how the aid itself is allocated between the various expenditure channels, the way it affects tax effort and then its effect on fiscal balance and debt sustainability. This is view is reinforced by Mavrotas (2002) who stresses that since aid is given to a government, its impact on the overall economy is contingent on fiscal behaviour of the government. From the perspective of Mascagni and Timmis (2014), aid is usually a more politically expedient and convenient source of revenue and therefore has the tendency to discourage tax effort which in the literature is characterized as tax displacement. They however stress that this argument is stronger in respect of grants than loans because of the obvious fact that loans require future payments whereas grants do not. Mascagni and Timmis (2014) put forward another dimension of the aid–revenue debate which is that rather undermining the revenue efforts, aid may actually help strengthen tax administration and improve tax policies. Again, it is argued that if aid is utilized properly and effectively it may promote economic activities, expand the economy and by that increase tax yields from the economy.

In the view of Njeru (2004), aid inflows into the developing countries has tended to create an ominous dependency mentality which seem to affect their economic performances and the absence of such funds greatly affect their budgets, usually coming with their attendant consequences. This is echoed by Feyzioglu *et al* (1999) who posit that aid dependence is something which has widespread ramifications for countries. There is an also another dimension of the aid debate which is canvassed by Martins(2007) .In his estimation apart from the fact that aid is sometimes used to offset domestic debts, it can trigger off extra government expenditures especially in aid funded projects which require some maintenance and recurrent expenditure. Again aid programmes and projects which require counterpart funding may in reality also further put pressure on government's already overstretched finances and thus lead to mounting deficits. This scenario is what McGillivray and Morrissey (2000) describe as aid illusion. Having regard to the fact that foreign aid may be associated with some challenges; the other viable alternative is borrowing from domestic sources to be able to undertake the necessary government activities. However, this avenue also comes with its own problems. One of the challenges that this poses is that it leads to a situation in which government enters the credit markets to compete with private entities for the available funds, a situation which generally inhibits the growth of privately engineered economic growth in an economy. This can in many respects also affect tax mobilization. Aside of these issues ,it is often argued that in a lot of the developing countries, excessive reliance on borrowing modes to enable governments meet its commitments in terms of delivering the required services has invariably led to compounding debt servicing obligations and thereby constricting fiscal space as the piling of debts both internally and externally have tended to increasingly impose severe servicing and payments obligations on the government thereby limiting what the government can achieve within its resource envelop. Studies in fiscal response has its origins in the 1970s starting with Heller(1975) who used a utility based government fiscal behaviour function to show that the aid process has effects on how governments manage their fiscal operations . Despite the vast array of research in this area, results from these studies have largely been inconclusive. According to Mascagni and Timmis (2014), this situation may be due to the fact that various studies adopted different methodologies and contexts. In his study, Njeru (2004) assessed the impact of foreign aid on public expenditure in Kenya and based on government welfare utility function specified government expenditure related to aggregated government revenues from tax and domestic borrowing sources, programme aid and project aid. The dynamic analysis indicated that aid does not affect government expenditure whilst it is also established that government is able to divert aid funds into government consumption expenditure.

A similar study by Osei *et al* (2003) modelled the fiscal effects of aid in Ghana by particularly employing a dynamic impulse response functions. Using the government utility maximization approach, two variants of the empirical model were specified; these are aggregate government expenditure ,domestic borrowing ,total government tax revenues and aid finance on hand and government capital expenditure, government consumption expenditure, domestic borrowing, total tax revenue and foreign aid. In the analysis, it is established that there are co-integrating relationships in both models. Results also showed that in both models, aid finance and domestic revenues are in long run negatively related to domestic borrowing whilst government expenditure whether aggregated or disaggregated positively influences domestic borrowing .Another important finding that issues from Osei et al (2003) is that aid in Ghana over the study period has generally been used to replace domestic borrowing as a method of financing government projects and programmes.

The work of Martins (2007) also explores further the aid-fiscal behaviour nexus within the context of the Ethiopian economy and actually separates aid into two components-loans and grants based on the premise that fiscal response by government to them may be different. The conclusions from the estimations are that whilst aid finance positively affects total government expenditure, its effects on government consumption expenditure is less pronounced and that external borrowing has a bigger impact on public investment than grants. Another important finding from this study is that aid finance undermines domestic revenue mobilization.

In his contribution in the fiscal response and effectiveness of aid studies, Mavrotas (2002) introduced a categorization of foreign aid into project aid, programme aid, technical assistance and food aid and based on the popular utility maximization approach obtained results which affirm that aid may be fungible.

The study by Mascagni and Timmis (2014) also dealt with the fiscal effects of aid in Ethiopia employing the co integrated vector autoregressive model based on the conventional Heller utility maximization function. Their model encompassed total government expenditure, tax and non-tax revenues, grants and loans .In the long run , government expenditure was established to be related to domestic revenue and foreign aid; there is a positive relationship between tax revenue ,grants and loans. In the short run too, government expenditure is established to be influenced positively by both grants and loans whilst the equation for tax shows that non-tax revenue, grants and loans are all positive determinants. The, loans variable is also impacted positively by non-tax revenue but negatively by tax revenues. The most recent study in this area, authored by Bwire *et al* (2017) also sought to examine fiscal reforms and the effects of aid in Uganda employing a dynamic analysis and to test whether aid flows lead to a full or less than a full change in government expenditure, determine if aid displaces tax effort as well as ascertain whether aid and domestic borrowing are substitutes in fiscal management in Uganda. Their analysis uncovered three co integrating equations for government expenditure, revenue and aid and found that in the long run aid leads to increased tax effort and public spending but a reduced domestic borrowing.

Section IV: **Empirical model**

According to Osei *et al* (2003), there are two broad approaches adopted in the literature to examine the fiscal effects of aid. The first approach is the fungibility studies which attempt to assess aid effects on the spending patterns of the government and the other method which seeks to integrate revenue variables into a government utility function to determine the overall impact of the aid process on the fiscal behaviour of the government which they call the fiscal response models (FRMs). Since the latter is more comprehensive in its outlook, it is more popular in the literature and has been adopted in most of the recent studies. This approach is based on the seminal work of Heller (1975) which posits government allocating revenue among the different expenditure streams but subject to some budget constraints. In the model, government expenditure is usually categorized into government consumption and capital expenditure whilst government derives its income endogenously from conventional taxation sources and domestic borrowing. However, in these models, foreign aid is defined as an exogenous source of revenue which modifies the government budget constraints; even though it is assumed not to be relevant in the utility function of the government since it is not defined as one of the variables for which targets are set. Against this background, Osei *et al* (2003) set the maximum unconstrained value of the utility function represented by α_0 as a quadratic expression defining a loss in the form below;

$U=\alpha_0-\alpha_1/2(GK-GK^*)^2-\alpha_2/2(GC-GC^*)^2-\alpha_3/2(R-R^*)^2-\alpha_4/2(D-D^*)^2$ (1), where GK*, GC*,R* and D* are exogenous target values of government capital expenditure ,government consumption expenditure ,total government revenue and government borrowing from domestic sources. The above equation is thus maximized subject to the following budget constraints,

$$GK = (1-\rho_1)R + (1-\rho_2)F + D \quad (2)$$

and

$$GC=\rho_1 R+ \rho_2 F \quad (3)$$

Where equations (2) and (3) are disaggregated equations derived from the total government expenditure constraints, of the form,

$$GK + GC = R+F+D \quad (4)$$

From the above equations, it is taken that ρ_2 represents the fraction of aid which is diverted into financing government consumption ;in other words the extent of the fungibility of aid .The implicit argument underlining this formulation is that when foreign aid is received , it is meant for capital investment .However , as the aid comes into the economy, a part of it is channeled into financing recurrent expenditure which means that mathematically, $\rho_2=0$ ex ante but this according to Osei *et al* (2003) is not in the real world realistic because aside of directing resources into investments in the economy, foreign aid sometimes finances certain components of government consumption ,particularly in the social sectors especially education and health, hence $\rho_2 \neq 0$ is an unrealistic assumption but $\rho_2 > 0$ at most times is the most realistic assumption to make. This situation occurs especially when aid comes in in the form of budgetary support or even strictly as aid funded project in an economy. With the inherent limitations of this approach, Franco-Rodriguez et al (1998) modified the approach by defining a utility function such that foreign aid is interacted and integrated directly into the function thereby making aid endogenous. The argument put forward is that generally governments define targets for aid flows and this tends to influence their fiscal behaviour. As a result, the quadratic utility loss function expressed in (1) becomes

$$U =\alpha_0- \alpha_1/2(GK-GK^*)^2- \alpha_2/2(GC- GC^*)^2- \alpha_3/2(R-R^*)^2 -\alpha_4/2(F-F^*)^2 -\alpha_5/2(D-D^*)^2 \quad (5)$$

whilst the constraining function becomes

$$GC \leq \rho_1 R + \rho_2 F + \rho_3 D \quad (6)$$

since external flow of funds tend to influence how resources are allocated among competing needs.

In this current paper, we further redefine (5) as

$$U =\alpha_0- \alpha_1/2(GK-GK^*)^2- \alpha_2/2(GC- GC^*)^2- \alpha_3/2(DT-DT^*)^2 - \alpha_4/2(IT-IT^*)^2 -\alpha_5/2(F-F^*)^2-\alpha_6/2(D-D^*)^2-\alpha_7/2(Gr-Gr^*)^2 \quad (7)$$

Subject to

$$GC \leq \rho_1 DT + \rho_2 IT + \rho_3 F+\rho_4 D +\rho_5 Gr \quad (8)$$

The implicit meaning of the above is that both direct and indirect sources of revenue are endogenously determined in addition to the other sources of revenue. In this formulation, we separate F, external borrowing from Gr, grants because in the literature, it is argued that most governments treat loans differently from grants which are not to be paid back. Though Franco-Rodriguez *et a*l (1998) provided an improvement of the earlier fiscal response models (FRMs), they did not address the methodological challenges that most of the earlier studies were fraught with. Osei *et al* (2003) therefore in their study changed direction to the new vector autoregressive (VAR) approach which in their view provided the means to go round the existing problematic methodological frameworks whilst

making it easier to define the dynamic linkages between the various components of the budget. Building upon Osei *et al*(2003), M'Amanja *et a*l (2005),Martins (2010),Bwire *et al*(2017) and Mascagni and Timmis(2014), we specify two variants of the
VAR model involving aggregate and disaggregated government expenditure models below:

(GE, DT, IT, Db, Fb, Gr) and

(GK, GC, DT,IT, Db, Fb, Gr) respectively where GK is government capital expenditure, GC is the government consumption expenditure, IT is indirect tax revenue ,DT defines direct tax revenue, Db represents domestic borrowing ,Fb is used for external borrowing whilst Gr is grants obtained from various external sources and finally GE defines aggregate government expenditure. In these models above, the application of the VAR allows us to determine whether the variables are in the long run are dynamically related whilst at the same time providing useful information about the short run properties of the models. Generally an orthodox VAR model is defined as a dynamic system in which all the variables are endogenously determined and each of them is represented as a function of its own lags and the lags of the other endogenous variables. The advantage from this, according Blanchard and Peroti (1999) is that the system assumes *a priori* there is no direction of causation among the variables of interest.

Mathematically, we define our VAR (k) as

$$X_t=\varphi_1X_{t-1} + \varphi_2X_{t-2} +\varphi_3X_{t-3} +\ldots..+\varphi_kX_{t-k}+ \pi R_t + \epsilon_t,\ t=1,2,\text{----},n. \quad (9)$$

In the above, X_t is defined as a (m × 1) vector of non-stationary variables whose order of integration is one and which are jointly determined, whilst the R_t is also a vector of deterministic variables of dimension, (p× 1). The coefficients π and φ which are to be estimated are matrices of the dimension (m × p) and (m× m) respectively whereas the disturbance term ϵ_t is a vector of dimension (m ×1) and k is the lag length of the system.

Using the Johansson (1991) approach, the general VAR can be transformed into an error correction model, usually referred as a restricted VAR of the form

$$\Delta X_t=\alpha+\psi X_t+\tau\Delta X_{t-1}+\ldots\ldots..+\tau_{k-1}\Delta X_{t-k+1}+ \epsilon_t,t=1,2,\text{-----},n. \quad (10)$$

In this expression, we use the τs to define the short run characteristics of the variables. Specifically the coefficients of the lagged dependent variable represent the feedback in the system whilst the coefficients of the other endogenous variables in the system define the pass through effects of these variables on the dependent variable. The matrix of coefficients ψ represents the long run equilibrium relationships among the variables of interest in the system. We start the analysis by examining the stationarity properties of the variables. This is important because in empirical analysis, most macroeconomic variables have been found to be non-stationary as result of their time dimensions and as a result prejudice and distort estimations. This thus makes it imperative for the non-stationary properties to be dealt with. In the words of Thomas (1993),if a variable is stationary, it means that the time path traced by the variable is stable. In other words, a series is said to be stationary when it has a spectrum which is finite but non-zero at all frequencies.

Mathematically determining the stationarity of a series Y_t involves finding whether the equation

$$Y_t = \alpha_0+\alpha_1 t +\alpha^2 \ln Y_{t-1}+\sum_{i=2}^{p} \beta\Delta \ln Yt \quad + ut \quad (11)$$

follows an AR process.

Typically, assessing the stationarity properties of variables involves testing the following hypotheses; H_0: The series has unit roots ,H_1 :The series has no unit roots.

In the conventional VAR system, the order of integration of the variables allowed is one meaning that the each variable in the system must attain stationarity after first differencing.

Beyond examining the stationarity status of the variables, we employ the Johansson approach to test for co integration; that is to ascertain whether there exists a linear combination of the variables which is also stationary. According to Anaman *et al* (2017),co integration is the statistical implication of the existence of a long run equilibrium relationship between economic variables. Soli *et al* (2008) also characterize co integration as representing the tendency of variables to drift together over time. The obvious advantage in the Johansson approach over the other methods of determining long run equilibrium relationships is that it makes it possible to uncover more one co integrating vector at a time. To proceed with this, we test,

H_0:there is no long co integrating vector in the system, as opposed to

H_1: At least one co integrating vector exists in the system.

In a VAR system, a major requirement is that for variables to be co integrated they must have the same order of integration. This is underscored by Enders (1995) who emphasizes that for variables to be co integrated they must be integrated of the same order and have a linear combination of residual sequence which is stationary .

In order to extract more information from the system and sufficiently understand the dynamic relationships among the variables in our system, we undertake impulse response analysis. The importance of the impulse response analysis is buttressed by Osei *et al* (2003).According to them, when the interrelationships that characterize economic systems are considered, it is always more informative to undertake an impulse response analysis especially when the analysis involves uncovering short and long run relationships within a given system. Osei *et al* (2003) assert that the advantage that the impulse response analysis has is that it captures the net effect of both the direct and indirect impact of a shock, not only in the long run but also at all periods after the shock has been transmitted. Johnston and DiNardo (1997) underline the relevance of the impulse response function by intimating that it traces the chain reaction or the knock-on effects arising from one standard deviation perturbation in one innovation in the system over time on the other variables in the system granted that no other shock affects the system afterwards. Impulse response functions can thus measure both the current and future values of the given endogenous variable to one standard deviation shock in one of the innovations. Lutkepohl and Rimmers (1992) also reinforce the importance and suitability of the impulse response in a dynamic analysis.

Generally, the impulse response function can be defined as the moving average representation of our equation (9) Expressed as

$$X = \varepsilon_t + A_1\varepsilon_{t-1} + A_2\varepsilon_{t-2} + \ldots + \sum_{i=0}^{\infty} A_1 \quad \pi Rt\text{-}1$$

(12), where, the As are of dimension (m× m)

Apart from the impulse response analysis, we employ the forecast error variance decomposition from our VAR model to ascertain and predict the most important innovation for each endogenous variable along the entire time horizon. This will enable us to identify which variable is most relevant in achieving a given objective.

According to Bhasin (2004), in a VAR model, variance decomposition is usually employed to isolate the innovations of the endogenous variables into the portions which can be attributed to own innovations and that which are due to innovations of other variables in the system and in doing so we recourse to the Cholesky method based on Sim's recursive approach.

Data Set

For the purposes of this study, we employ annual series for all the variables from 1978 to 2017 .The variables were largely extracted from the World Bank Databases and supported with data from Ghana Statistical Service (GSS) and the Bank of Ghana.

Results of Data Analysis Test for stationary (Unit roots tests)

In the tables below, we report the results of the stationary tests.

Table1:**Unit root tests of log levels of variables**

Variable (log levels)	ADF test Statistic	Prob level	Phillip Perron test statistic	Prob level
ldb	-2.298031	0.1778	-1.917340	0.3212
ldt	-1.682815	0.4318	-1.597301	0.4744
lfb	-0.413932	0.8968	-0.404310	0.8985
lgc	-0.141300	0.9375	-0.072070	0.9455
lge	-1.130286	0.6941	-1.120580	0.6980
lgk	-0.724807	0.8286	-0.710912	0.8322
lgr	-1.946252	0.3085	-1.946252	0.3085
lit	-2.194319	0.2115	-2.057338	0.2623

Source: Author's calculations using E Views

Table 2 : **Unit root tests of first differences of variables**

Variable (first differences)	ADF statistic	Prob. level	Phillips Perron Statistic	Prob. level
dldb	-4.411600	0.0012	-4.425672	0.0011
dldt	-5.736767	0.0000	-9.443833	0.0000
dlfb	-6.196007	0.0000	-6.195848	0.0000
dlgc	-5.475900	0.0001	-5.466520	0.0001
dlge	-5.076895	0.0002	-4.944660	0.0003
dlgk	-5.107552	0.0002	-5.032008	0.0002
dlgr	-6.775472	0.0000	-6.799061	0.0000
dlit	-7.863574	0.0000	-9.818331	0.0000

Source: Generated from E Views estimations

From tables 1 and 2, we infer that all variables are non-stationary at log levels but are stationary at first differences .This means that the order of integration of all variables is one. We proceed to determine the optimal lag for the disaggregated and the aggregated models respectively. For the disaggregated model, we determine whether or not there is first or higher order serial correlation in the initial model by performing the autocorrelation LM test. The test results are presented below

Table 3

Included observations: 37		
Lags	LM-Stat	Prob
1	39.13263	0.8424
2	48.47734	0.4942

From the results generated , we fail to reject the null hypothesis that there is no serial correlation in the model meaning that the model is can be correctly specified by using the first lags of all variables.

We proceed to corroborate the above finding by determining the optimal lag structure of the model using various criteria. The table below shows the selected optimal lag structure using various criteria for the disaggregated model.

Table 4

Included observations: 36						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	39.11941	NA	3.96e-10	-1.784412*	-1.476505	-1.676944
1	70.04318	48.10365*	1.14e-09*	-0.780177	1.683075*	0.079564*
2	114.0449	51.33531	2.08e-09	-0.502493	4.116104	1.109521
3	170.9768	44.28037	3.70e-09	-0.943154	5.830788	1.421133
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						

The results confirm that appropriate lag to be used in the analysis is one considering that four out of the five criteria settle on lag one. In the case of the aggregated model, the test for 1st and 2nd order serial correlation is presented in the table below.

Table 5

Null Hypothesis: no serial correlation at lag order h

Sample: 1978 2017

Included observations: 38

Lags	LM-Stat	Prob
1	47.48022	0.0955
2	50.66403	0.0533

From these statistics, we conclude therefore that in the aggregated model, there is evidence of serial correlation in the residuals at lags one and two so we proceed to determine the optimal structure for the model. The following table shows the selection analysis.

Table 6

Included observations: 36						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	26.83531	NA	1.27e-08	-1.157517	-0.893598*	-1.065402*
1	59.96044	53.36827	1.53e-08	-0.997802	0.849636	-0.352997

2	101.9825	53.69481	1.30e-08	-1.332359	2.098598	-0.134863
3	156.1070	51.11764*	7.91e-09*	-2.339279*	2.675197	-0.589093
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						

From the results shown in the table above, we firmly conclude that the optimal lag for the aggregated model is three based on the different criteria. Having completed the tests for stationarity and optimal lag structures for the two models we then enter the log levels of the variables in the two models into the Johansson test for co integration, the results of which are presented in the tables below.

Table 7 Johanssen test for co integration for the disaggregated model Series: lgc lgk ldt lit lfb ldb lgr

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.716509	146.2219	134.6780	0.0087
At most 1	0.623665	98.31997	103.8473	0.1098
At most 2	0.424277	61.18352	76.97277	0.4275
At most 3	0.318226	40.20262	54.07904	0.4603
At most 4	0.256078	25.64646	35.19275	0.3620
At most 5	0.187746	14.40532	20.26184	0.2625
At most 6	0.157301	6.503534	9.164546	0.1553
Trace test indicates 1 cointegratingeqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: Generated from E-Views.

From the results presented above, we reject the hypothesis that there is no co integration in our series in favour of the alternative hypothesis that there is one co integrating equation in our model. Using the un-normalized coefficients, we derive the long run equation for government consumption expenditure below by normalizing on government consumption expenditure.

Table 8 Long run equation for government consumption expenditure

LGC	LGK	LDT	LIT	LFB	LDB	LGR	C
1.000000	0.265024	0.945707	4.311506	-2.071946	0.967689	-1.537559	38.95029
	(0.32764)	(0.58921)	(0.72563)	(0.50301)	(0.43209)	(0.30392)	(6.55926)

Source: Generated from E-Views.

From the long run equation, we observe that government capital expenditure, direct taxes, indirect taxes as well as domestic borrowing have negative effect on government consumption expenditure with about 27%,95%, 431%and 97% impacts respectively on government consumption expenditure with a 100% increase in each of the variables. However, in the long run , borrowing from abroad and grants are financing sources which have positive impact on government consumption expenditure. Specifically, a 100% increase in external borrowing in the long run triggers a little over 207% increase in government consumption expenditure whilst a 100% increase in grants also leads to a 154% upswing in government consumption expenditure. In the table below, we present the results of the tests for co integration in the aggregated model.

Table 9: Test for Co-Integration in the Aggregated Model

Series: LGE LDT LIT LFB LDB LGR

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.642654	127.6208	103.8473	0.0006
At most 1 *	0.606512	88.51696	76.97277	0.0050
At most 2	0.493073	53.07422	54.07904	0.0613
At most 3	0.275454	27.25744	35.19275	0.2761
At most 4	0.199710	15.01346	20.26184	0.2256
At most 5	0.158281	6.547753	9.164546	0.1525
Trace test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				

Source: Output generated by author from E-Views using data

In the table above, we test the null hypothesis that there is no co integrating relationship in our series against the alternative hypothesis that there is at least one co integrating relationship. From the table above we fail to accept the hypothesis that there is at most one co integrating relationship but fail to reject the null hypothesis that there are most two co integrating vectors in our model. This thus means that in our series, we can uncover two co integrating relationships. In the table below, we present the first co integrating equation from our model.

Table10. Long run function for aggregated government expenditure

LGE	LDT	LIT	LFB	LDB	LGR	C
1.000000	7.033729	18.66572	-8.250564	-0.279982	-6.581200	259.1778
	(2.36778)	(3.53366)	(1.53188)	(1.71301)	(1.37989)	(30.0200)

Source: Generated by author using E-Views estimation.

From the results, we determine that in the long run, direct and indirect taxes negatively impact on government expenditure whereas external borrowing, domestic borrowing and grants exert a positive effect on government expenditure. The estimated negative long run impacts of direct and indirect taxes on government expenditure are respectively 7.03 and 18.67 units as each of these increases by a unit. On the other hand, a unit increase of each of external borrowing, domestic borrowing and grants leads to about 8.3, 0.28 and 6.58 units increase in government expenditure. We derive the second co integrating equation from the un–normalized co integrating coefficients by normalizing on external borrowing .We thus derive the long run equation for external borrowing in the form below;

Table 11.Long run equation for external borrowing

LGE	LDT	LIT	LFB	LDB	LGR	C
-0.346960	0.850657	0.668850	1.000000	-1.277610	0.027437	-13.132143

Source: Output generated by author based on E-Views estimations.

From the table, we define the long run equilibrium relationship between external borrowing and the endogenous variables. In this relationship, we observe that government expenditure and domestic borrowing exert positive effects on external borrowing meaning that in the long run an increase in both government expenditure and domestic borrowing lead to an increased external borrowing. Generally from the estimation results, a 100% increase in government expenditure leads to about 35% increase in external borrowing whilst a 100% increase in domestic borrowing calls forth a whopping 128% increase in external borrowing. On the other hand, direct taxes, indirect taxes as well as grants expectedly all impact negatively on external borrowing. More specifically, in the long run a 100% increase in each of direct taxes, indirect taxes and grants precipitates about 85%,67% and 3% decline in external borrowing. Using tables 8,10 and 11 , we derive the error correction terms ect1,ect2 and ect3 respectively which are entered into the short run models to determine the short run effects of each of the endogenous variables on the other endogenous variables in tour system.

Short Run Relationships

Proceeding with our analysis, we estimate the short run/error correction models for the government consumption expenditure, aggregated government expenditure and external borrowing (the estimates are provided in the appendices). In these models, we observe the signs of the error correction terms are all negative meaning that the behaviours of the short run equations are in line with the theory that once these are co integrated then there is a tendency for each of them to be moved towards the desired equilibrium position.; that is each system is eventually drawn towards the equilibrium time path when there is a deviation from their expected long run position. Of the three models, the equation for aggregated government expenditure is estimated to have the fastest return to its equilibrium time path after a deviation with a speed of adjustment of about 81% per period. This followed by the equation for external borrowing with a speed of adjustment of about 43% per period when it deviates from the equilibrium .The government consumption equation however has about 20% of its deviation from the long run corrected in each period. In the general government consumption equation, our short run estimates show that the government consumption expenditure is significantly impacted by a feedback, growth in government capital expenditure, direct taxes, domestic borrowing and grants. Their contemporaneous effects are estimated at -0.701589, 0.564860, 0.3202703,0.223057 and 0.203551 respectively. This shows that previous period government consumption expenditure tends to have a negative impact on current government spending on consumption.

It is also noticed from the estimation that the previous government capital expenditure has a positive effect on current government consumption expenditure. This result contrasts with Osei *et al* (2003). In actual terms, from the results, a 1 unit increase in the previous period government consumption expenditure triggers about 0.56 unit increase in current government consumption expenditure.

Lastly a previous increase in grants precipitates an increase in current government consumption expenditure with a 100% previous increase in grants leading to a 20% increase in the current values of general government consumption expenditure. In the aggregated government expenditure function, just as is witnessed in the consumption expenditure equation registers a negative feedback with a magnitude of 0.134650 per unit increase in government expenditure. The only difference is that in the case of the aggregated government expenditure function, the feedback comes from the third period. Also, growth in direct taxes and indirect taxes respectively exert positive and negative effects on government expenditure with contemporaneous impacts of about 1.15 and 0.40 when there is a unit increase in each of them. Thus the dynamic effects of domestic revenue from these results appear mixed, and therefore do not fall wholly in tandem with the finding of Njeru (2004).

In relation to external borrowing, the short run behaviour is explained by growth in aggregated government expenditure, direct taxes, indirect taxes as well as grants. In the estimates, it is seen that a 100% increase in government expenditure in the first period expectedly leads to about 35% increase in current levels of external borrowing. From the short-run equation, it is also realized that in the third period, increased direct taxes leads to a decline in external borrowing. From the results, a 100% increase in direct taxes tends to lead to about 92% decline in external borrowing which falls in line with expectation that increased domestic revenue mobilization leads to reduction in dependence on external sources of financing projects and programmes. The indirect tax variable, in the period also elicits a negative response from external borrowing. The measured effect, significant in the first period is even bigger in magnitude than that of direct taxes. In real terms, a 100% growth in indirect taxes precipitates over 138% decline in external borrowing. The effect of growth in grants on external borrowing is felt in two periods-the first and third periods and in both periods their impacts are positive. In the first period, a 100% growth in grants tends to increase external borrowing by about 105% whereas in the third period, the effect is smaller at 0.31 unit's growth in external borrowing with respect to a unit increase in grants. One major position which is dominant in the literature that we wanted to verify was whether or not the availability of other sources of financing government activities dampens tax effort.

In the disaggregated government expenditure model, we are unable to substantiate the hypothesis that external financing tends to stunt domestic mobilization of revenue. Our regression results indicate that the impact of external borrowing and grants are positive and negative respectively. Thus for 100% increase in external borrowing, we experience about 33% increase in direct taxes but the same amount of increase in grants precipitates a 4% decline in direct taxes. For the aggregated government expenditure, the story is similar that is positive and negative in respect of external borrowing and grants respectively. The impacts of external borrowing and grants on indirect taxes are mostly insignificant except in the aggregated expenditure model in which growth in external borrowing triggers a decline in indirect tax yield. These findings are partly consistent with Mascagni and Timmis (2014) who discovered positive but significant impacts of grants and loans on the tax revenue variable.In the aggregated model, growth in external borrowing rather than leading to a decline in growth in direct tax mobilization actually triggers an increase. This finding coincides with Osei *et al* (2003). From the estimated equation, a 100% growth in external borrowing in the second period precipitates about 42% growth in direct taxes in the current period. However its estimated effect on indirect taxes is negative .The estimates indicate that a 100% increase leads to about 24% decline in indirect tax. The effect of domestic borrowing variable on the revenue variables- direct and indirect tax is very interesting. In the aggregated government expenditure models, we notice a negative impact of domestic borrowing on both direct and indirect tax variables. However whilst its effect is negative and significant with respect to growth in direct taxes, the measured impact is not significant in the case of indirect tax. From the estimated restricted VAR, a 100% growth in domestic borrowing elicits about 42% decline in direct taxes. On the other hand, for the disaggregated government models, the effect of domestic borrowing on both direct and indirect taxes is in line with the results for the aggregated model , meaning that an increased growth in domestic borrowing also impacts negatively on both direct and indirect taxes. Finally the effects of grants on the revenue channels-both direct and indirect taxes are estimated to be negative .Whilst its effect on direct taxes are significant that on indirect tax is insignificant.

Results of Forecast Variance Decomposition

In line with conventional dynamic analysis, we proceed to do a variance decomposition of the residuals of the variables and the results can be gleaned from the appendices of the paper. In dynamic analysis, variance decomposition is particularly very relevant in determining how much of the variation in a given variable can be traced to own innovations and innovations from other variables. The decompositions are performed on the basis of the aggregated and disaggregated government expenditure and in consonance with the Cholesky approach which ensures that the decomposition is carried out maintaining the ordering of the variables just as pertains in the co integration test as well as the error correction estimations.

In the aggregated government model, we determine the most important innovations for attaining a particular objective for the various variables the aggregate government expenditure, direct taxes, indirect taxes, external borrowing, domestic borrowing and grants. From the results generated, it is clear that in respect of government expenditure, from the second period, growth in grants assumes a very important position in accounting for over 50% of the behaviour of the government expenditure variable. In the long run, it accounts for close to 70% of the movements of the government expenditure variable. For direct taxes, own innovations are largely responsible for its variations in the short to the long term accounting for over 85% of its movements. The next most variables are indirect taxes and growth in government expenditure which between them from the short to long term explain more than 30% of the movements in the direct tax variable. From the variance decomposition of the indirect tax variable, its movements in the short term are dominated by own innovations and that from direct taxes. However in the medium to the long term the most important variable that influences movements in indirect tax is growth in grants. In respect of growth in external borrowing under the aggregated model, in the short to the medium term, own innovations are largely responsible for its behaviour though in the long run, growth in grants assumes the most dominant position accounting for just over 39% of variations in external borrowing. For domestic borrowing, in the short to the medium term, its variations are explained mainly by own innovations and that from external borrowing accounting for over 90% to about 30% between them. In the long term, however, growth in grants becomes the most dominant as it caters for over 54% of variations in the domestic borrowing variable.

For grants, its own innovations are most dominant in explaining its movements from about 51% in the first period to over 60% in the tenth period. In the short to the medium term, however, the growth in external borrowing is second most important innovation which affects movements in grants. We now consider the forecast error decomposition in the disaggregated government expenditure model. From the derived results, we observe that from the short to the long term, the important variable that explains the behaviour of government consumption expenditure is own innovations which constitutes 100% to 60% of its movements from the short to the long term. It is followed in terms of significance by the innovations due to government capital expenditure. In respect of government capital expenditure, the movements are mostly explained by own innovations and that emanating from government consumption expenditure. The movements in direct taxes are dominated by own innovations from the short to the long term accounting for over 99% to about 78% whilst that due to domestic borrowing takes about 12% of the innovations. The contributions of the various innovations to the movements in the indirect tax variable are mainly due to own movements and those that coming from direct taxes. Specifically, own innovations account for over 63% to about 58% from the short to the long period whereas proportion of innovations from direct taxes range from 34% to 30%. Again movements in external borrowing are dominated by own innovations and predictably followed by innovations due to grants.

Impulse Response Functions

Finally in our analysis, we attempt to trace the effects of shocks emanating from the other variables in the system on each endogenous variable. (Estimations are found in the appendices) We first consider the aggregated government expenditure model. In respect of total government expenditure we realize that its time path around equilibrium is not very much affected by own shocks and that emanating from the other variables. However shocks coming from own innovations and from other variables cause more instability in the trajectory of direct tax variable around the equilibrium path. The instability as witnessed from the graphs is more pronounced especially in response to own shocks and the shocks which originate from total government expenditure and indirect taxes. The greatest effect of any shock in the system on indirect taxes comes from grants. However, the trajectory of external borrowing is affected much more by shocks from grants and then by own shocks than shocks coming from any other variable in the system.

For domestic borrowing, apart from shocks triggered from grants the other shocks appear not to have any significant drift in its time path. Finally movements in the grants are largely unaffected by shocks which are transmitted from other variables. It is only own shocks which appear to drift the trajectory of grants from the equilibrium position. In the disaggregated government expenditure model, the story is different from that which is experienced in the aggregated expenditure model. From the graphs, we observe that shocks from government capital expenditure aside of own shocks are those which have more impact on the movement of government consumption expenditure. The time path of government capital expenditure is affected more in the early periods by shocks from government consumption expenditure and own shocks. The shocks from the other variables do not cause as much trepidation. In respect of direct taxes own shocks are the most prominent among all the shocks which are transmitted from the various variables whilst indirect taxes react to own shocks and that which emanates from direct taxes. It is also observed that the effects of shocks from government capital expenditure are noticeable only in the early period of the time horizon.

Conclusions and Policy Implications

In this study, our major preoccupation has been to establish the nexus between total government expenditure and disaggregated government expenditures and their corresponding financing modes, particularly focusing on the effects of foreign aid well as the response from domestic borrowing. Its import has been to verify whether the theoretical precepts established in the fiscal response models found in the literature still hold true for the Ghanaian economy using current data available. In our analysis we have generally found that whether government expenditure is aggregated or disaggregated, there exists one or other long run equilibrium relationship between expenditure and other variables in the model. More specifically, in the disaggregated government expenditure model, we have found that there only one co integrating equation exists between government consumption expenditure and other variables – government capital expenditure, direct taxes, indirect taxes, external borrowing, domestic borrowing and grants whereas in the model involving aggregate government expenditure, we discovered two co integrating equations-one for government expenditure and the other for external borrowing. In the long run, we find that external borrowing and grants lead to increased government consumption expenditure but government capital expenditure negatively impacts on government consumption expenditure. The positive effect of external borrowing and grants on government expenditure may point to aid fungibility though that conclusion may be erroneous or flawed on the grounds that some aid and grants come in the form of budgetary support and are therefore legitimately channeled into those areas of government spending which are important in the government's scheme of things.

In respect of the aggregate model, external borrowing, domestic borrowing and grants all in the long run lead to increase in government expenditure which confirms concept of aid illusion but surprisingly the domestic revenue streams –direct and indirect taxes trigger a negative response from government expenditure. The estimated long run equation for external borrowing also shows that increased government expenditure precipitates increased external borrowing. Domestic borrowing also has the same effect but direct taxes, indirect taxes and grants all exert a negative effect on external borrowing. The positive effect of domestic borrowing on external borrowing probably gives the indication that because of the inadequacy of the domestically mobilized revenues, external and domestic borrowings have become an important but constant feature of financing government activities. Thus in the long run, in the disaggregated model we were able to adduce evidence of domestic revenues being used to replace external borrowing as a financing avenue. In the literature there is an opinion which articulates the view that external borrowing leads to a lax attitude towards domestic revenue mobilization, usually characterized as the displacement hypothesis. This is partially affirmed by our results in the short run. This is because whilst the effect of external borrowing on direct taxes is positive in both aggregate and disaggregated expenditure models it leads to a decline in indirect taxes in the aggregate model and has an insignificant impact on indirect taxes in the disaggregated model. From the short run results, the external sources of government financing impact positively on the government capital expenditures and this implies these resources are going into areas of the economy which may be *reproductive* and thus helping to expand economic activities in the long run. In long run it is established that an increased external borrowing and grants lead to more than proportionate growth in aggregate government expenditure which suggests that these external financing channels come with local or counterpart funding components which also exert more pressure on government finances. To ease pressure on government, government would have to enter into external funding agreements which do not require too much of counterpart funding. One other view proffered by some economists in the literature is that governments in developing countries have a preference for grants than loans for financing projects and programmes.

In our analysis, it is obvious that the effect of grants undermines direct tax collection and it does appear because grants are normally free, its increased flow into the Ghanaian economy dampens the direct tax collections. Policy makers are encouraged to continue design tax policies and mechanisms which would in spite of increased flow of grant enable the government to rake in the desired revenues.

Another significant and illuminating finding is the fact that short run effect of domestic borrowing on both direct and indirect taxes is negative in the Ghanaian economy which signals that domestic borrowing may be inhibiting economic activities and thus may ultimately be having a distortionary impact on tax collections through its effect on economic activities. The government would therefore do well to scale down on its appetite for borrowing from domestic sources which particularly has a strangulating effect on private sector activities and ultimately impacts negatively on economic activities that generate the revenue needed by government.

One of the objectives of the study is to determine whether the borrowing modes have differential effects on the domestic tax channels and our estimated equations suggest that the tax channels do not response in the same way to borrowing. This therefore allows policy makers to design the relevant but right mechanisms to ensure continuous increased tax yields from both direct and indirect sources by creating unique mechanisms which work for each tax channel. Finally we also find that the short-run equation for domestic borrowing in the disaggregated government expenditure model shows that external borrowing is used to substitute domestic borrowing to certain extent and this has a huge implication for the Ghana's debt sustainability which has become a source of worry to international agencies and economic think-tanks within Ghana even against the background of a re-based economy. To conclude we would say that though we have through this study unearthed some important facts relating to the nexus among the fiscal variables and the borrowing modes in Ghana, we would have wished that we were able to segregate aid into the various other forms project, programme or even technical by which they come, which in our view would have enriched the analysis .It is therefore our hope that future studies would tackle this aspect to further add to the existing stock of knowledge in this area. Another area which may be interesting to examine in the future is the effects of these borrowing modes on private investments and economic growth.

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Appendix A 1a Unnormalized Co Integrating Coefficients For Disaggregated Government Expenditure Model

LGC	LGK	LDT	LIT	LFB	LDB	LGR	C
1.294453	0.343061	1.224174	5.581041	-2.682037	1.252628	-1.990298	50.41932
2.473469	-4.926923	3.323305	0.203476	0.760543	1.084518	1.902956	-9.314356
-2.734475	2.252014	1.876378	-0.711541	-1.777021	-1.152836	-0.274655	58.36492
0.626448	0.708572	-0.757148	-3.873066	-2.603299	4.320096	1.164597	-2.573859
-3.721753	2.645566	2.914102	-2.369617	1.228391	-1.890964	-1.548250	31.02504
1.690610	-1.846113	4.246725	-3.162973	0.280160	-0.497808	0.356670	-6.716738
2.546556	-2.991196	-0.573203	2.166093	1.917874	-0.844341	-0.672078	-18.44867

1b Unnormalized Co Integrating Coefficients For Aggregated Government Expenditure Model

LGE	LDT	LIT	LFB	LDB	LGR	C
0.331685	2.332985	6.191146	-2.736592	-0.092866	-2.182888	85.96550
-1.536605	5.185054	-5.442559	1.073965	2.058536	3.170925	-61.33498
1.272844	-3.814032	-0.244547	-3.236886	0.620246	-0.427752	60.13527
-0.924257	2.266703	1.782250	2.664649	-3.404383	0.070304	-34.99253
-0.416011	-2.639002	3.722309	1.874406	0.312871	0.073111	-38.92193
0.081428	-2.878044	0.715399	-0.521188	0.300898	0.115664	8.388109

Appendix B Short-Run /Error Correction Estimates Short Run Estimates For The Disaggregated Government Expenditure Model

Error Correction:	DLGC	DLGK	DLDT	DLIT	DLFB	DLDB	DLGR
ECT1(-1)	-0.019809	-0.024172	-0.001566	-0.018902	0.001415	-0.005638	0.022009
	(0.00701)	(0.00619)	(0.00604)	(0.00679)	(0.00492)	(0.00699)	(0.02305)
	[-2.82725]	[-3.90412]	[-0.25948]	[-2.78290]	[0.28745]	[-0.80695]	[0.95466]
DLGC(-1)	-0.701589	0.016095	0.155862	0.284686	-0.044776	0.180555	0.416556
	(0.15231)	(0.13459)	(0.07841)	(0.14765)	(0.10699)	(0.07136)	(0.14713)
	[-4.60624]	[0.11959]	[1.98767]	[1.92805]	[-0.41851]	[2.53034]	[2.83116]
DLGK(-1)	0.564860	-0.296333	-0.125927	-0.074017	0.071090	-0.217699	-0.206533
	(0.17444)	(0.15415)	(0.15030)	(0.16911)	(0.12254)	(0.17396)	(0.57399)
	[3.23805]	[-1.92237]	[-0.83782]	[-0.43769]	[0.58015]	[-1.25140]	[-0.35982]
DLDT(-1)	0.320703	0.606177	-0.546285	0.319727	-0.302274	0.032411	0.414471
	(0.15278)	(0.28556)	(0.18010)	(0.16165)	(0.14998)	(0.20845)	(0.68779)
	[2.09905]	[2.12277]	[-3.03324]	[1.97785]	[-2.01549]	[0.15549]	[0.60261]
DLIT(-1)	0.186466	-0.566537	-0.001965	-0.346928	-0.189941	0.065452	-1.080978
	(0.26140)	(0.22288)	(0.22522)	(0.17619)	(0.18362)	(0.26068)	(0.86010)
	[0.71335]	[-2.54186]	[-0.00873]	[-1.96908]	[-1.03445]	[0.25109]	[-1.25680]
DLFB(-1)	0.098782	0.050804	0.331934	-0.319583	-0.268403	-0.132600	1.249801
	(0.30483)	(0.02321)	(0.16903)	(0.29551)	(0.11911)	(0.05443)	(1.00302)
	[0.32405]	[2.18861]	[1.96381]	[-1.08146]	[-2.25347]	[-2.43620]	[2.24603]
DLDB(-1)	0.223057	0.364305	-0.307923	-0.430906	0.076035	-0.093922	-1.103910
	(0.11371)	(0.20497)	(0.11830)	(0.21693)	(0.16293)	(0.03904)	(0.45124)

	[1.96165]	[1.77738]	[-2.60286]	[-1.98634]	[0.46667]	[-2.40604]	[-2.44639]
DLGR(-1)	0.203551	-0.100615	-0.040873	-0.100401	0.120268	0.041354	-0.145643
	(0.08956)	(0.07914)	(0.01616)	(0.08682)	(0.06099)	(0.08931)	(0.29467)
	[2.27291]	[-1.27141]	[-2.52971]	[-1.15647]	[1.97183]	[0.46305]	[-0.49425]
C	-0.001451	0.002197	0.001929	0.000621	0.001887	-0.000925	-0.063636
	(0.04241)	(0.03747)	(0.03654)	(0.04111)	(0.02979)	(0.04229)	(0.13954)
	[-0.03421]	[0.05863]	[0.05279]	[0.01511]	[0.06336]	[-0.02187]	[-0.45605]
R-squared	0.551149	0.549121	0.504434	0.583416	0.516661	0.212850	0.526910
Adj. R-squared	0.422906	0.420298	0.362844	0.464393	0.378565	-0.012050	0.391742
Sum sq. resids	1.859653	1.452124	1.380543	1.747652	0.917605	1.849415	20.13418
S.E. equation	0.257713	0.227731	0.222047	0.249832	0.181029	0.257003	0.847985
F-statistic	4.297695	4.262614	3.562631	4.901676	3.741300	0.946419	3.898175
Log likelihood	2.824038	7.400244	8.335439	3.973200	15.89205	2.926176	-41.24349
Akaike AIC	0.333836	0.086473	0.035922	0.271719	-0.372543	0.328315	2.715864
Schwarz SC	0.725681	0.478318	0.427767	0.663564	0.019302	0.720160	3.107709
Mean dependent	-0.003087	0.001756	0.003245	-0.001704	0.000154	0.000452	-0.066715
S.D. dependent	0.339245	0.299103	0.278178	0.341370	0.229642	0.255468	1.087286

Appendix C Short Run Estimates For The Aggregated Government Expenditure Model

Error Correction:	DLGE	DLDT	DLIT	DLFB	DLDB	DLGR
ECT2(-1)	-0.814967	-0.559246	-0.693817	0.972253	0.828267	-1.359340
	(3.79677)	(0.44945)	(0.46205)	(0.52819)	(0.73398)	(2.44790)
	[-3.09437]	[-1.24428]	[-1.50162]	[1.84071]	[1.12847]	[-0.55531]
ECT3(-1)	0.232244	0.012426	0.353103	-0.425366	-0.111076	0.397426
	(0.17271)	(0.21543)	(0.22146)	(0.20943)	(0.35180)	(1.17329)
	[1.34474]	[0.05768]	[1.59442]	[-2.03106]	[-0.31574]	[0.33873]
DLGE(-1)	0.054739	0.261523	0.573447	0.354344	-0.082371	0.867620
	(0.17577)	(0.21924)	(0.22539)	(0.11625)	(0.35804)	(1.19409)
	[0.31143]	[1.19284]	[2.54427]	[3..04821]	[-0.23006]	[0.72660]
DLGE(-2)	-0.090568	0.205657	0.458363	-0.061591	-0.333092	0.248939
	(0.16896)	(0.21075)	(0.21665)	(0.24767)	(0.34416)	(1.14782)
	[-0.53604]	[0.97584]	[2.11564]	[-0.24868]	[-0.96783]	[0.21688]
DLGE(-3)	-0.134650	0.035054	0.129480	0.087230	0.271188	0.231454
	(0.06922)	(0.15817)	(0.16260)	(0.18588)	(0.13594)	(0.86147)
	[-1.97187]	[0.22162]	[0.79629]	[0.46927]	[1.99489]	[0.26867]
DLDT(-1)	0.172514	0.050142	0.517520	0.256857	0.033832	-2.202289
	(0.23221)	(0.28965)	(0.18901)	(0.34039)	(0.47301)	(1.10333)
	[0.74293]	[0.17311]	[2.73802]	[0.75459]	[0.07153]	[-1.99603]
DLDT(-2)	1.148476	0.025518	-0.138434	-0.536571	-0.845334	2.062187
	(0.25936)	(0.32352)	(0.33258)	(0.38020)	(0.52832)	(1.76201)
	[4.42808]	[0.07888]	[-0.41624]	[-1.41130]	[-1.60004]	[1.17036]
DLDT(-3)	0.349772	0.069256	0.305151	-0.916470	-1.702434	3.984505
	(0.35723)	(0.03213)	(0.45809)	(0.46590)	(0.72769)	(1.50826)
	[0.97911]	[2.15542]	[0.66614]	[-1.96709]	[-2.33951]	[2.64179]
DLIT(-1)	0.553068	0.253030	-0.338736	-1.382197	-1.282164	2.899246
	(0.37157)	(0.46348)	(0.47647)	(0.54468)	(0.64301)	(2.52431)
	[1.48846]	[0.54593]	[-0.71093]	[-2.53762]	[-1.99399]	[1.14853]

DLIT(-2)	-0.395099	0.330036	0.236805	-0.224872	-0.091448	-0.446796
	(0.17676)	(0.16527)	(0.12177)	(0.25911)	(0.36005)	(1.20082)
	[-2.23527]	[1.99690]	[1.94477]	[-0.86787]	[-0.25398]	[-0.37208]
DLIT(-3)	-0.234890	-0.094442	-0.243058	0.104862	0.414603	-1.457794
	(0.18283)	(0.22806)	(0.23445)	(0.26802)	(0.37243)	(1.24211)
	[-1.28471]	[-0.41411]	[-1.03671]	[0.39125]	[1.11323]	[-1.17364]
DLFB(-1)	0.115739	-0.055537	-0.337443	0.523889	0.179581	0.007247
	(0.36633)	(0.45694)	(0.46975)	(0.26518)	(0.74621)	(2.48870)
	[0.31594]	[-0.12154]	[-0.71835]	[1.97559]	[0.24066]	[0.00291]

DLFB(-2)	0.224531	0.424402	-0.240696	-0.437316	-0.682534	1.368240
	(0.09086)	(0.16517)	(0.08399)	(0.31780)	(0.44162)	(1.47284)
	[2.47116]	[2.56939]	[-2.86581]	[-1.37606]	[-1.54553]	[0.92898]
DLFB(-3)	0.150271	0.119247	-0.043971	0.000501	-0.094436	2.359789
	(0.20228)	(0.25232)	(0.25939)	(0.29653)	(0.41205)	(1.18157)
	[0.74287]	[0.47260]	[-0.16952]	[0.00169]	[-0.22919]	[1.99717]
DLDB(-1)	0.337644	-0.223752	0.276325	0.308478	0.447370	0.735352
	(0.13910)	(0.29508)	(0.30334)	(0.34677)	(0.48187)	(1.60710)
	[2.42731]	[-0.75829]	[0.91093]	[0.88957]	[0.92840]	[0.45756]
DLDB(-2)	0.259235	-0.424442	-0.196132	0.022124	-0.162952	0.261685
	(0.18529)	(0.21368)	(0.23760)	(0.27162)	(0.37744)	(1.25881)
	[1.39905]	[-1.98639]	[-0.82545]	[0.08145]	[-0.43173]	[0.20788]
DLDB(-3)	0.087809	-0.126465	0.133979	0.311050	0.399951	-0.663780
	(0.16787)	(0.20940)	(0.21527)	(0.24609)	(0.18434)	(1.14047)
	[0.52306]	[-0.60394]	[0.62238]	[1.26399]	[2.16959]	[-0.58202]
DLGR(-1)	0.969935	-0.641608	-0.430083	1.049242	1.055592	-2.475217
	(0.36425)	(0.45435)	(0.46708)	(0.53395)	(0.74197)	(2.47456)
	[2.66285]	[-1.41215]	[-0.92079]	[1.96507]	[1.42269]	[-1.00027]
DLGR(-2)	0.505786	-0.464436	-0.363172	0.510144	0.410434	-1.610878
	(0.23730)	(0.23587)	(0.30429)	(0.34786)	(0.48338)	(1.61213)
	[2.13141]	[-1.96904]	[-1.19349]	[1.46653]	[0.84909]	[-0.99922]
DLGR(-3)	0.070551	-0.231593	-0.088270	0.314585	0.177093	-0.333660
	(0.12391)	(0.15457)	(0.15890)	(0.11515)	(0.25241)	(0.84183)
	[0.56935]	[-1.49833]	[-0.55551]	[2.73185]	[0.70159]	[-0.39635]
C	0.004849	0.012664	0.020949	-0.005055	-0.014179	-0.076360
	(0.02025)	(0.02526)	(0.02597)	(0.02969)	(0.04125)	(0.13759)
	[0.23941]	[0.50132]	[0.80665]	[-0.17026]	[-0.34369]	[-0.55499]
R-squared	0.927544	0.778822	0.895330	0.783659	0.654236	0.790353
Adj. R-squared	0.824036	0.462853	0.745801	0.474601	0.160288	0.490856
Sum sq. resids	0.189327	0.294576	0.311316	0.406836	0.785588	8.738089

S.E. equation	0.116290	0.145056	0.149120	0.170469	0.236883	0.790031
F-statistic	8.961041	2.464869	5.987662	2.535638	1.324503	2.638939
Log likelihood	41.68061	33.94453	32.97730	28.29429	16.77889	-25.37886
Akaike AIC	-1.181749	-0.739688	-0.684417	-0.416817	0.241207	2.650220
Schwarz SC	-0.248541	0.193521	0.248792	0.516392	1.174415	3.583429
Mean dependent	0.002435	0.012086	0.015653	0.003679	-0.002856	-0.076870
S.D. dependent	0.277223	0.197919	0.295767	0.235180	0.258505	1.107195

Variance Decomposition of DLGE:

Period	S.E.	DLGE	DLDT	DLIT	DLFB	DLDB	DLGR
1	0.111813	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.265269	23.43584	20.37757	3.577401	0.422971	0.413212	51.77301
3	0.385462	15.65435	12.85675	2.279425	1.161694	0.582181	67.46560
4	0.444459	15.27655	11.13926	1.777144	0.909225	4.016351	66.88147
5	0.480041	18.49762	9.680806	2.009450	0.842194	3.446230	65.52370
6	0.509495	18.37302	9.024340	2.928824	2.621776	3.661696	63.39034
7	0.530525	18.10874	8.592325	2.945605	2.653703	3.634360	64.06527
8	0.592717	16.41770	9.398415	2.439467	2.725268	3.237613	65.78154
9	0.645311	16.74329	8.484315	2.063404	2.578772	3.102590	67.02763
10	0.707590	17.26560	7.260408	2.026676	2.782769	2.649450	68.01510

Variance Decomposition of DLDT:

Period	S.E.	DLGE	DLDT	DLIT	DLFB	DLDB	DLGR
1	0.135609	14.67399	85.32601	0.000000	0.000000	0.000000	0.000000
2	0.168781	18.62678	57.94360	15.88752	2.083583	5.320575	0.137940
3	0.171894	18.51302	56.19375	15.58305	2.923035	6.649722	0.137425
4	0.187967	15.56514	56.71454	16.41705	2.446050	6.768987	2.088241
5	0.196661	15.84631	52.83267	19.01200	2.663066	6.243143	3.402820
6	0.201969	15.12285	50.18036	18.64150	3.122657	5.935793	6.996830
7	0.202326	15.12402	50.07573	18.69772	3.124804	5.957755	7.019973
8	0.206023	14.68438	49.98696	18.16153	3.086644	7.243165	6.837325
9	0.207504	15.14699	49.39309	18.35866	3.175843	7.150039	6.775385

10	0.210232	15.37626	48.35545	17.94419	3.096044	6.967732	8.260324

Variance Decomposition of DLIT:

Period	S.E.	DLGE	DLDT	DLIT	DLFB	DLDB	DLGR
1	0.172417	1.586740	48.92190	49.49136	0.000000	0.000000	0.000000
2	0.222251	6.532833	39.76821	36.29187	2.542720	4.247651	10.61671
3	0.240533	5.666080	42.98798	32.38567	2.495584	3.642069	12.82262
4	0.282419	7.145570	32.56612	24.49860	1.925561	2.648976	31.21517
5	0.305613	7.189801	30.23615	20.92503	1.708072	3.511665	36.42929
6	0.324604	9.538451	27.59595	18.58652	1.582996	3.176390	39.51969
7	0.340375	11.50168	25.84900	19.30786	1.613194	2.956258	38.77200
8	0.349941	12.00197	24.45653	18.30123	1.805046	3.433497	40.00173
9	0.372219	12.16112	23.06242	16.47424	2.106031	3.147840	43.04836
10	0.392478	12.20646	21.59352	14.82943	2.053484	3.118234	46.19888

Variance Decomposition of DLFB:

Period	S.E.	DLGE	DLDT	DLIT	DLFB	DLDB	DLGR
1	0.158397	0.044068	1.797966	0.832714	97.32525	0.000000	0.000000
2	0.177824	0.283293	10.59105	4.897140	78.39354	0.021085	5.813892
3	0.231639	1.864778	7.092211	2.953018	60.72698	1.889828	25.47319

4	0.245491	1.801467	6.655475	7.144054	56.78387	3.317991	24.29714
5	0.256219	3.597538	6.326243	7.361394	52.13185	3.170792	27.41218
6	0.265092	5.934772	5.950920	7.822540	49.15187	3.312355	27.82755
7	0.276468	6.407326	6.361810	7.229981	45.20437	3.128504	31.66801
8	0.292901	7.634311	6.580809	6.595101	40.28310	3.123580	35.78309
9	0.302819	8.628087	6.568402	6.291867	37.78864	3.198804	37.52420
10	0.311030	9.505549	6.228335	6.097690	36.03080	3.074052	39.06357

Variance Decomposition of DLDB:

Period	S.E.	DLGE	DLDT	DLIT	DLFB	DLDB	DLGR
1	0.206871	2.265834	0.810045	2.773664	22.89687	71.25359	0.000000
2	0.223675	2.783841	6.202074	4.149667	19.80236	64.21923	2.842822
3	0.288792	3.716311	3.763684	2.544012	22.32057	38.78066	28.87476
4	0.338815	12.26334	2.735667	1.852837	16.64807	31.38268	35.11741
5	0.401912	19.12568	2.211283	6.381911	11.92865	23.45652	36.89596
6	0.441166	19.68044	2.240487	6.544079	11.51591	19.74382	40.27526
7	0.461121	19.85563	3.003299	5.993447	10.54970	18.09470	42.50323
8	0.502054	17.95271	5.140998	5.121903	9.264051	15.39093	47.12941
9	0.537271	16.97087	5.065356	4.512318	9.047540	13.47473	50.92919
10	0.574863	16.64304	4.665101	3.945109	8.396938	11.83882	54.51099

Variance Decomposition of DLGR:

Period	S.E.	DLGE	DLDT	DLIT	DLFB	DLDB	DLGR
1	0.755211	0.207621	2.294906	4.433442	39.47587	2.841255	50.74691
2	0.892897	5.268719	2.287596	3.424055	40.66342	10.57656	37.77965
3	1.118448	6.441865	2.333939	4.617557	28.37545	6.795336	51.43585
4	1.162192	11.41789	2.963043	4.304557	26.28069	6.318548	48.71527
5	1.250068	12.21659	4.194314	4.814527	22.72084	5.506416	50.54731
6	1.335245	12.91167	4.548363	4.353771	20.51086	4.894152	52.78119
7	1.416154	13.08263	5.335398	3.877774	18.46247	4.949913	54.29181
8	1.525871	13.21428	4.937466	3.401963	16.37939	4.283290	57.78361
9	1.618501	13.31405	4.747701	3.062418	15.41920	3.826015	59.63062
10	1.693009	14.17167	4.431628	2.800191	14.16598	3.500881	60.92966

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Variance Decomposition of Disaggregated Model

Variance Decomposition of DLGC: Period	S.E.	DLGC	DLGK	DLDT	DLIT	DLFB	DLDB	DLGR
1	0.217085	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.269649	65.04258	23.12333	1.721511	5.952523	1.337863	2.821443	0.000746
3	0.277826	61.27276	21.81767	1.692895	7.846924	1.277528	3.468516	2.623707
4	0.278827	60.95690	21.66242	1.705474	7.793662	1.791860	3.467854	2.621829
5	0.279151	60.82222	21.63173	1.708604	7.792124	1.787999	3.499983	2.757338
6	0.279248	60.78512	21.62981	1.708247	7.786927	1.810778	3.523712	2.755411
7	0.279262	60.77978	21.62889	1.708456	7.786194	1.810644	3.527721	2.758316
8	0.279266	60.77815	21.62924	1.708446	7.786028	1.811031	3.528838	2.758263
9	0.279266	60.77803	21.62921	1.708450	7.786039	1.811035	3.528958	2.758272
10	0.279266	60.77800	21.62923	1.708450	7.786037	1.811035	3.528974	2.758273

Variance Decomposition of DLGK: Period	S.E.	DLGC	DLGK	DLDT	DLIT	DLFB	DLDB	DLGR
1	0.221260	28.65337	71.34663	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.256241	22.73093	54.92869	2.311531	17.06961	0.387709	0.286688	2.284841
3	0.259609	22.66329	53.98672	2.253508	16.75220	1.325450	0.502436	2.516391
4	0.260652	22.49917	53.67423	2.237255	16.72579	1.333753	0.538337	2.991464
5	0.260929	22.47505	53.57948	2.234198	16.69179	1.418543	0.615461	2.985473
6	0.260984	22.46692	53.56351	2.234675	16.68504	1.418000	0.630732	3.001125
7	0.261000	22.46491	53.56006	2.234580	16.68338	1.420510	0.635649	3.000918
8	0.261001	22.46470	53.55959	2.234606	16.68323	1.420555	0.636214	3.001109
9	0.261002	22.46463	53.55954	2.234606	16.68319	1.420579	0.636324	3.001121
10	0.261002	22.46463	53.55953	2.234607	16.68320	1.420583	0.636330	3.001121

Variance Decomposition of DLDT:

Period	S.E.	DLGC	DLGK	DLDT	DLIT	DLFB	DLDB	DLGR
1	0.177084	0.109107	0.077847	99.81305	0.000000	0.000000	0.000000	0.000000
2	0.200855	1.745636	2.080662	80.25215	0.882415	0.001371	12.52711	2.510653
3	0.202226	1.821304	2.507557	79.17233	1.231177	0.137470	12.52452	2.605643
4	0.202403	1.852392	2.556090	79.03863	1.231784	0.193493	12.52652	2.601091
5	0.202479	1.851029	2.572860	78.98032	1.242394	0.193999	12.52149	2.637904

6	0.202498	1.852722	2.572986	78.96633	1.243655	0.201673	12.52373	2.638906
7	0.202501	1.852663	2.573234	78.96395	1.243682	0.202162	12.52383	2.640481
8	0.202502	1.852679	2.573349	78.96325	1.243719	0.202460	12.52393	2.640620
9	0.202502	1.852677	2.573347	78.96319	1.243719	0.202496	12.52392	2.640650
10	0.202502	1.852677	2.573353	78.96317	1.243719	0.202502	12.52392	2.640656

Variance Decomposition of DLIT: Period	S.E.	DLGC	DLGK	DLDT	DLIT	DLFB	DLDB	DLGR
1	0.212646	1.939034	0.554682	34.35595	63.15033	0.000000	0.000000	0.000000
2	0.233070	5.509995	0.505978	30.80457	59.42870	0.027701	3.722568	0.000492
3	0.234843	5.627085	1.376441	30.35335	58.53693	0.222132	3.827006	0.057054
4	0.235286	5.608014	1.415256	30.24030	58.38279	0.250664	3.825924	0.277053
5	0.235387	5.609290	1.414108	30.21875	58.33838	0.295249	3.830620	0.293600
6	0.235408	5.608271	1.414022	30.21479	58.32870	0.299418	3.830326	0.304476
7	0.235414	5.608157	1.414510	30.21367	58.32605	0.301472	3.830780	0.305368
8	0.235415	5.608128	1.414509	30.21357	58.32572	0.301660	3.830780	0.305632
9	0.235415	5.608121	1.414552	30.21354	58.32564	0.301701	3.830795	0.305656
10	0.235415	5.608120	1.414554	30.21353	58.32563	0.301705	3.830795	0.305658

Variance Decomposition of DLFB: Period	S.E.	DLGC	DLGK	DLDT	DLIT	DLFB	DLDB	DLGR
1	0.156790	0.000780	7.993319	4.304904	6.65E-05	87.70093	0.000000	0.000000
2	0.178720	0.612045	9.628148	4.875545	2.494607	67.50957	0.088682	14.79141
3	0.184871	0.773861	10.64180	4.594926	2.999946	65.36298	1.283818	14.34266
4	0.185743	0.950584	10.55694	4.566684	2.981302	64.84869	1.658247	14.43755
5	0.186080	0.955757	10.66522	4.550185	2.973320	64.63541	1.794920	14.42519
6	0.186132	0.961358	10.66508	4.547643	2.977045	64.60594	1.825808	14.41713
7	0.186140	0.961336	10.66764	4.547317	2.976789	64.60008	1.829933	14.41690
8	0.186142	0.961392	10.66769	4.547260	2.977030	64.59911	1.830600	14.41691
9	0.186142	0.961391	10.66769	4.547263	2.977032	64.59909	1.830626	14.41691

10	0.186142	0.961391	10.66769	4.547263	2.977037	64.59906	1.830627	14.41692

Variance Decomposition of DLDB:

Period	S.E.	DLGC	DLGK	DLDT	DLIT	DLFB	DLDB	DLGR
1	0.215948	4.175000	4.859923	0.489323	0.605885	22.17905	67.69082	0.000000
2	0.234199	3.952763	7.392635	1.278903	0.638402	18.86131	65.22346	2.652535

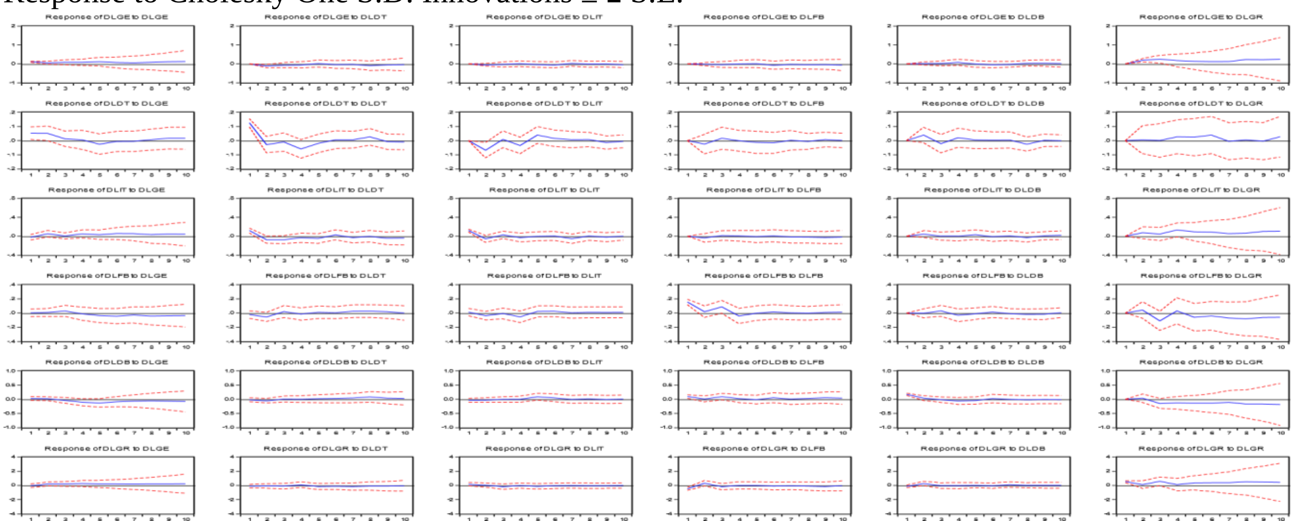
3	0.237645	4.077868	7.873997	1.298188	0.911934	18.73193	64.46117	2.644914
4	0.237988	4.068213	7.914957	1.301817	0.927342	18.70947	64.41447	2.663731
5	0.238062	4.065940	7.924473	1.302481	0.934178	18.70143	64.39396	2.677537
6	0.238067	4.065806	7.924171	1.302719	0.934944	18.70362	64.39132	2.677422
7	0.238068	4.065833	7.924185	1.302764	0.934989	18.70346	64.39078	2.677982
8	0.238069	4.065830	7.924253	1.302763	0.935003	18.70350	64.39066	2.677997
9	0.238069	4.065836	7.924250	1.302763	0.935004	18.70349	64.39065	2.678003
10	0.238069	4.065835	7.924255	1.302763	0.935004	18.70349	64.39065	2.678004

Variance Decomposition of DLGR: Period	S.E.	DLGC	DLGK	DLDT	DLIT	DLFB	DLDB	DLGR
1	0.755153	0.002803	11.06231	1.502395	2.097732	16.00708	9.021366	60.30632
2	0.822087	0.060881	12.26010	1.790907	3.884525	21.34494	9.482869	51.17578
3	0.829529	0.293374	12.52555	2.002059	3.815918	20.96703	9.393659	51.00241
4	0.832194	0.295626	12.77577	1.997428	3.841262	20.91620	9.436867	50.73685
5	0.832515	0.311644	12.76592	1.996002	3.850621	20.91331	9.464671	50.69783
6	0.832614	0.311572	12.77297	1.995730	3.850479	20.90860	9.469079	50.69158
7	0.832635	0.311966	12.77253	1.995715	3.851079	20.90871	9.470205	50.68979
8	0.832637	0.311967	12.77253	1.995745	3.851055	20.90879	9.470231	50.68968
9	0.832638	0.311969	12.77252	1.995752	3.851068	20.90879	9.470237	50.68966
10	0.832638	0.311969	12.77252	1.995754	3.851067	20.90880	9.470235	50.68965

Cholesky Ordering DLGC DLGK DLDT DLIT DLFB DLDB DLGR

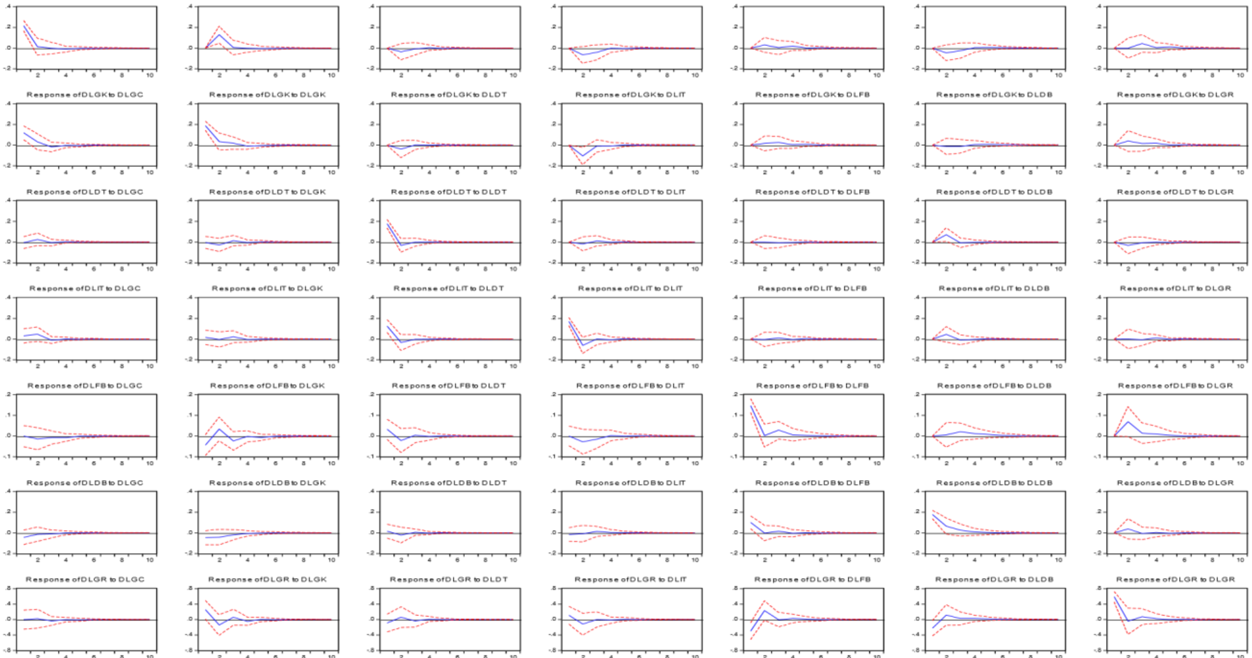
IMPULSE RESPONSE FUNCTIONS FOR AGGREGATED GOVERNMENT EXPENDITURE MODEL

Response to Cholesky One S.D. Innovations ± 2 S.E.



IMPULSE RESPONSE FUNCTIONS FOR DISAGGREGATED GOVERNMENT EXPENDITURE MODEL FUNCTIONS

Response to Cholesky One S.D. Innovations ± 2 S.E.



Response of DLGC to DLGC Response of DLGC to DLGK
Response of DLGC to DLDT Response of DLGC to DLIT Response of DLGC to DLFB Response of DLGC to DLDB Response of DLGC to DLGR