Broad Dollar Shocks and Economic Activity in Trade-Heavy Countries: The Role of Government Size

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Abstract

This paper investigates how government size influences the responses of government expenditure and economic growth to broad dollar shocks in 155 trade-heavy countries across 6 continents from 1995 to 2019. In most cases, we document that the magnitude of contractions in expenditures and economic growth from broad dollar appreciations depends on the size of government. Countries with large governments experience a more severe negative impact from dollar appreciations than countries with smaller governments and this is true for different expenditure types: total, current and capital government expenditures. Accordingly, government size plays a role in the disparities observed in the responses of expenditure and growth to broad dollar shocks across these countries.

JEL classification: B27, F31, F41, F43, O5

Keywords: Dollar Shocks, Economic Growth, Government Expenditure, Trade-heavy Countries

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1. Introduction

The dollar influences economic activity through various mediums including trade, fiscal policies (such as government expenditure), and international financial activities that include cross-broader flows. More recently, attention has been channelled into how dollar shocks impact economies via the financial and trade channels. The financial channel is gaining prominence in light of enhanced cross-border flows which have gone hand-in-hand with globalisation, greater balance sheets integration and financial risk-taking capabilities. The trade channel is historically more prominent and manifests on the real economy through net exports. Both channels can move in the same or opposite directions. Under standard open economy models such as the Mundell-Fleming model (Mundell, 1963; Fleming, 1962), dollar appreciations relative to domestic currencies enhance net exports and hence support real economic activity. Conversely, under the more recent 'dominant currency paradigm, the dominant currency of trade is the dollar rather than the home country's currency (Gopinath, Boz, Casas, Díez, Gourinchas & Plagborg-Møller, 2020). So, dollar appreciations relative to domestic currencies are associated with trade reductions which can stifle net exports and dampen economic activity. Meanwhile, on the financial side, dollar appreciations stifle risk-taking capacity and cross-border lending in dollars, because borrowers' liabilities become elevated, balance sheets get weaker and borrowing risk worsens, which in turn dampens real economic activity (Hofmann, Shim & Shin, 2016; Kearns & Patel, 2016; Avdjiev, Bruno, Koch & Shin, 2019). Thus, under traditional models, trade and financial channels work in opposite directions.

Under the more recent dominant currency paradigm where the modal trades are invoiced in dollars, both the trade and financial channels work in the same direction. In general, economic activity such as government expenditures and economic growth should weaken or improve depending on the impact of dollar appreciations on the channels of shock transmission. For instance, under the dominant currency paradigm, dollar appreciations dampen trade; this would rub negatively on economic activity for trade-heavy countries. Similarly, based on cross-border dollar flows, dollar appreciations weaken borrowers' balance sheets and elevates borrowing risk, leading to depressed lending in dollars and a slowdown in economic activity.

There is empirical evidence on the existence and importance of the trade and financial channels of dollar shocks. Gopinath et al. (2020) have documented a dominant currency paradigm for which they find that dollar appreciations predict declines in trade volumes. Avdjiev et al. (2019) have shown that stronger dollar leads to lower dollar-denominated cross-border bank flows and lower real investment in emerging market economies. In the same way, Avdjiev et al. (2019) have shown that dollar appreciations contract cross-border bank lending denominated in US dollars while Shousha (2019) recently demonstrated how dollar appreciations lead to declines in output, investment, and private sector credit in emerging market economies, where the transmission of dollar movements to the economies occurs mainly through the financial channel. Along the same line, Kearns and Patel (2016) have found evidence that the financial channel partly offsets the trade channel for emerging market economies and that investment is found to be particularly sensitive to the financial channel. All of these studies have one thing in common – that dollar appreciations can be contractionary for economic activity. However, none of these studies attempted to consider

the role of government size in the transmissions of dollar shocks to domestic economic activity across countries even though there are several reasons why such role is intuitively plausible.

For trade-heavy countries, shocks that give rise to dollar appreciations can significantly influence economic activity. This influence can occur through the trade or financial channels, as documented in the studies discussed above. One important conduit which this paper will explore is the role of government size in explaining the responses of economic growth and government expenditures to dollar appreciations. Trade-heavy countries' governments can enhance spending to sustain their size and contribute favourably to economic activity when trade and its accessibility is benign, then cross-border dollar borrowing becomes less risky; both of which occurs only in the absence of shocks that trigger large dollar appreciations, as recent studies have shown. This also means that with dollar appreciations, these sources of funds for the governments are likely to be adversely affected, so that the more the governments rely on proceeds from trade or cross-border dollar borrowing to fund expenditures and maintain size, the more spending and economic activities are adversely affected. In this light, government size should play a plausible role in explaining the extent to which dollar appreciations affects economic activity across trade-intensive countries.

Past studies such as Avdjiev et al. (2019) consider dollar impact on real investment from the perspective of exchange rate's influence through the effects of global risk on cross-border lending in dollars. Bruno and Shin (2015, 2019) also emphasize the importance of the dollar on real outcomes through competitiveness and variations in dollar credit supply using comprehensive export data of firms. Bruno, Kim and Shin (2018) perform similar investigations for manufacturing firms in Asia. Therefore, previous studies have focused on dollar and economic linkages through both trade and financial channel, without paying a focused attention to a broad collection of the most trade-intensive economies at the macro level based on trade openness. Likewise, studies that have analysed government expenditure in relation to growth generally did not consider the angles of how dollar shocks can impact economic performance and government's ability to spend and maintain its size in trade-intensive countries. Moreover, past studies are quite restrictive as they often investigated few emerging market economies alone or performed single-country studies, which inadvertently exclude aggregates of a broad collection of countries, limiting the richness of the data or making the results less comprehensive. Thus, no one study was found that explored dollar-related impacts on national growth and the interacting role of government size, especially within the context of trade intensiveness where trade openness is used as the criterion to choose countries for a case study analysis.

As such, the main contribution of this paper is in assessing whether government size plays an important role in explaining the degree of exposure of economic activity to broad dollar shocks in trade-intensive countries. Particularly, we determine the response of economic activity to broad dollar shocks in trade-heavy countries and ask whether the effect of dollar appreciations on economic activity is more prominent for countries with large government sizes. We approach this novel empirical exercise systematically. First, we examine the hypothesis for a large panel of 155 trade-heavy countries selected from countries around the world based on data availability. Second, we examine the hypothesis using subpanels of the countries segmented into the continents to which

they belong. We perform both full panel and sub-panel analysis by considering small and large government sizes based on total and disaggregated (current and capital) government expenditures.

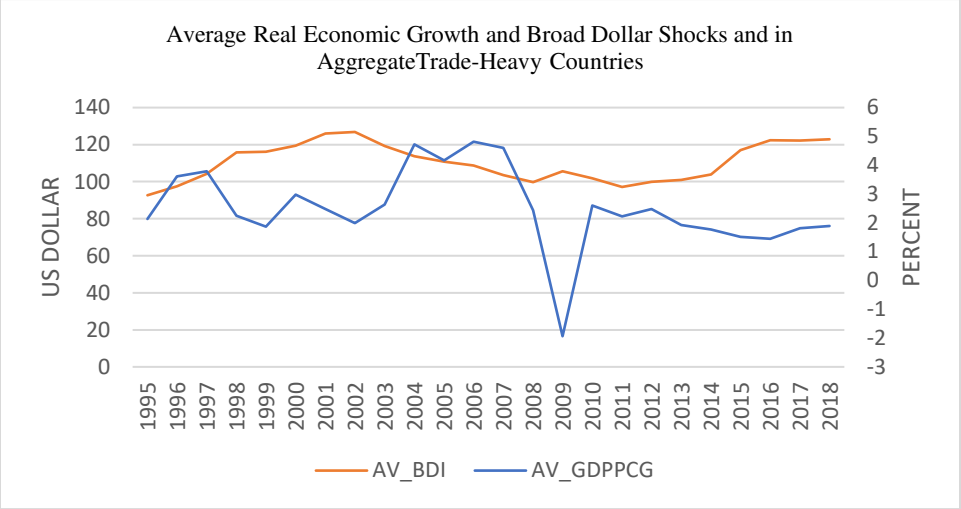
This paper contributes to existing literature in several dimensions. Firstly, the link between dollar shocks and economic growth is investigated by considering the role that government size plays in mediating this relationship for trade-intensive nations. Secondly, this study is carried out from a macroeconomic perspective as several countries across six continents are analysed on an aggregate basis. Abstracting from Lane and Milesi-Ferretti (2004), Vivek (2018) and Ibhagui (2019), these countries are selected based on their levels of trade openness following a yardstick of 50% for random classification in models such that those nations below the average of 50% are termed 'trade-light' while those with at least 50% trade openness fall into the category of trade-intensive countries, which are the ones we analyse. Also, key control variables, encompassing financial depth, inflation and institutions are added to our empirical specification to control for other factors in explaining cross-country variations of economic growth. Moreover, in determining the responses of economic activity to dollar shocks, we have employed panel vector autoregression (PVAR) approach to construct impulse responses. Thus, given the evidence that broad dollar appreciations impose severe consequences for economic growth in trade-intensive countries, this paper answers pertinent questions such as the consequences of dollar appreciations for economic activity in trade-heavy countries when government size is considered.

In most trade-heavy nations, trade income makes up a substantial part of government revenue which contributes to funding government expenditures, so that lower trade income should reduce government revenue and potentially dampen expenditures. Thus, a plausible linkage should exist between the broad dollar and government expenditure in trade-heavy countries. Nonetheless, in light of the obvious role of tax income in financing national expenses, one cannot boldly say that greater government expenditure indicates higher reliance on trade income and therefore more exposure to broad dollar shocks.

To ascertain that government size adequately measures the magnitude of exposure to broad dollar shocks, the ratio of government expenditure to output for trade-heavy nations is taken to enable cross-country comparisons and eliminates scenarios that could diminish the link between broad dollar shocks and government expenditure. First, broad dollar index and average economic growth are evaluated against each other for the total sample of trade-intensive countries as shown in figure 1.[2] The graph depicts an inverse relationship, that is, growth occurs when broad dollar index is lower and vice-versa. Second, rather than taking average economic growth for the overall sample, the sample is segmented into two sub-samples: (i) country-year observations that are less than the sample mean of overall expenditure-to-output ratio (small government) and (ii) those that surpass the sample average (large government) such that growth series is computed for both cases. Figure 2 gives a preliminary evidence which indicates that among trade-heavy nations, the average growth of countries with large government size is more responsive to the broad dollar compared to the average growth of countries with small governments.

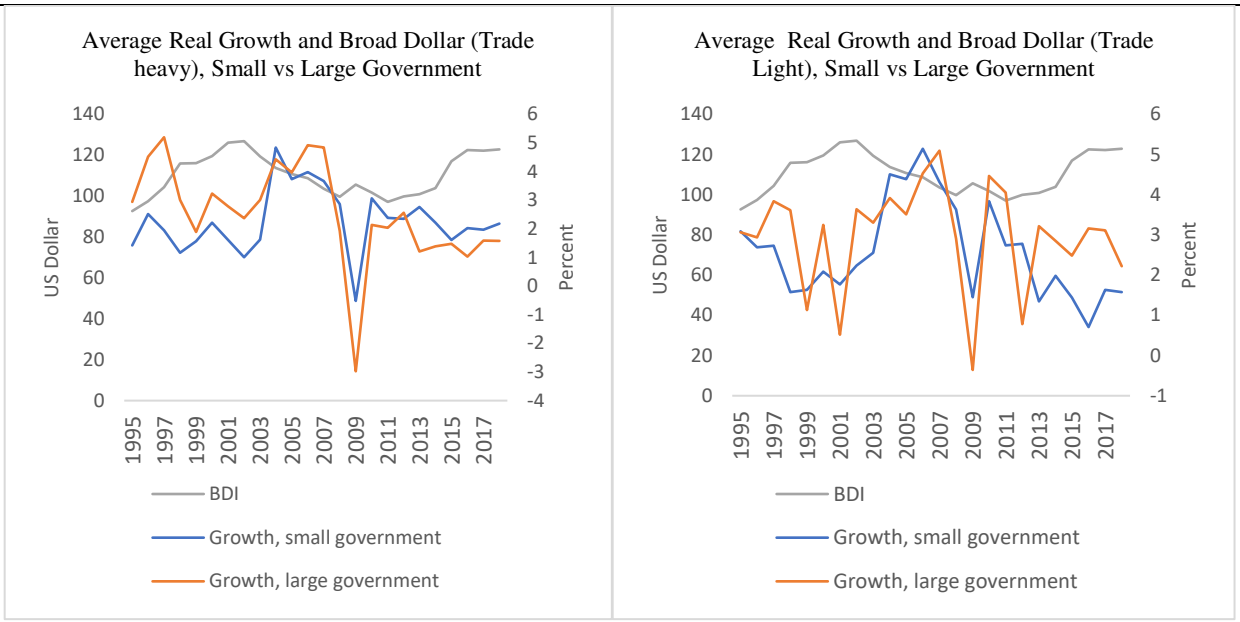
[2] 1 The list of sample trade-heavy countries can be found in Appendix I.

Figure 1: Broad Dollar and Economic Growth in the Sample of Trade-Heavy Countries, 1995-2019



Source: IMF WEO and WDI dataset, Authors' Compilations (2020)

Figure 2a, b: Broad Dollar & Economic Growth in the Sample Trade-Heavy (Trade-Light) Countries, 1995-2019, Small vs Large Governments



Source: IMF WEO and WDI dataset, Authors' Compilations (2020). Note: The sample is divided into small (large) government sub-sample where total expenditure, as a share of GDP is smaller (larger) than the sample mean.

In the main empirical analysis investigating the impact of broad dollar shocks, the outcome is that economic growth of large governments responds more to broad dollar (BDI) shocks than smaller governments.

Our paper adds to the existing literature along several important dimensions. On one hand, we explicitly demonstrate that the effect of broad dollar appreciations on economic growth and

government expenditure is mostly negative and that trade-heavy countries with higher government size experience greater contractions in economic activity during dollar appreciations. Specifically, dollar appreciations lead to a higher fall in government expenditures and a larger contraction in economic growth for trade-heavy countries with large governments compared to their smaller government counterparts. On the other hand, we indicate the plausibility of the above relationships using both the whole panel of trade-heavy countries and the subpanels created by segmenting the countries into continents. We also perform the analysis using government size that is based on total government spending as well as disaggregated government expenditures which are based on current and capital expenditures. Our extensive impulse response functions reveal that dollar appreciations lead to contractions in government expenditure and economic growth and are more associated with sustained contractions in government expenditures than in economic growth. We obtain this evidence for a subpanel of trade-heavy countries grouped by continents. Six continents are in total generated. Thus, in general, the empirical analysis suggests that dollar appreciations are mostly linked with declines in government expenditures (total and disaggregated) and economic growth, with the relation being stronger when countries have a large government size compared to countries with small government size. Having established the existence of the relationships for each continent, we repeat the exercise for the full panel of trade-heavy countries, as a form of extensive robustness checks, and we find that our main results remain unchanged. Results for the continents largely carry over or generalize into the whole sample of trade heavy countries.

Our work is most closely related to a growing body of literature on the response of economic activity to broad dollar shocks given the dominant currency status that the dollar has come to be known for, in trade and cross-border borrowing and lending activities. Priewe (2016) notes that out of the daily transactions, the dollar is used in 87% o of world dealings, Additionally, most prices of products in the financial markets are denominated in dollar. Goldberg and Tille (2009) and Gopinath et al. (2020) document evidence of the dominant currency status of the dollar, particularly how the dollar has gained a prominent role as the major dominant currency for trade invoicing, finding that a more expensive dollar, i.e. broad dollar appreciations, lead to weaker trade. They also demonstrate how the presence of a dominant currency paradigm alters the passthrough of fluctuations in exchange rates into import prices and transmission of fluctuations in exchange rates into terms of trade, export and import quantities. Furthermore, greater global integration of value chain worsens trade responses to dollar and exchange rate fluctuations, particularly when dominant currency pricing prevails (Casas, Diez, Gopinath & Gourinchas, 2017; Gopinath et al., 2020). Bruno et al. (2018) find that dominant currency paradigm and the preponderance of dollar denominated trade credit implies a negligible or contractionary effect on exports following dollar appreciations or local currency depreciation, which can diminish trade and economic growth for trade-heavy countries. Druck, Magud and Mariscal (2018) report a negative relation between dollar strength and economic growth in emerging markets, suggesting that a stronger dollar leads to a decline in emerging markets' real GDP growth. We contribute to this literature by showing that it is the economic growth and government expenditure of countries with large government sizes that experience the most contractions following broad dollar appreciations.

In addition to the above papers on trade, our work is also related, albeit implicitly, to the financial strand of the literature. Bebczuk, Galindo and Panizza (2010) and Kohn, Leibovici and Szkup (2016) demonstrate that weaker currencies, or stronger dollar, are contractionary globally, especially given the countercyclicality of the dollar. Bruno and Shin (2015) and Avdjiev et al. (2019) have shown that dollar appreciation leads to a reduction in cross-border flows in dollars, a situation which can stifle growth and economic activity for governments with substantial dependence on dollar borrowing to maintain a high government size. Although not our focus, our paper provides an implicit contribution to this literature by inferring that, to the extent by which governments and even firms depend on cross-border dollar borrowing, the impact of broad dollar shocks on government expenditures and economic growth would be higher for larger government sizes.

The rest of this paper is structured as follows: Section two reviews the methodology which comprises the empirical model, identification issues and estimation procedure. Section three presents and discusses the results while the last section concludes the paper and gives policy recommendations in light of findings.

2. Data and Methodology

2.1 Empirical Specification

We employ a tri-variate vector autoregression comprising the three main variables namely: broad dollar index (d), government expenditure (g) – capital, current and total, and economic growth (y). The empirical specification utilized is given by:

$$\begin{cases} d_{i,t} = v_{i,1} + \sum_{l=1}^{p} b_{11,l} d_{i,t-l} + \omega_{i,t}^{d} \\ g_{i,t} = v_{i,2} + \sum_{l=0}^{p} b_{21,l} d_{i,t-l} + \sum_{l=1}^{p} b_{22,l} g_{i,t-l} + \sum_{l=1}^{p} b_{23,l} y_{i,t-l} + \omega_{i,t}^{g} \\ y_{i,t} = v_{i,3} + \sum_{l=0}^{p} b_{31,l} d_{i,t-l} + \sum_{l=0}^{p} b_{32,l} g_{i,t-l} + \sum_{l=1}^{p} b_{33,l} y_{i,t-l} + \omega_{i,t}^{y} \end{cases} \quad (1)$$

where $i = 1, \ldots N$ represents the countries, $t = 1 \ldots T$ represents the years, and $\omega_{i,t}^{d}$, $\omega_{i,t}^{g}$, and $\omega_{i,t}^{y}$ are mutually and serially uncorrelated shocks. For these countries outside the US, changes in the broad dollar is exogenous. Thus, assuming that the broad dollar is exogenous helps in identifying broad dollar shocks as those exogeneous shocks that occur outside the control of these countries and have a major impact on their smooth running and economic outcomes. In line with the literature, we also include domestic credit to private sector, inflation and institution as controls variables as adapted from Abasimi, Li, Salim and Khan (2019), Avdjiev et al. (2019), Ho (2018), Bruno et al. (2018) and Sakyi and Egyir (2017).

We measure economic growth as GDP per capita growth rate which is more reflective of a nation's actual growth pace (Waugh & Ravikumar, 2016). As earlier noted, the selection of trade-heavy countries, which is analysed, is based on the magnitude of trade openness measured as (imports +

exports)/GDP. This is much more representative of trading activity than using only exports and ignoring imports or vice versa. The US trade-weighted broad dollar index is used to capture the behaviour of the dollar. Total government investment and general government expenditure, both expressed as percentage of GDP, are adopted to capture capital and current expenditures respectively. Total government spending is the sum of capital and current expenditures. All variables are obtained from World Development Indicators (WDI) except total, current and capital expenditure which come from the International Monetary Fund's World Economic Outlook (IMF WEO) database as well as institutions from World Governance Indicators (WGI).

In the empirical analysis, our goal is to examine how small vs large government sizes influence the responses of economy activity to broad dollar shocks. In constructing the impulse responses, we adopt the procedure of interacting government expenditure to GDP (as a proxy for government size) with the variables on the right-hand side of our VAR model, which gives rise to an interacted panel VAR (IPVAR) model. This approach is adopted, rather than splitting the sample into two subsamples and separately analysing each subsample, because it allows us to maintain a greater degree of freedom and fully utilize the entire sample, whereas sample splitting leads to loss of degrees of freedom. Moreover, as noted in Sadeghi (2017), utilising pooled sample leads to identical broad dollar dynamics and coefficient across sample countries.

One important advantage of the interacted panel VAR (IPVAR) models is that they allow coefficients to vary as a deterministic function of observable country characteristics (Wieladek, 2016). To construct the IPVAR, all right-hand side variables in the second and third expressions of equation (1) are interacted with government size (g_s). This alters the coefficients in the second and third expressions of equation (1) and allows them to vary as a deterministic function of government size, the observable country characteristic of interest to us. The deterministically varying coefficients can thus be written as:

$$b_{jk,l} = b^1_{jk,l} + b^2_{jk,l}.\, g\_s_{it}, \qquad j = 2,3;\ k = 1,2,3 \tag{2}$$

where $j = 2,3$ is a subscript to represent the relations generated from the second and third expression in equation (1), $k = 1,2,3$ represents the fact that for each j, there are three coefficients estimated, and l represents, as before, the appropriately chosen lag length.

We perform a lag length selection exercise and find that based on the Akaike Information Criteria (AIC), two lags are appropriate for specifying the model[3]. We construct the confidence interval for each impulse response function (IRF) which is adjusted to suit the panel and utilise the interaction terms. The key variables are interacted with capital, current and total expenditures and IRF are constructed. The IRFs of growth and expenditure to dollar shocks for small and large governments are graphed separately together with their lower and upper confidence boundaries at 95% confidence interval. Overall, this process is performed seven times – for each of the six continents into which the trade-heavy countries are grouped, and for the combined sample of trade-heavy countries.

[3] Increasing the number of lags does not affect the results.

3. Empirical Results and Discussion

This section presents the response of government expenditure and economic growth to broad dollar shocks in trade-heavy countries, for small and large governments. Results are segmented in three cases: when (i) government size is total expenditure relative to GDP (ii) government size is current expenditure to GDP, and (iii) government size is capital expenditure to GDP. The sum of capital and current spending makes up total government expenditure.

To examine the role that government size plays in influencing the responses of economic growth and expenditure to broad dollar shocks, the distribution of government spending to GDP ratio is broken down, in the spirit of Sadeghi (2017), into 20-percentage-point parts, starting from the 10^{th} percentile till the 90^{th} percentile as in Table 1 and IRFs that correspond to these points are compared. In this classification, small and large government are represented by the 30^{th} and 70^{th} percentiles of government size with regard to each expenditure type (current, capital and total expenditures). The percentiles together with their corresponding government sizes are displayed in Table 1 below.

Table 1: Cut-Points for each Type of Government Expenditure

	Total Expenditure	Current Expenditure	Capital Expenditure
10^{th} percentile	27	17	15
30^{th} percentile (Small government)	43	24	20
50^{th} percentile	53	31	23
70^{th} percentile (Large government)	63	38	27
90^{th} percentile	74	49	34

According to Table 1, a trade-heavy country has a small government size or, alternatively, runs a small government if its total expenditure is at most 43 percent of GDP whereas the government size is considered larger if total expenditure exceeds 63 percent of GDP. For capital and current expenditure, the benchmarks for small (large) governments are 20 (27) and 24 (38) percent respectively.

To present the impulse responses, we begin first with showing the IRFs that capture the dynamics of the responses of growth and government expenditure to broad dollar shocks in each of the six continents for each of the expenditure types – total, current and capital expenditures. Following this, we would present the dynamics for the full sample collection of the panel of trade-heavy countries.

Figures 3a-f and 4a-f display the impulse responses and cumulative impulse responses of expenditure and economic growth to positive broad dollar shocks for all six (6) continents. Figures 3g and 4g reveal impulse responses and cumulative impulse responses for the full panel of trade-heavy countries. In all figures, charts on the left and right represent small and large governments respectively, while each row depicts the responses of government expenditure (total, current and capital) followed intermittently by the responses of economic growth to positive broad dollar shock.

Figure 3a: Impulse Response of Government Spending and Economic Growth to a Unit Broad Dollar Shock in Europe (Small vs Large Government)

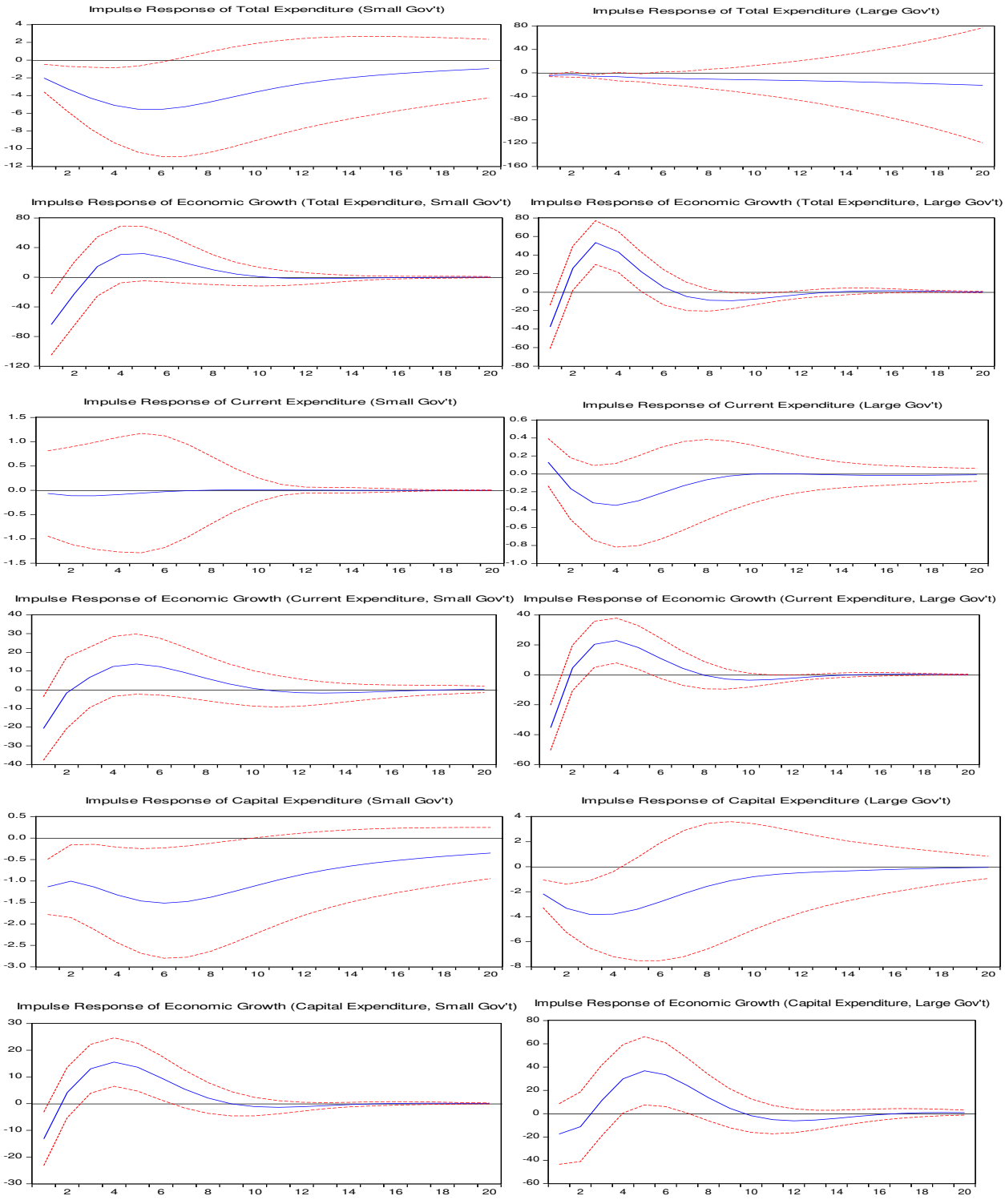


Fig. 3a shows the impulse responses and confidence bands associated with a one-unit positive shock to the dollar on the expenditures and growth of trade-heavy countries, for both small and large government sizes in Europe. In figure 3a, for small government in Europe, an unexpected rise in broad dollar leads to a decline in government expenditure which lasts for the first 6 years before subsequently turning insignificant. Economic growth also responds negatively to broad dollar shocks within the first 2 years, after which the response turns insignificant and gradually decays to steady state. Similar outcomes can be seen for large government for which government expenditure declines following a positive broad dollar shock in the first few years but soon turns upwards after year 3. The response of growth for large government is however somewhat mixed. Growth declines on impact for 2 years following a broad dollar shock but this response soon turns positive after year 2 and the expansion lasts up to year 5 before becoming insignificant from around year 6 to year 8, turning negative once again after year 8 and this lasts up to year 12 before decaying to equilibrium.

However, for both small and large governments based on current expenditure, government expenditure does not respond significantly to broad dollar shocks both on impact and as time progresses as its effect is not statistically different from zero. This suggests that broad dollar appreciations, or even any financial shocks for that matter, may not lead to statistically significant changes in government's current expenditure in Europe, irrespective of whether the countries run large or small current expenditure size. This outcome is consistent with the welfare nature of most countries in Europe that have large social benefits or social transfers. For small and large governments in Europe based on capital spending, a positive shock that gives rise to broad dollar appreciations however leads to fall in national capital expenditure. This decline is larger for big governments compared to small governments and lasts for 5 and 9 years respectively before becoming statistically indifferent from zero. Lastly, for the small government based on both current and capital expenditures, economic growth responds negatively on impact for about 1 year following a broad dollar shock. Afterwards, output becomes insignificant for current expenditure, however, for capital expenditure, this negative response turns positive from year 3 and lasts a little over year 6 before decaying to statistical insignificance and then to steady state. For large governments based on both current and capital expenditure, some interesting outcomes also emerge. For large government based on current expenditure, economic growth responds negatively on impact and lasts for around 2 years before becoming briefly positive between years 3 and 5, then it becomes briefly negative again before decaying to steady state. For large government based on capital expenditure, the response of growth to broad dollar shocks is not significant on impact for the first 3 years. However, it becomes positive and significant between year 4 and 5 before becoming statistically indifferent from zero. In most cases, the responses of expenditure and growth to dollar appreciations, at least on impact, are bigger for large governments than their smaller counterparts for each government size types.

Figure 3b: Impulse Response of Government Spending and Economic Growth to a Unit Broad Dollar Shock in Asia (Small vs Large Government)

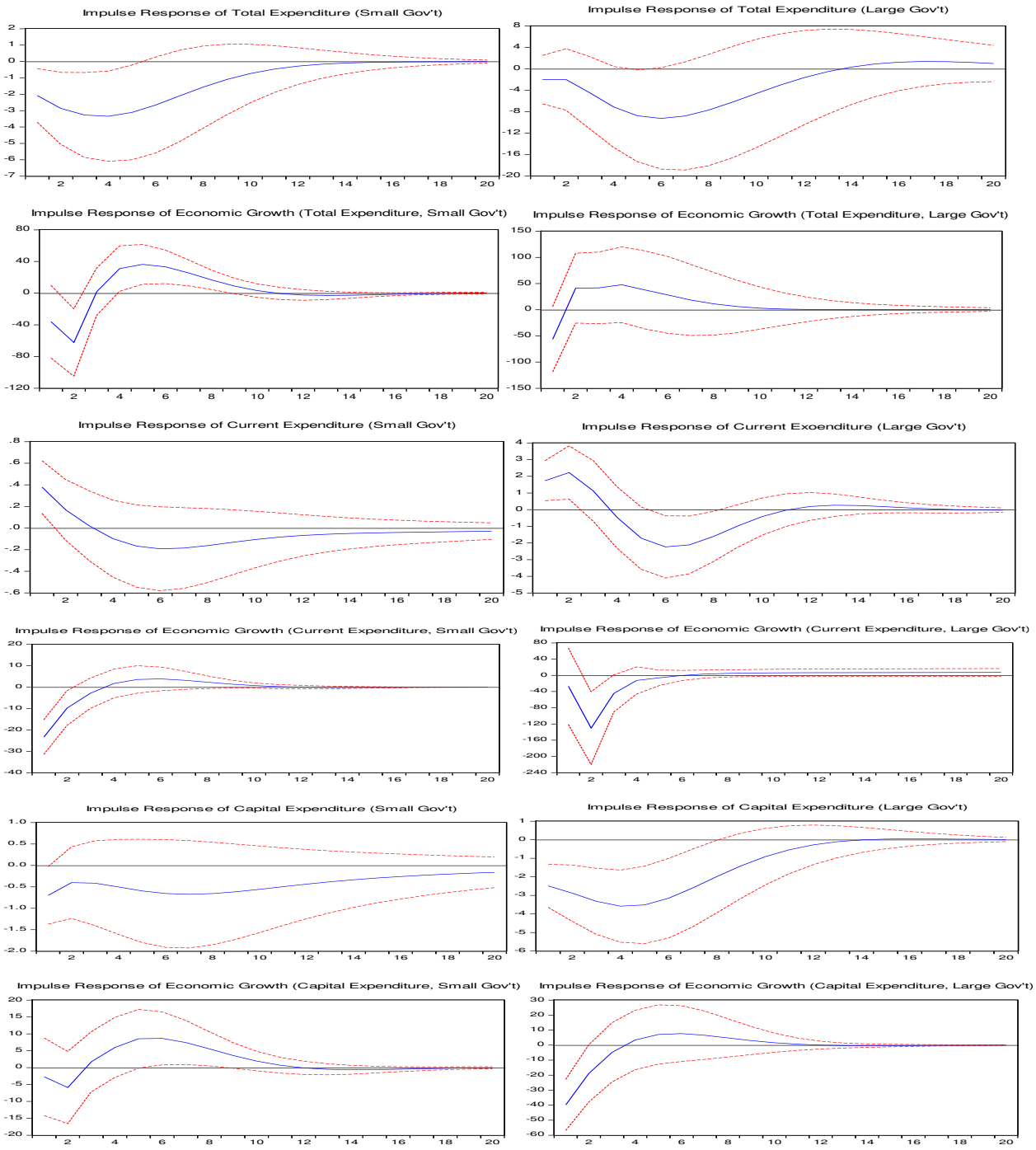


Fig. 3b displays the impulse responses and confidence bands associated with positive shocks to the dollar on expenditures and growth of trade-heavy countries in Asia, for both small and large government sizes. In Fig. 3b for small government (based on total expenditure type) in Asia, broad dollar appreciations contract government expenditure. The contraction begins on impact and lasts until year 5 before turning statistically zero. For large governments, the response of expenditure

to broad dollar shocks appears negative on impact but is also statistically significant between the narrow range of years 5 and 6. As for economic growth, the response is insignificant on impact for small governments in Asia but becomes positive in year 4 and lasts till year 9 before decaying to steady state. For large governments, the response of economic growth to broad dollar shocks is not statistically significant.

We now turn to the disaggregated expenditures (current and capital expenditures). For small government (based on current expenditure), broad dollar shocks do not lead to declines in expenditure. In fact, the response of expenditure to broad dollar shocks is temporarily positive on impact before becoming insignificant after year 2. This is in opposition to the case for large governments where the response of expenditure to dollar shocks is not significant on impact but turns negative and significant between years 5 and 8 after which it becomes statistically zero. This result suggests that for trade-heavy countries in Asia, based on current expenditure type, countries that run a small government size behave differently from those that run large government size in the responses of their current expenditure to broad dollar shocks. There is evidence that those countries with small government size in Asia are able to temporarily sustain current expenditure following a broad dollar shock whereas the large size governments may not. Meanwhile, in response to broad dollar appreciations, economic growth declines on impact and this decline lasts for the first 3 years before decaying to zero for small government. For large government, economic growth begins to decline 1 year after the broad dollar appreciations and the decline lasts until year 3 after which it becomes statistically insignificant and decays to zero. Accordingly, for Asian countries that run large or small government size (based on current expenditure), their economic growth tends to decline following broad dollar appreciations, but this decline occurs at different times, being lower and more immediate for small governments and larger and less immediate for large governments.

Going now to the disaggregated spending based on capital expenditure, we see that while the effect of broad dollar shocks on capital expenditure is not significant for small governments in Asia over time. This effect is negative and persistently significant for large governments, with the expenditure declining on impact and continues along this downward trend for 9 years before turning statistically insignificant. In a similar vein, for large government, economic growth responds negatively to broad dollar shocks and this lasts for around 3 years before turning insignificant and then decaying to zero. Whereas for small government, the response of economic growth on impact is weakly statistically significant and temporarily positive between year 6 and year 8, after which it decays to insignificance. Again, it is noteworthy to see that, wherever observed, the declines observed in response to dollar shocks are larger in dimension for large governments relative to their smaller counterparts, thereby buttressing the essential role of government size.

Figure 3c: Impulse Response of Government Spending and Economic Growth to a Unit Broad Dollar Shock in Africa (Small vs Large Government)

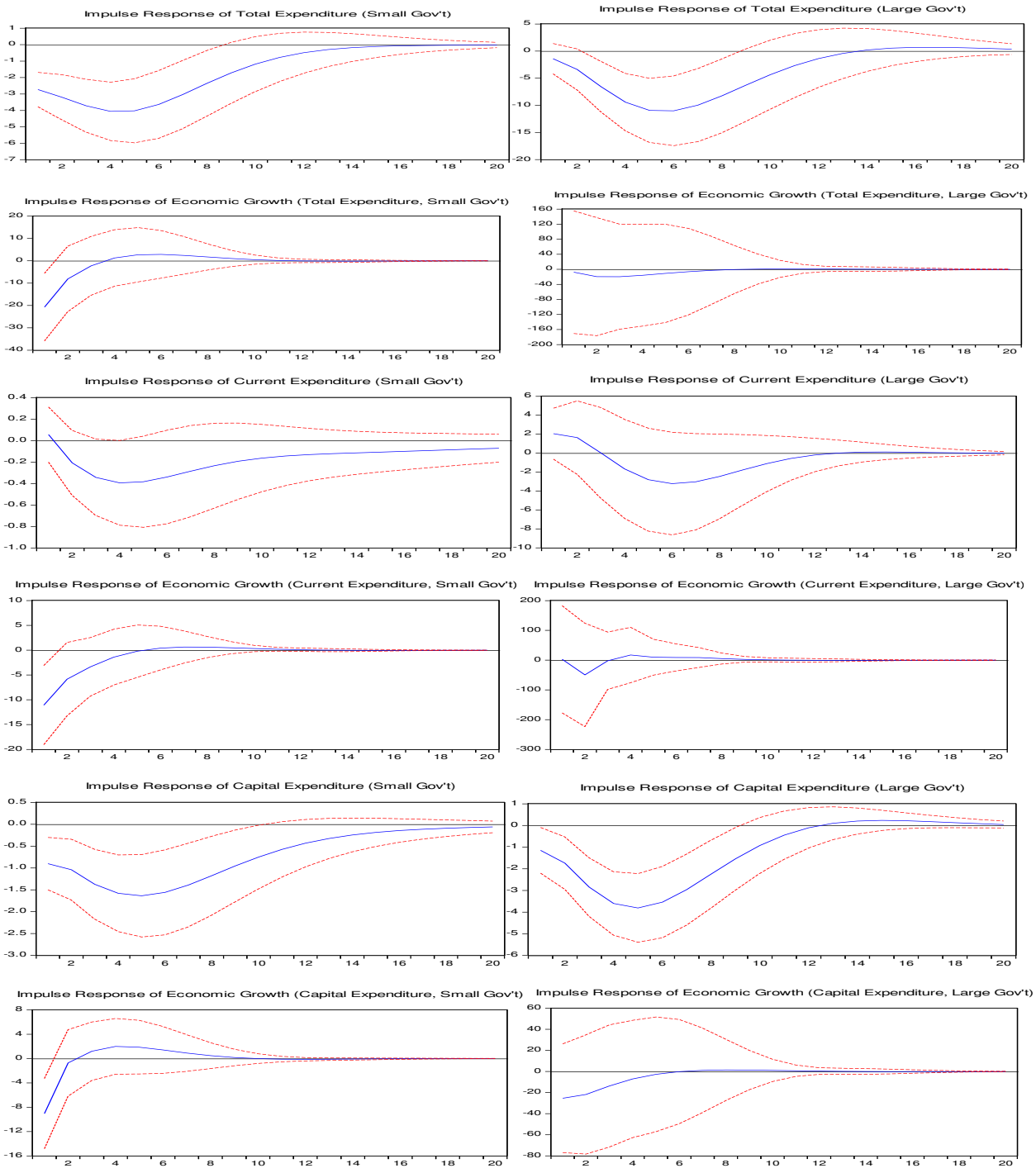


Fig. 3c for Africa displays the responses of expenditures and growth to broad dollar shocks. In many instances, the modal outcomes share some similarities with the preceding outcomes for Asia and to some extent Europe: there is evidence that dollar appreciations lead to contractions in expenditures and growth. For expenditures, this outcome is generally more uniform for small and large government sizes and across expenditure types (i.e. total, current and capital). For growth, the contractionary response to broad dollar shocks is more prevalent for small governments than for large governments across all expenditure types, although the negative effects are transitory and generally short-lived in the case of small governments for which they are significant, turning statistically insignificant just after year 2.

To provide more details, the impulse responses show that the effect of a positive shock to the dollar contracts total expenditures on impact and the contraction continues for the next 9 years for both the small and large government sizes, after which the effects become statistically indifferent from zero. When the total expenditure is split into current and capital expenditures, the response of current expenditure to dollar shock is negative and significant just briefly, between years 3 and 4, before becoming insignificant over time for both small and large government sizes. Meanwhile, the response of capital expenditures to dollar appreciations is negative on impact and persists for 11 and 10 years for small and large government sizes respectively, after which the response turns statistically insignificant. This finding suggests that capital expenditure experiences much more persistent contractions than current expenditure following dollar appreciations, and this finding is true for both small and large government sizes that are based on capital expenditures. One way to think about this result is that when there is a negative external shock, such as broad dollar appreciations, there is evidence that trade-heavy countries subsequently react by cutting capital expenditure or allocations to productive government expenditure such as infrastructure, much more so than current expenditure. Another way of saying this is that expenditure on capital tends to thrive when unfavourable external shocks, such as broad dollar shocks, are absent.

Turning now to growth, the impulse responses in Fig 3c show that dollar appreciations lead to contractions in growth on impact and last for 2 years when government size is small before turning statistically insignificant. For large government size, the effect of broad dollar shocks on growth is not statistically different from zero. When total expenditure is disaggregated, positive dollar shocks dampen economic growth on impact and persists for close to 2 years after which the response turns statistically insignificant for small government size (based on current expenditure). For large government size (based on current expenditure), positive dollar shocks exert no statistically meaningful effect on growth, whether on impact or as time progresses. A similar result holds when government size is based on capital expenditure, both for small and large government sizes. Meanwhile, for small government size, dollar appreciations contract growth on impact which persist for around 2 years before turning insignificant; this effect is not statistically significant for large government size. Thus, in terms of magnitude, the effects of broad dollar shocks on economic growth and expenditures are more pronounced for large rather than small government size across all expenditure types – total, current and capital expenditures.

Figure 3d: Impulse Response of Government Spending and Economic Growth to a Unit Broad Dollar Shock in North America (Small vs Large Government)

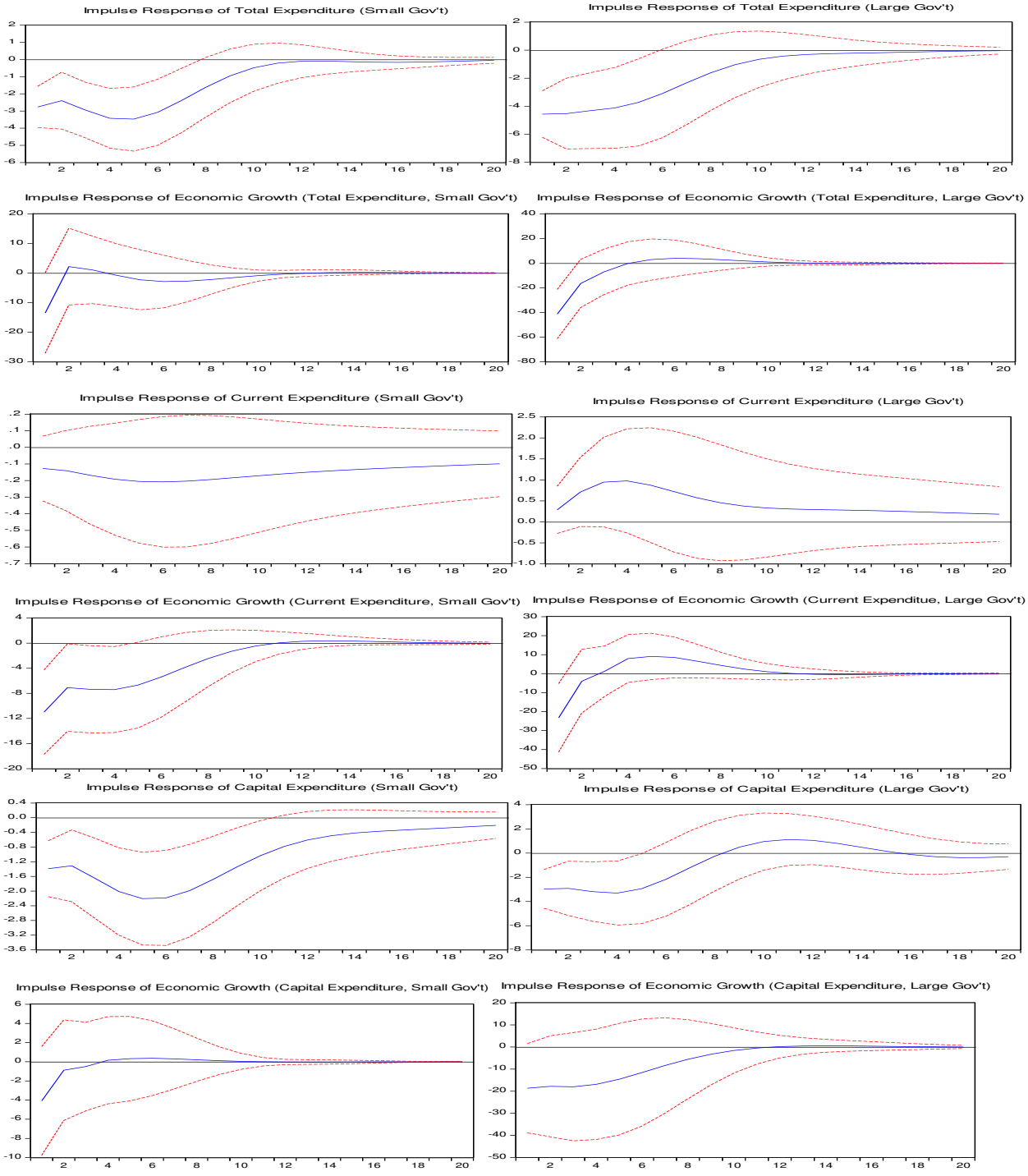
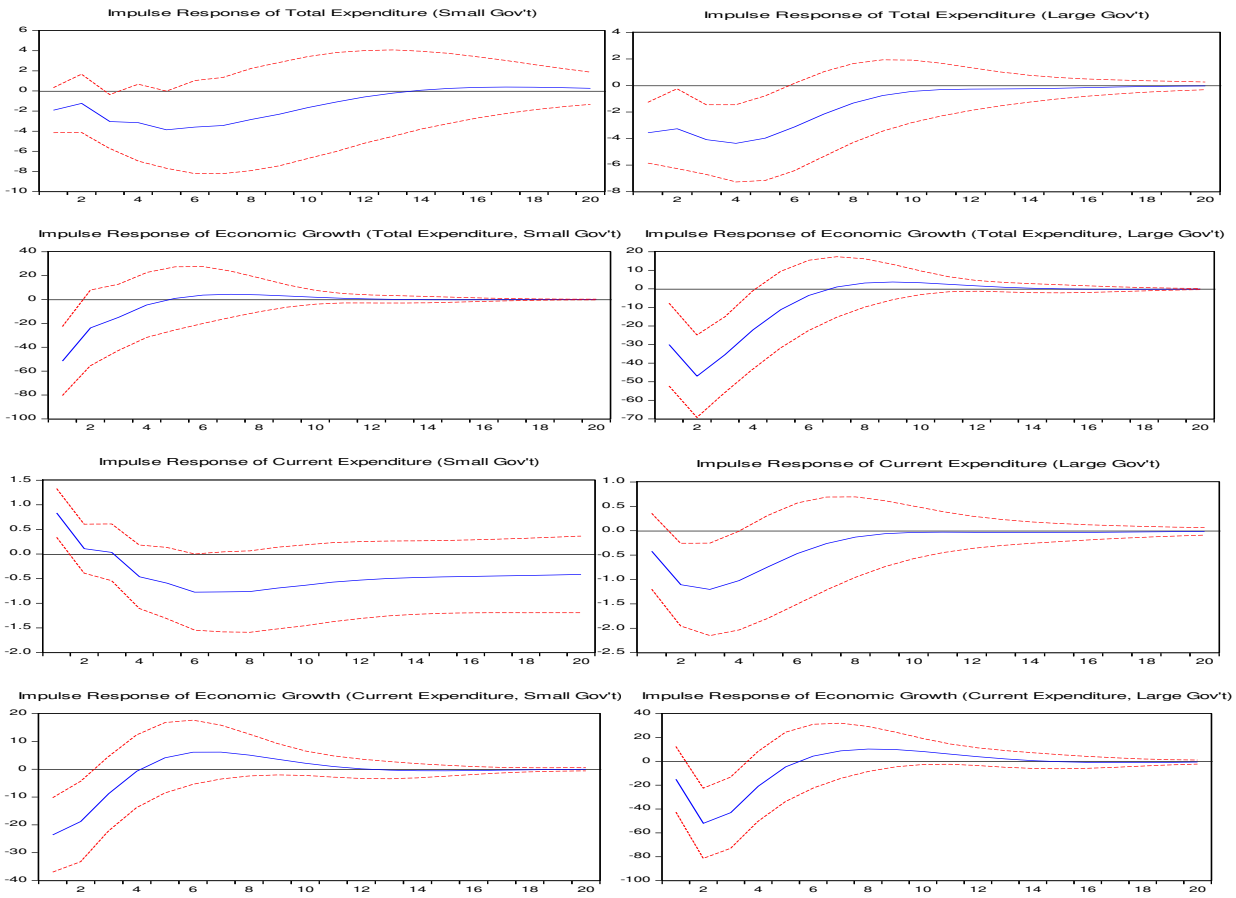


Fig. 3d shows the impulse responses and confidence bands associated with a positive shock to the dollar on expenditure and growth of trade-heavy countries in North America, for small and large government sizes. The results show that when dollar appreciates, total, current and capital expenditures display a similar evolution reported for the other continents whose results were earlier presented. Broad dollar shocks initially lessen these expenditures, except for current expenditure where the result is not statistically different from zero, and the contraction persists for around 9 years for total expenditure and 11 (8) years for capital expenditure of small (large) governments before it fizzles to zero and /or becomes statistically insignificant.

Meanwhile, economic growth does not respond significantly to broad dollar shocks for small government size based on total expenditure. However, for large government size, the response of economic growth to dollar appreciations is negative on impact and continues for around 2 years before turning statistically indifferent from zero. For government size based on current expenditure, the response of growth to broad dollar shocks is negative for both small and large government sizes before decaying to zero after 2 years and 1 year respectively, whereas for government size based on capital expenditure, the results show that the response of growth to dollar shocks is not statistically different from zero.

Figure 3e: Impulse Response of Government Spending and Economic Growth to a Unit Broad Dollar Shock in South America (Small vs Large Government)



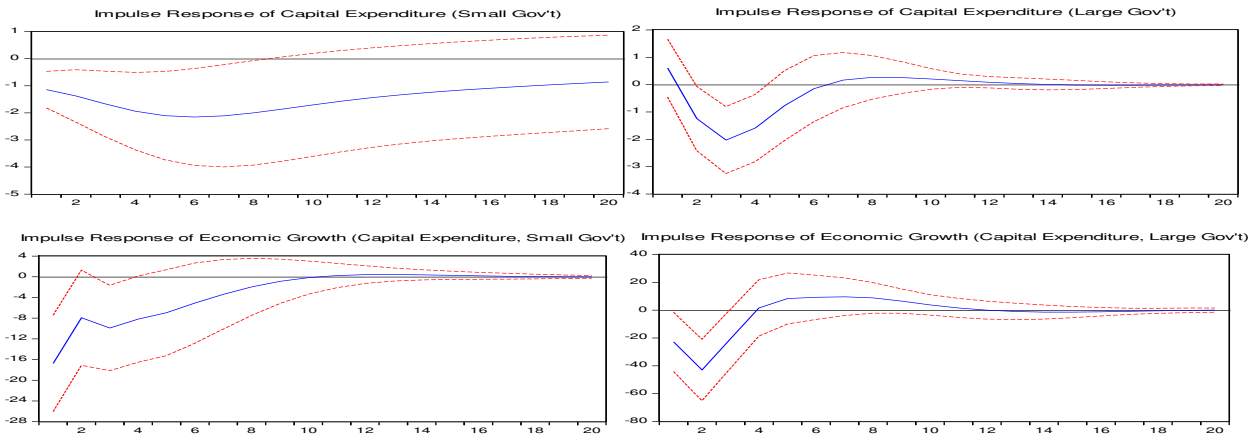
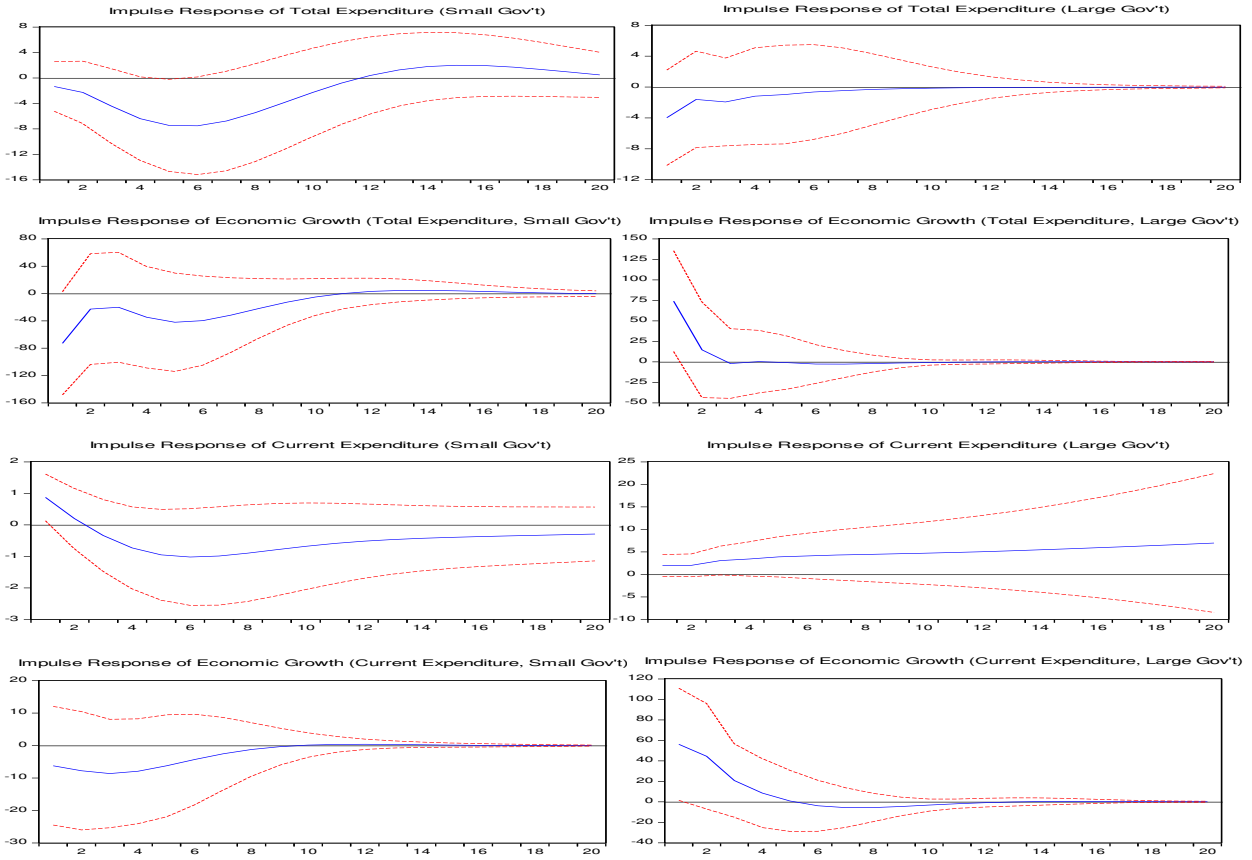
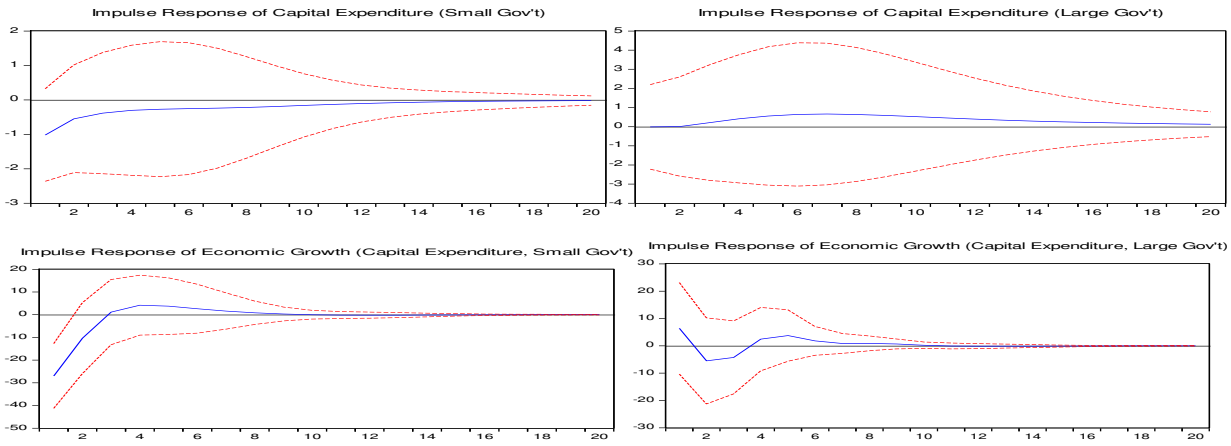


Figure 3e displays results for South America which are generally similar to the preceding results: Expenditures and growth mostly respond negatively to broad dollar shocks for both small and large government sizes. The negative response of capital expenditure to dollar shocks is frequently more significant and persistent than the response of current expenditure which is either statistically insignificant or even temporarily positive. Contraction in expenditures and growth, wherever they occur are significant and continue to be higher when government size is large than when it is small.

Figure 3f: Impulse Response of Government Spending and Economic Growth to a Unit Broad Dollar Shock in Australia (Small vs Large Government)





For the continent of Australia, we note that, even though trends of results over time appear to mimic previous results in some instances, the responses to broad dollar shocks are mostly not as strongly significant statistically at the 5% level. This outcome leads us to posit that broad dollar appreciations have less pronounced impact in Australia compared to the other continents[4].

4. Robustness Analysis

In the preceding section, we find that for the individual continents explored, the responses of economic activity, being economic growth and government expenditure, to broad dollar shocks is mostly negative and greater magnitude of contraction for larger government sizes, which leads to the interesting discovery that prevailing government size plays a role in explaining the extent of negative exposure of economic activity in trade-heavy countries to broad dollar appreciations. We show that this outcome is largely robust across the three expenditure types – total, current and capital expenditures – and that the effect of broad dollar shocks is statistically more severe on capital expenditure compared to current expenditure, for both small and large governments. This seems to suggest that when such negative exogenous shocks occur, much of the brunt is borne by capital expenditure as both small and large governments evidently reduce their productive or capital spending which are less pressing to focus more on current expenditures that are urgent.

In this section, we take the analysis a step further by performing robustness checks to concretize our main findings. To perform robustness analysis, the full panel of countries is considered, which is a fusion of all the 155 countries that were subpanelled into continents in the preceding section,

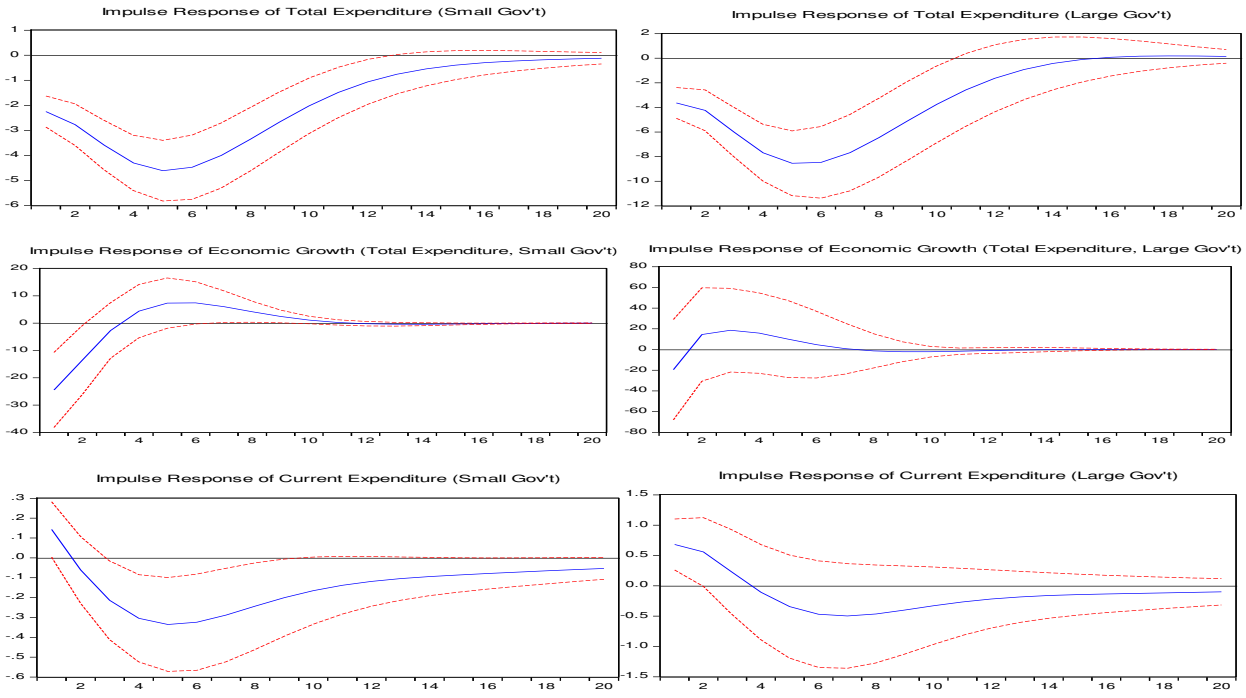
[4] Although it is not our focus to explore the relatively softer statistical significance of the dollar in Australia, we note that the diminished significance outcome could be because many countries in the continent of Australia utilize the Australian or New Zealand dollar and are relatively less exposed to vagaries in the US dollar. This is either because several trading partners engage in one-to-one trades that directly utilize these currencies or countries on the continent rely more on debt denominated in these currencies or in their own currencies. Australia, as the largest economy or country in Australia, has the vast bulk of its foreign debt denominated in Australian dollars and all of the government or public sector debt is issued in Australian dollars (Debelle, 2019). This means the government is much less reliant on foreign currency debt and shielded/less burdened from the effect of any decline in cross-border dollar flows since it does not depend significantly on it in the first place, hence no significant negative effect of broad dollar appreciations on the economic activity. Whatever the nuances might be, our result shows that, irrespective of government size, dollar appreciations have limited and statistically insignificant effect on government expenditures and economic growth in the continent of Australia compared to the other continents previously examined.

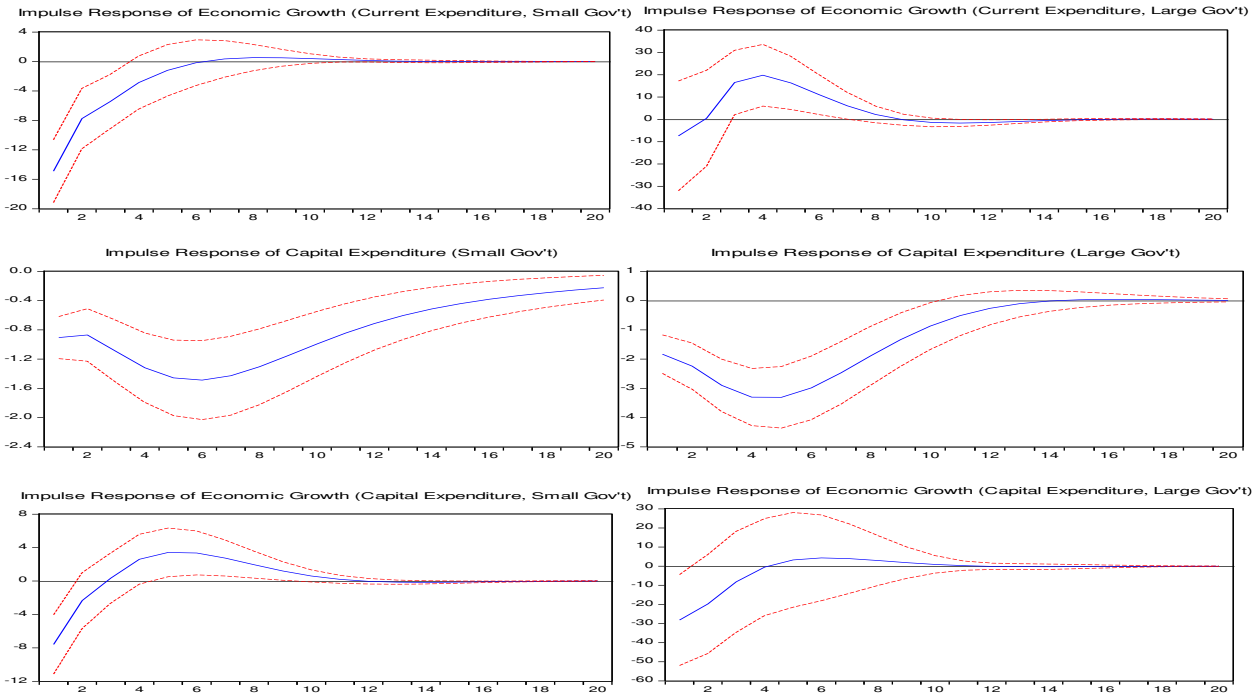
and the panel VAR is re-estimated for this full sample of countries from around the world using yearly data from 1995 - 2019. Data sources and explanations are listed in the Appendix.

To a broad analysis for a large collection of countries as represented in this paper, it is imperative to employ data which are realistically more available. Indeed, for a sizeable number of countries, high frequency data are heavily scanty or generally unavailable, a situation which would limit the scope and compromise the depth of empirical analysis performed in this paper. That said, apart from availability issues, we note that annual data have some distinct advantages over others. Beetsma, Giuliodori and Klaassen (2006) argue that annual data samples are much less vulnerable to anticipation effects as do quarterly data samples. Other advantages for annual data include: First, fiscal expenditure decisions are mostly made annually, and hence follow an annual cycle. The response of economic activity would thus correspond to the effect from an actual shift in fiscal policy decisions. Second, employing annual data lessens anticipation effects which are usually present in models estimated with quarterly data (Ramey, 2011, Benetrix & Lane, 2013). Third, the impact of seasonal effects is circumvented in empirical analysis with annual data. One reason is that seasonal variations in government policies normally do not have cycles lasting above one year.

Fig. 3g below presents impulse responses based on panel VAR for the full sample of countries. As additional robustness checks, we also estimate cumulative impulse responses for both aggregate panel of countries and the subpanels of different continents and report the results in the Appendix.

Figure 3g: Impulse Response of Government Spending and Economic Growth to a Unit Broad Dollar Shock in Overall Sample (Small vs Large Government)





The results presented in Fig. 3g, which represent the robustness analysis based on the full panel of countries, as well as cumulative impulse responses in the Appendix, confirm that the main results from the preceding section carry over into the full panels of countries and generally hold, even after combining all the countries. This suggests that the results are in general not isolated to certain regions as it holds across the large panels of countries we have considered over time.

Indeed, Fig. 3g confirms that the responses of each expenditure type and economic growth to broad dollar appreciations are mostly negative and this is true for small and large government sizes. The contractionary effects of dollar appreciations are more pronounced for large governments. In addition, capital expenditure is persistently more affected by broad dollar appreciations than current expenditure, both for large and small government sizes. This provides evidence that governments significantly reduce capital expenditures in response to positive broad dollar shocks; however, evidence that current expenditures are significantly reduced, even in the presence of broad appreciations, is generally weak.

5. Conclusion and Policy Implications

A growing body of studies have been examining the effect of broad dollar shocks on economic activity via the trade and financial channels, at the micro and macro level, for a limited number of mostly emerging market economies. Yet, not much attention has been given to providing a comprehensive study that examines this issue for economies that are particularly trade heavy across countries in the world. More importantly, until now, no attempt had been made to explore the particular role that government size plays in explaining the responses of economic activity to broad dollar appreciations: That is, how differing government sizes, based on total and disaggregated government expenditures (i.e. current and capital expenditures), influence the responses of economic activity - economic growth and government expenditures - to broad dollar shocks for a comprehensive collection of trade-heavy countries globally. This paper addresses these gaps in the literature.

We focus on a considerably large panel of trade-heavy countries that cut across both developed and emerging market economies and examine the relations between (i) broad dollar strength, (ii) government expenditure, (iii) economic growth and (iv) the role of government size in influencing these relations. Particularly, our paper investigates how government size influences the responses of economic growth and government spending to positive broad dollar shocks in trade-heavy countries across six broad continents: Europe (44), Asia (38), Africa (41), North America (20), South America (7), Australia (11). However, six (6) countries namely Armenia, Azerbaijan, Cyprus, Georgia, Kazakhstan and Russian Federation are commonly grouped geographically and historically as Eurasian regions. Thus, after accounting for these 6 repetitions individually in Europe and Asia, the total drops from 161 to 155 trade-intensive nations between 1995 and 2019.

We present two sets of evidence – one for the whole panel of trade-heavy countries (which constitute our robustness analysis) and another for sub panels of the trade-heavy countries (which is our main benchmark result) segmented into 6 continents – Europe, Asia, South America, North America, Africa and Australia. In each case, we explore the responses of government expenditures and economic growth to broad dollar shocks for countries with large and small government sizes, where the large and small government sizes are determined based on both total government expenditure and disaggregated government expenditure, i.e. current and capital expenditures. Thus, in each exercise, we have the responses of expenditure and growth to broad dollar shocks for two groups of trade-heavy countries – those with a large government size and those with small government size, where the large and small government sizes are based on total, current and capital government expenditure.

Our study is not intended to argue that government size plays the only unique role of revealing the asymmetric responses of economic activity to broad dollar shocks; instead our view is simply that it is an important source of the explanation for the largely uneven responses of economic activity to broad dollar appreciations across countries. The previous literature may have ignored this role of government size, and demonstrating its robustness, possibly because it has been confined to a small subset of countries whose governments may not necessarily derive substantial resources for expenditures from avenues that external shocks, such as broad dollar shocks, have a significantly large influence on, and thus exhibit relatively little swings from dollar shocks. Instead, here, we

consider a substantially large panel of trade-heavy countries, enabling us to perform a comprehensive study that fills the gap in the existing literature. Through our systematic empirical analysis of a broad set of countries, we are able to generate robust insights on the role that government size plays in the responses of economic growth and expenditure to broad dollar shocks.

As a modal outcome, we find that, in trade-heavy countries, dollar appreciations lead to lower growth and lower government expenditures, and the result is most prominent for trade-heavy economies with a large government size. This outcome is largely robust as it not only holds for the whole panel of countries but is also generally true for most of the continents into which the trade-heavy countries are segmented. The responses of economic activity, economic growth and government expenditure, to broad dollar shocks is mostly negative and the magnitude of contraction is greater for larger government sizes, which leads us to posit that prevailing government size plays a role in explaining the degree of negative exposure of economic activity to broad dollar appreciations. We show that this outcome is largely robust across three expenditure types considered – total, current and capital expenditures – and that the effect of broad dollar shocks is statistically more severe on capital expenditure compared to current expenditure, for both small and large governments, which seems to suggest that when such negative exogenous shocks occur, much of the brunt is borne by capital expenditure, as both small and large governments significantly reduce their productive or capital expenditures possibly to focus on more urgent current expenditures. Our paper is the first attempt to examine the role of government size in the responses of economic aggregates to broad dollar shocks for a broad country sample of trade-heavy countries.

In summary, we have documented a trilateral connection between the broad dollar, government expenditure and economic growth for a large panel of trade-heavy countries. More specifically, a stronger dollar leads to lower government expenditures and contractions in economic growth. This points to a dominant role that the dollar plays in recent times as the currency of trade as well as of cross-border lending and borrowing across countries. Differences in government sizes can explain the dissimilarities in the extent of sensitivity of government expenditure and economic growth to dollar appreciations across countries, for diverse expenditure types.

Hence, an important policy implication of our findings is that government size plays a role in the ultimate effect that a stronger dollar would have on growth and government expenditure in trade-heavy countries and to the best of our knowledge, this constitutes a new contribution to the literature. One main takeaway is that countries that are trade-heavy and run large government sizes are more prone to the debilitating effect of broad dollar appreciations. Previous studies such as Gopinath et al. (2020), Avdjiev et al. (2019) and Shousha (2019), among others, have shown that dollar appreciations dampen trade, economic activity and or cross-border lending in dollars. Our paper takes this a step further by documenting that the effect is most prominent for countries with large government sizes.

References

Abasimi, I., Li, X., Salim, A., & Khan, M. I. (2019). The Role of Institutions in Affecting the Course of International Trade in The Neighboring Countries of Ghana. *Journal of Business School, 2*(3), 28-39.

Avdjiev, S., Bruno, V., Koch, C., & Shin, H. S. (2019). The dollar exchange rate as a global risk factor: evidence from investment. *IMF Economic Review, 67*(1), 151-173.

Bebczuk, R., Galindo, A., & Panizza, U. (2010). An evaluation of the contractionary devaluation hypothesis. *In Economic Development in Latin America (pp. 102-117)*. Palgrave Macmillan, London.

Beetsma, R., Giuliodori, M., & Klaassen, F. (2006). Trade spill-overs of fiscal policy in the European Union: a panel analysis. *Economic policy, 21*(48), 640-687.

Bénétrix, A. S., & Lane, P. R. (2013). Fiscal cyclicality and EMU. *Journal of International Money and Finance, 34,* 164-176.

Bruno, V., & Shin, H. S. (2015). Cross-border banking and global liquidity. *The Review of Economic Studies, 82*(2), 535-564.

Bruno, V., & Shin, H. S. (2019). Dollar Exchange Rate as a Credit Supply Factor–Evidence from Firm-Level Exports.

Bruno, V., Kim, S. J., & Shin, H. (2018). *Exchange rates and the working capital channel of trade fluctuations*. In AEA Papers and Proceedings, 108, 531-36).

Casas, C., Diez, M. F., Gopinath, G., & Gourinchas, P. O. (2017). Dominant currency paradigm: A new model for small open economies. *International Monetary Fund*.

Debelle, G. (2019). *A Balance of Payments.* Address to the Economic Society of Australia, Canberra, 27 August.

Druck, P., Magud, N. E., & Mariscal, R. (2018). Collateral damage: Dollar strength and emerging markets' growth. *The North American Journal of Economics and Finance, 43,* 97-117.

Fleming, J. M. (1962). Domestic financial policies under fixed and under floating exchange rates. *Staff Papers, 9*(3), 369-380.

Goldberg, L., & Tille, C. (2009). Macroeconomic interdependence and the international role of the dollar. *Journal of Monetary Economics, 56*(7), 990-1003.

Gopinath, G., Boz, E., Casas, C., Díez, F. J., Gourinchas, P. O., & Plagborg-Møller, M. (2020). Dominant currency paradigm. *American Economic Review, 110*(3), 677-719.

Ho, S. Y. (2018). Analysing the sources of growth in an emerging market economy: The Thailand experience.

Hofmann, B., Shim, I., & Shin, H. S. (2016). Sovereign yields and the risk-taking channel of currency appreciation.

Ibhagui, O. (2019). The Transfer Problem Surfaces in Sub-Saharan Africa: Net Foreign Assets,

Financial Liberalization and Real Exchange Rates. *Review of Economic Analysis, 11*(3).

Kearns, J., & Patel, N. (2016). Does the financial channel of exchange rates offset the trade channel? *BIS Quarterly Review December*.

Kohn, D., Leibovici, F., & Szkup, M. (2016). Financial frictions and new exporter dynamics. *International economic review, 57*(2), 453-486.

Lane, P. R., & Milesi-Ferretti, G. M. (2004). The transfer problem revisited: Net foreign assets and real exchange rates. *Review of Economics and Statistics, 86*(4), 841-857.

Mundell, R. A. (1963). Capital mobility and stabilization policy under fixed and flexible exchange rates. *Canadian Journal of Economics and Political Science/Revue canadienne de economiques et science politique, 29*(4), 475-485.

Priewe, J. (2016). The enigmatic dollar-euro exchange rate and the world's biggest forex market: Performance, causes, consequences (No. 49). *IMK Study*.

Ramey, V. A. (2011). Can government purchases stimulate the economy? *Journal of Economic Literature, 49*(3), 673-85.

Sadeghi, A. (2017). Oil Price Shocks and Economic Growth in Oil-Exporting Countries: Does the Size of Government Matter? *International Monetary Fund*.

Sakyi, D., & Egyir, J. (2017). Effects of trade and FDI on economic growth in Africa: an empirical investigation. *Transnational Corporations Review, 9*(2), 66-87.

Shousha, S. (2019). The dollar and emerging market economies: financial vulnerabilities meet the international trade system. *FRB International Finance Discussion Paper,* (1258).

Vivek, S. (2018). Model performance & cost functions for classification models. *Towards Data Science*.

Waugh, M. E., & Ravikumar, B. (2016). Measuring openness to trade. *Journal of Economic Dynamics and Control, 72,* 29-41.

Wieladek, T. (2016). The varying coefficient Bayesian panel VAR model.

Appendix I – Data

Sample

Full sample contains 155 trade-heavy countries across six (6) continents from 1995 to 2019. Total number of observations is 3799.

Table A1: List of the Country Years Included in the Full Sample

Country	Year	Country	Year	Country	Year
Afghanistan	1995-2019	Guatemala	1995-2019	North Macedonia	1995-2019
Albania	1995-2019	Guinea	1995-2019	Norway	1995-2019
Algeria	1995-2019	Guinea-Bissau	1995-2019	Oman	1995-2019
Angola	1995-2019	Guyana	1995-2019	Palau	1995-2019
Antigua and Barbuda	1995-2019	Haiti	1995-2019	Panama	1995-2019
Armenia	1995-2019	Honduras	1995-2019	Papua New Guinea	1995-2019
Austria	1995-2019	Hungary	1995-2019	Paraguay	1995-2019
Azerbaijan	1995-2019	Iceland	1995-2019	Philippines	1995-2019
Bahamas, The	1995-2019	Indonesia	1995-2019	Poland	1995-2019
Bahrain	1995-2019	Iraq	1995-2019	Portugal	1995-2019
Barbados	1995-2019	Ireland	1995-2019	Qatar	1995-2019
Belarus	1995-2019	Israel	1995-2019	Romania	1995-2019
Belgium	1995-2019	Jamaica	1995-2019	Russian Federation	1995-2019
Belize	1995-2019	Jordan	1995-2019	Samoa	1995-2019
Benin	1995-2019	Kazakhstan	1995-2019	Saudi Arabia	1995-2019
Bhutan	1995-2019	Kenya	1995-2019	Senegal	1995-2019
Bolivia	1995-2019	Kiribati	1995-2019	Serbia	1995-2019
Bosnia and Herzegovina	1995-2019	Korea, Rep.	1995-2019	Seychelles	1995-2019
Botswana	1995-2019	Kosovo	1995-2019	Sierra Leone	1995-2019
Brunei Darussalam	1995-2019	Kuwait	1995-2019	Singapore	1995-2019
Bulgaria	1995-2019	Kyrgyz Republic	1995-2019	Slovak Republic	1995-2019
Cabo Verde	1995-2019	Lao PDR	1995-2019	Slovenia	1995-2019
Cambodia	1995-2019	Latvia	1995-2019	Solomon Islands	1995-2019
Canada	1995-2019	Lebanon	1995-2019	Somalia	1995-2019
Chad	1995-2019	Lesotho	1995-2019	South Africa	1995-2019
Chile	1995-2019	Liberia	1995-2019	South Sudan	1995-2019
Congo, Dem. Rep.	1995-2019	Libya	1995-2019	Spain	1995-2019
Congo, Rep.	1995-2019	Lithuania	1995-2019	Sri Lanka	1995-2019
Costa Rica	1995-2019	Luxembourg	1995-2019	St. Kitts and Nevis	1995-2019
Cote d'Ivoire	1995-2019	Madagascar	1995-2019	St. Lucia	1995-2019
Croatia	1995-2019	Malawi	1995-2019	St. Vincent and the Grenadines	1995-2019
Cyprus	1995-2019	Malaysia	1995-2019	Suriname	1995-2019
Czech Republic	1995-2019	Maldives	1995-2019	Sweden	1995-2019
Denmark	1995-2019	Mali	1995-2019	Switzerland	1995-2019
Djibouti	1995-2019	Malta	1995-2019	Syrian Arab Republic	1995-2019
Dominica	1995-2019	Marshall Islands	1995-2019	Tajikistan	1995-2019
Dominican Republic	1995-2019	Mauritania	1995-2019	Thailand	1995-2019
Ecuador	1995-2019	Mauritius	1995-2019	Timor-Leste	1995-2019
El Salvador	1995-2019	Mexico	1995-2019	Togo	1995-2019
Equatorial Guinea	1995-2019	Micronesia, Fed. Sts.	1995-2019	Tonga	1995-2019
Eritrea	1995-2019	Moldova	1995-2019	Tunisia	1995-2019
Estonia	1995-2019	Mongolia	1995-2019	Turkmenistan	1995-2019
Eswatini	1995-2019	Montenegro	1995-2019	Ukraine	1995-2019
Finland	1995-2019	Morocco	1995-2019	United Arab Emirates	1995-2019

France	1995-2019	Mozambique	1995-2019	United Kingdom	1995-2019
Gabon	1995-2019	Namibia	1995-2019	Uzbekistan	1995-2019
Gambia, The	1995-2019	Nauru	1995-2019	Vanuatu	1995-2019
Georgia	1995-2019	Nepal	1995-2019	Venezuela, RB	1995-2019
Germany	1995-2019	Netherlands	1995-2019	Vietnam	1995-2019
Ghana	1995-2019	New Zealand	1995-2019	Zambia	1995-2019
Greece	1995-2019	Nicaragua	1995-2019	Zimbabwe	1995-2019
Grenada	1995-2019	Niger	1995-2019		

Some countries do not have complete observations for some variables and for all years observed which reduces the number of observations depending on available data for observed countries.

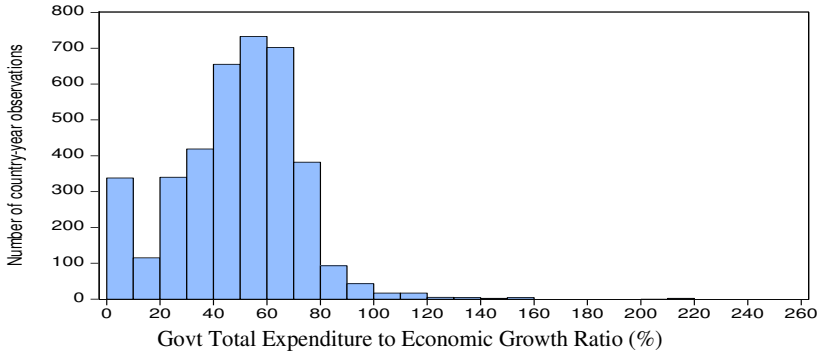
Table A2: Breakdown of Countries on Continent-Basis

Countries in Europe		**Countries in Asia**	
Albania	Kosovo	Afghanistan	Nepal
Armenia	Latvia	Armenia	Oman
Austria	Lithuania	Azerbaijan	Philippines
Azerbaijan	Luxembourg	Bahrain	Qatar
Belarus	Malta	Bhutan	Russian Federation
Belgium	Moldova	Brunei Darussalam	Saudi Arabia
Bosnia and Herzegovina	Montenegro	Cambodia	Singapore
Bulgaria	Netherlands	Cyprus	Sri Lanka
Croatia	North Macedonia	Georgia	Syrian Arab Republic
Cyprus	Norway	Indonesia	Tajikistan
Czech Republic	Poland	Iraq	Thailand
Denmark	Portugal	Israel	Timor-Leste
Estonia	Romania	Jordan	Turkmenistan
Finland	Russian Federation	Kazakhstan	United Arab Emirates
France	Serbia	Korea, Rep.	Uzbekistan
Georgia	Slovak Republic	Kuwait	Vietnam
Germany	Slovenia	Kyrgyz Republic	
Greece	Spain	Lao PDR	
Hungary	Sweden	Lebanon	
Iceland	Switzerland	Malaysia	
Ireland	Ukraine	Maldives	
Kazakhstan	United Kingdom	Mongolia	
Countries in Africa		**Countries in North America**	**South American Countries**
Algeria	Libya	Antigua and Barbuda	Bolivia
Angola	Madagascar	Bahamas, The	Chile
Benin	Malawi	Barbados	Ecuador
Botswana	Mali	Belize	Guyana
Cabo Verde	Mauritania	Canada	Paraguay
Chad	Mauritius	Costa Rica	Suriname
Congo, Dem. Rep.	Morocco	Dominica	Venezuela, RB
Congo Republic	Mozambique	Dominican Republic	
Cote d'ivoire	Namibia	El Salvador	**Australian Countries**
Djibouti	Niger	Grenada	Kiribati
Equatorial Guinea	Senegal	Guatemala	Marshall Islands
Eritrea	Seychelles	Haiti	Micronesia, Fed. Sts.
Eswatini	Sierra Leone	Honduras	Nauru
Gabon	Somalia	Jamaica	New Zealand
Gambia, The	South Africa	Mexico	Palau

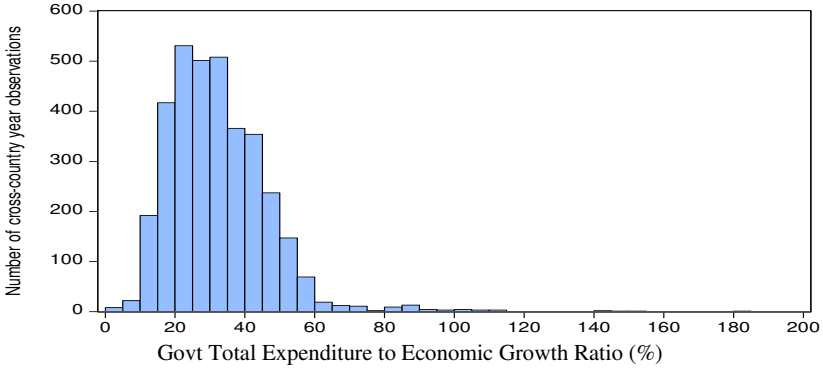
Ghana	South Sudan	Nicaragua	Papua New Guinea
Guinea	Togo	Panama	Samoa
Guinea-Bissau	Tunisia	St. Kitts and Nevis	Solomon Islands
Kenya	Zambia	St. Lucia	Tonga
Lesotho	Zimbabwe	St. Vincent and the Grenadines	Vanuatu
Liberia			

Figure A1: Distribution of Government Expenditure as a Percent of Economic Growth

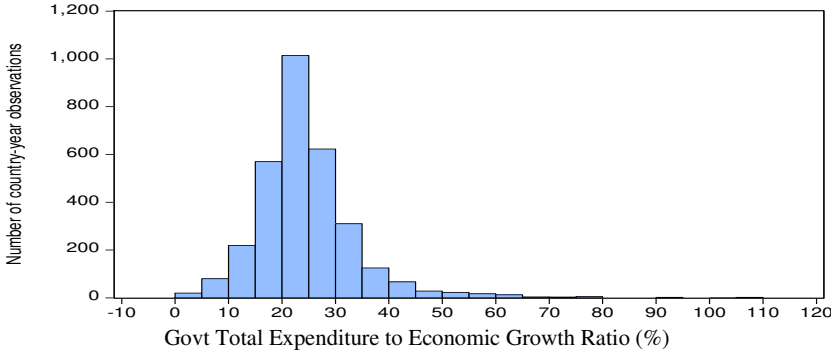
Total Expenditure:



Current Expenditure:



Capital Expenditure:



Appendix II – Cumulative Impulse Responses

Figure 4a: Cumulative Impulse Response of Government Spending and Economic Growth to a Unit Broad Dollar Shock in Europe (Small vs Large Government)

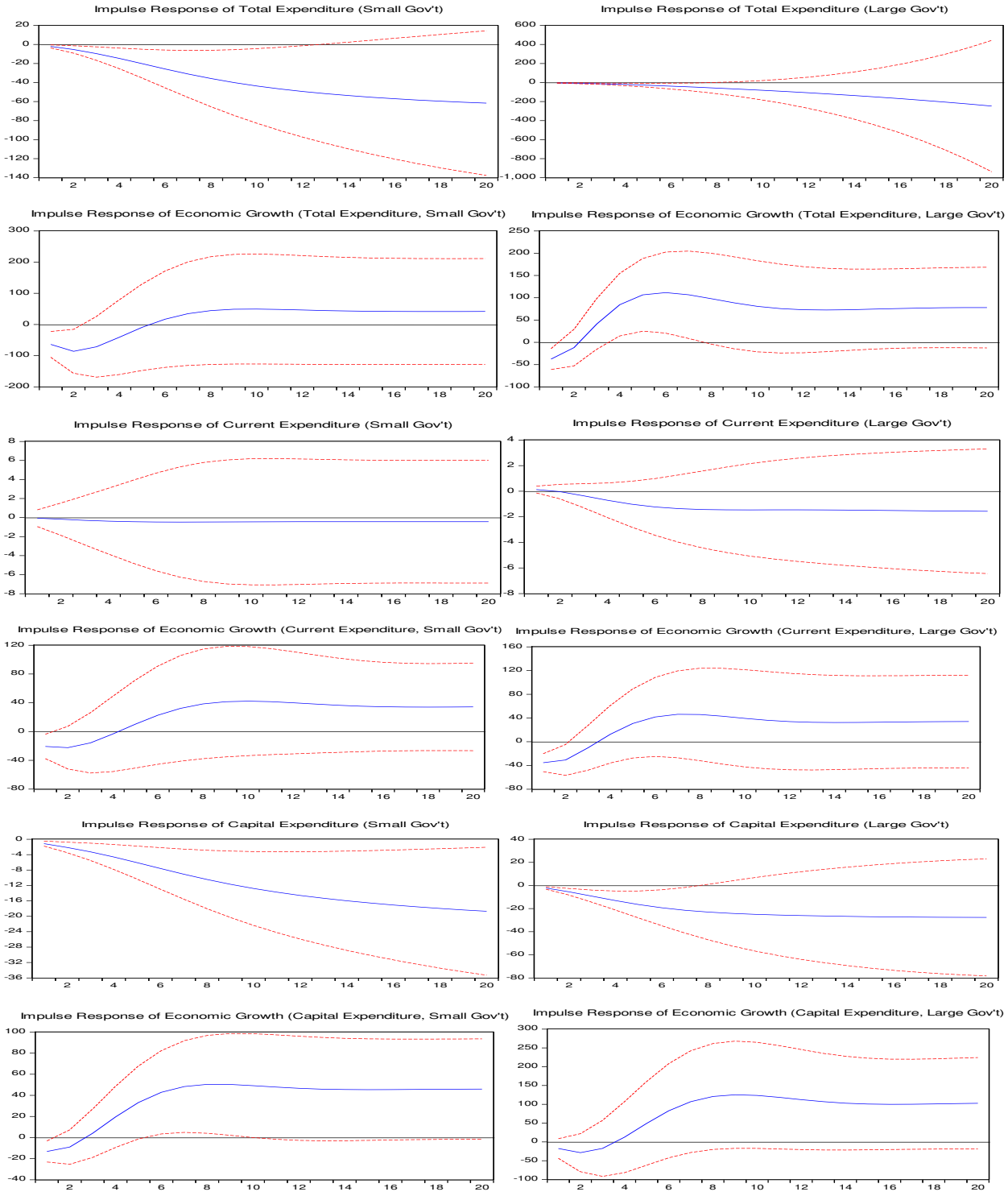


Figure 4b: Cumulative Impulse Response of Government Spending and Economic Growth to a Unit Broad Dollar Shock in Asia (Small vs Large Government)

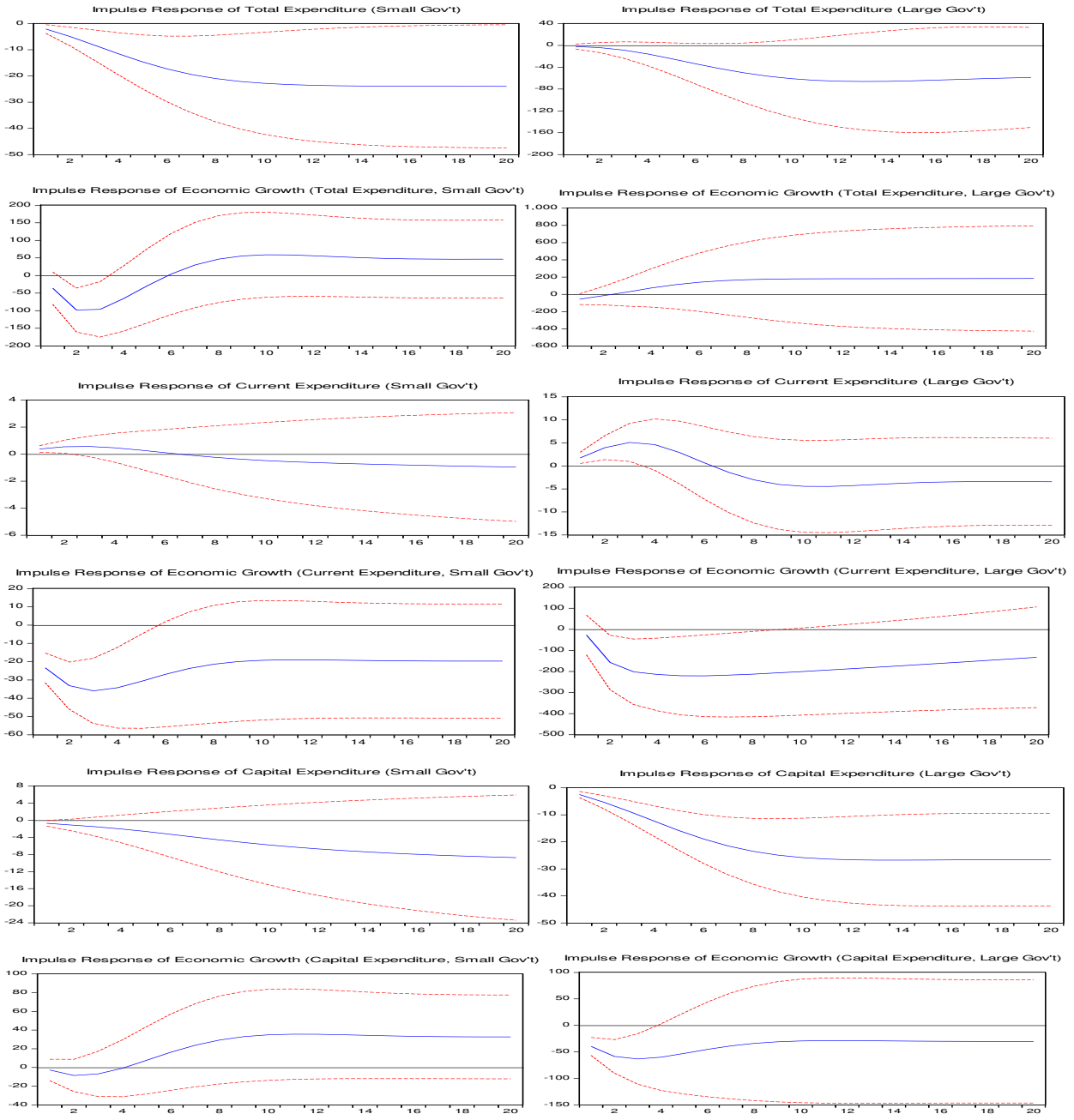
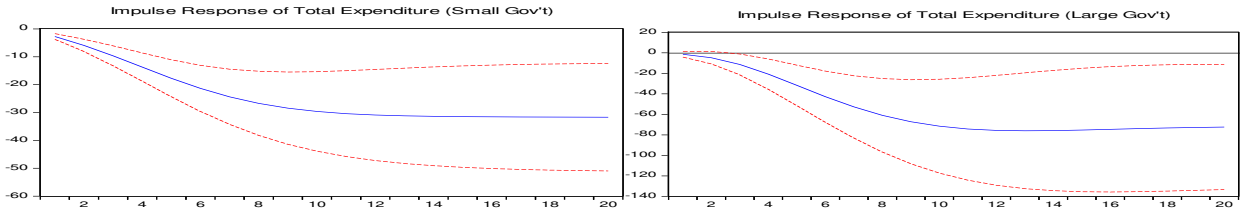


Figure 4c: Cumulative Impulse Response of Government Spending and Economic Growth to a Unit Broad Dollar Shock in Africa (Small vs Large Government)



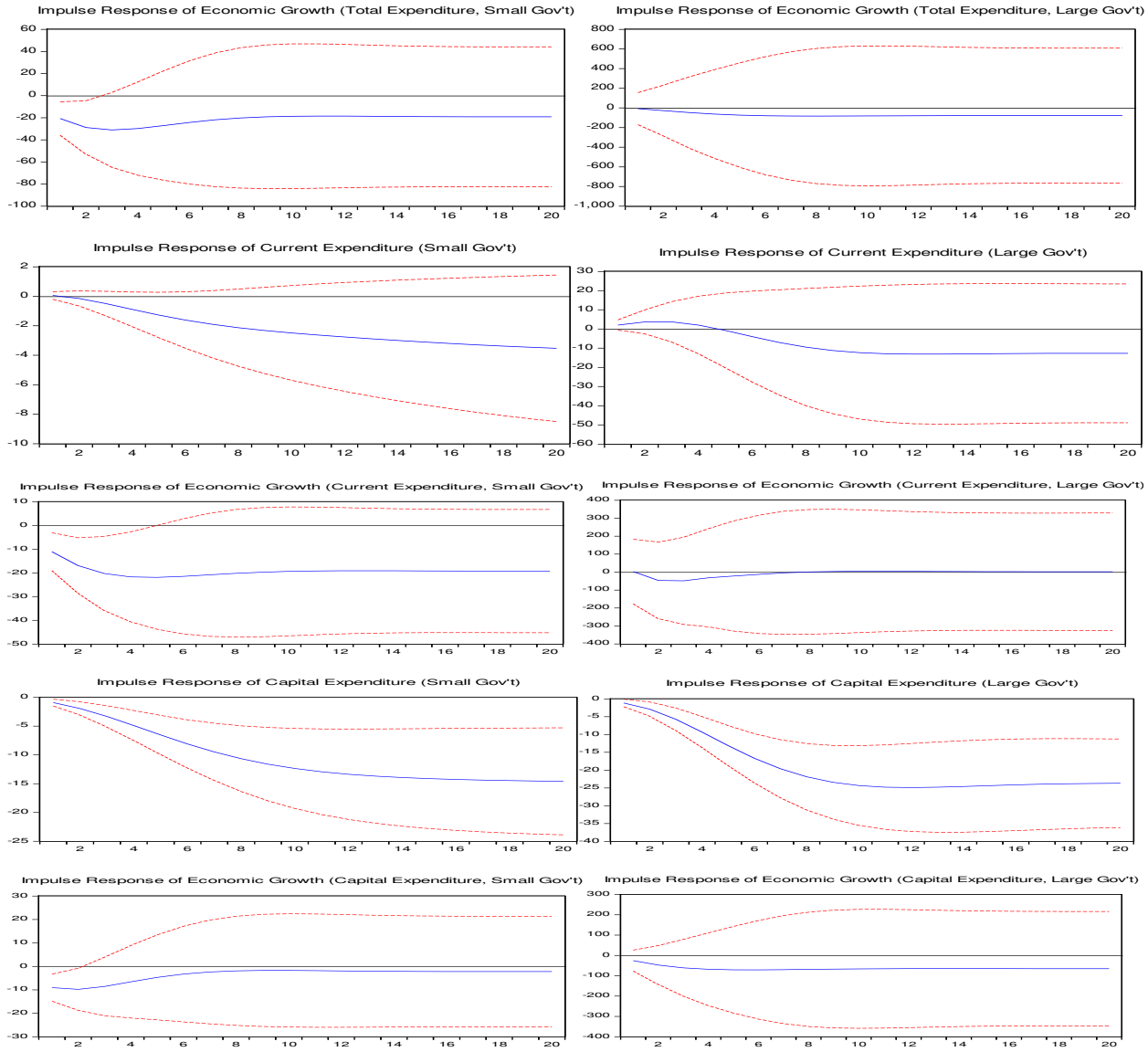
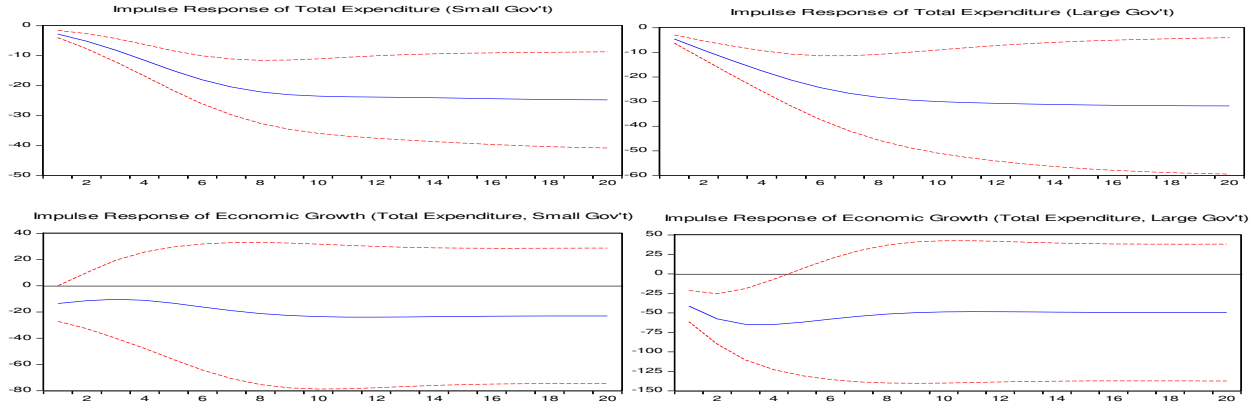


Figure 4d: Cumulative Impulse Response of Government Spending and Economic Growth to a Unit Broad Dollar Shock in North America (Small vs Large Government)



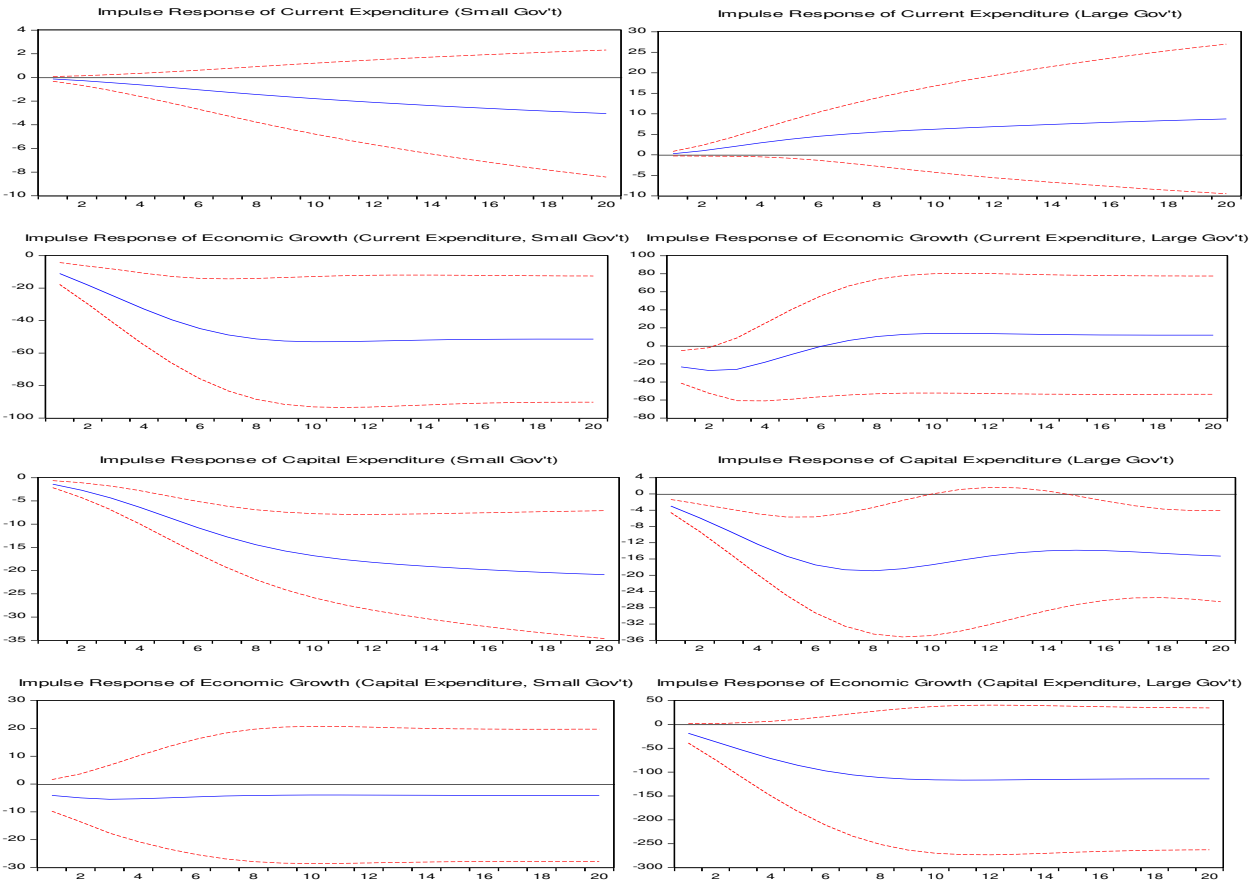
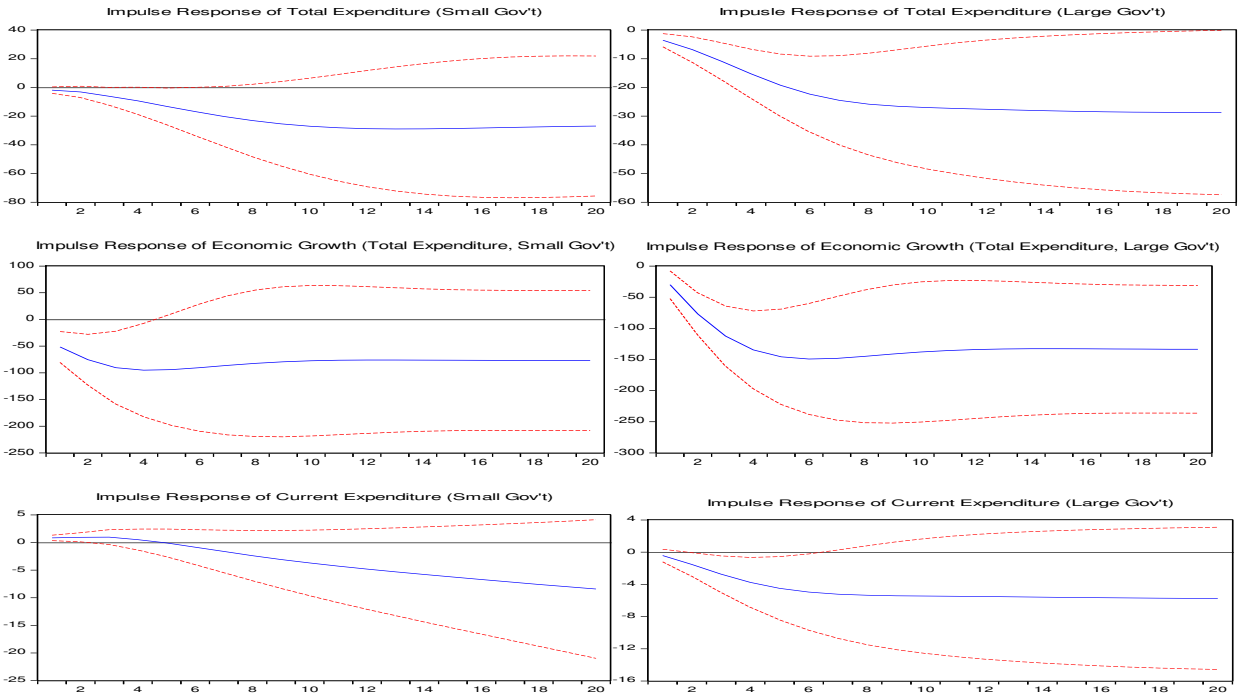


Figure 4e: Cumulative Impulse Response of Government Spending and Economic Growth to a Unit Broad Dollar Shock in South America (Small vs Large Government)



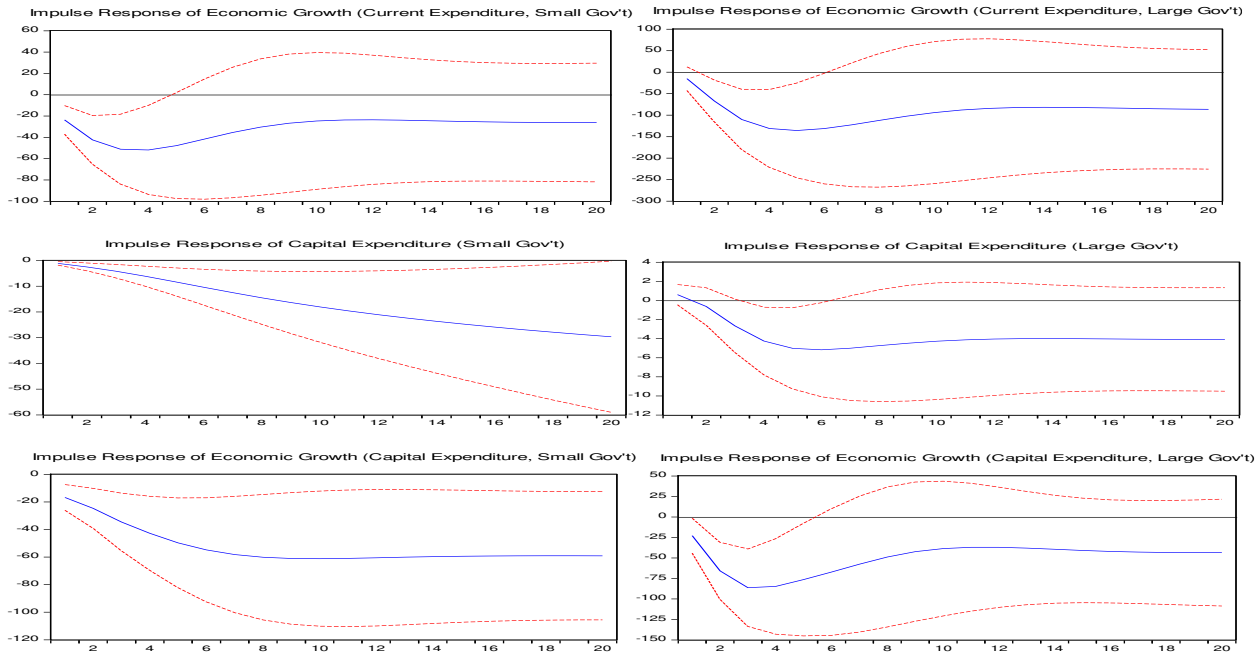
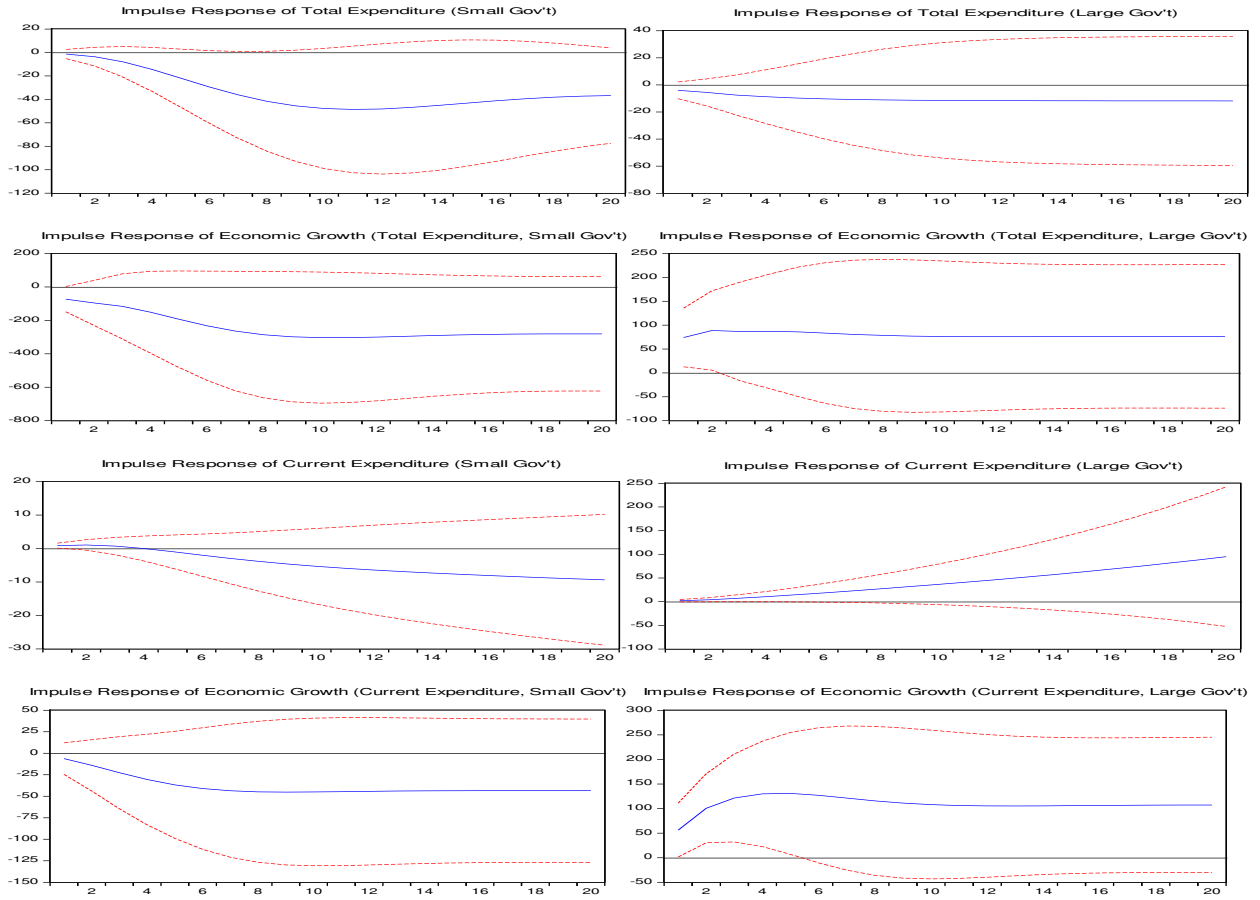


Figure 4f: Cumulative Impulse Response of Government Spending and Economic Growth to a Unit Broad Dollar Shock in Australia (Small vs Large Government)



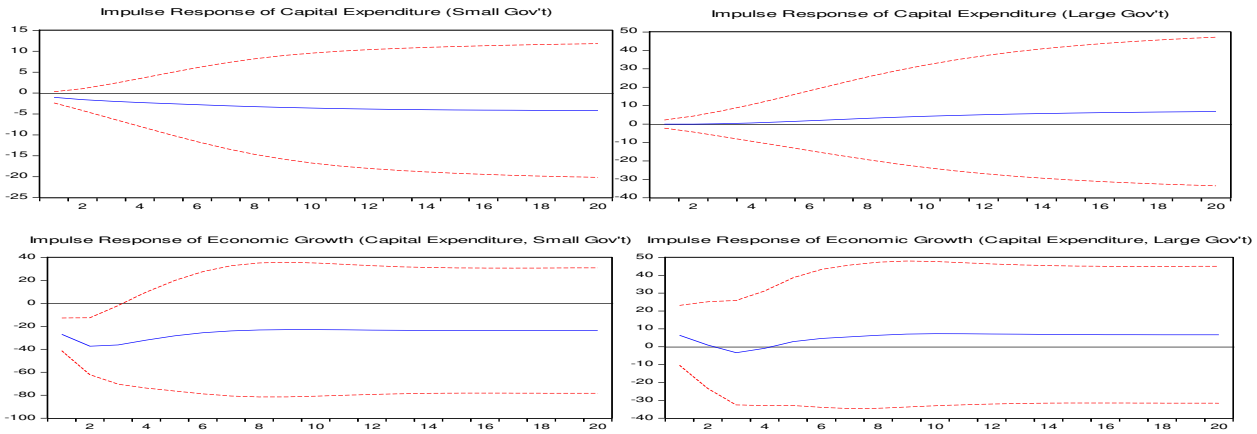
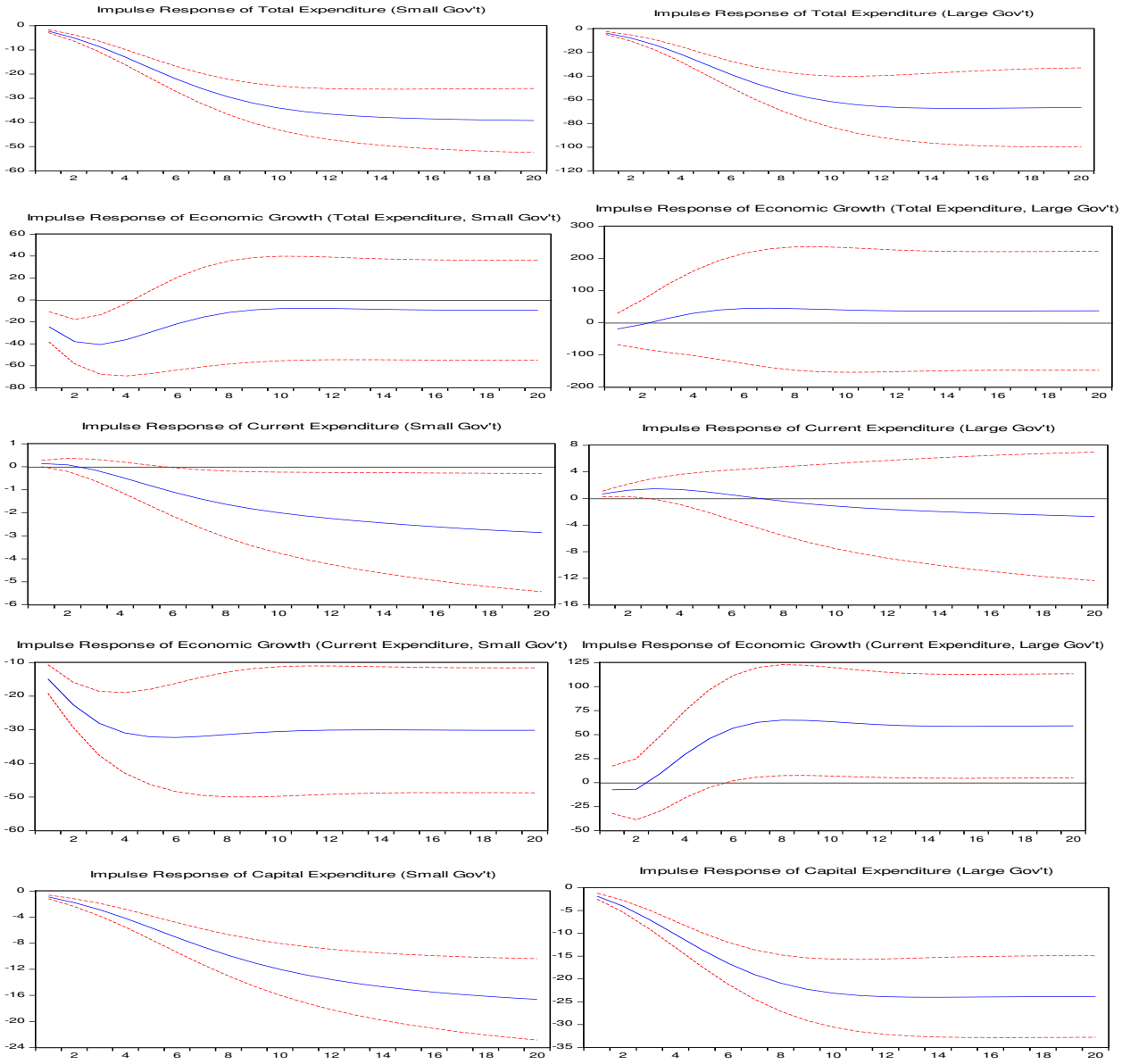
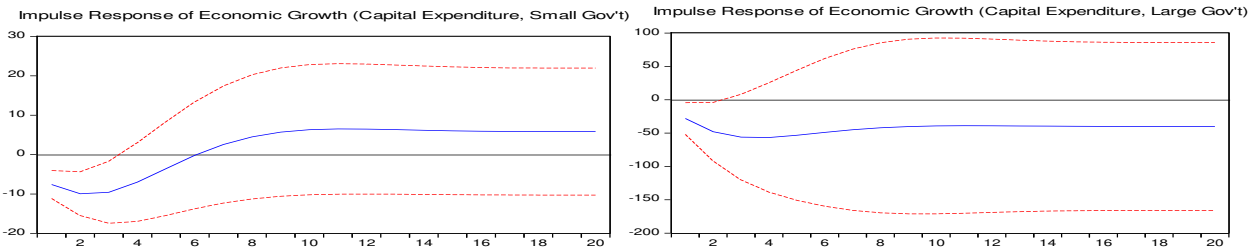


Figure 4g: Cumulative Impulse Response of Government Spending and Economic Growth to a Unit Broad Dollar Shock in Overall Sample Study (Small vs Large Government)





The cumulative response graphs presented above in Figures 4a-g depict the importance of government size in explaining the transmission of BDI shocks to economic growth and government expenditures. Thus, the accumulated responses of government expenditure and output levels to one-unit positive BDI shock are presented for Europe, Asia, Africa, North America, South America, Australia and the overall sample study. These re-affirm earlier findings from figures 3a-g where a positive BDI shock leads to contractions in all expenditure types while negatively affecting corresponding growth levels. Although there are brief periods of increase towards the positive region, this is mostly followed by declines towards the steady state. For the whole, large government has greater responses to small government and capital expenditure records greater magnitude of transmitting broad dollar shocks to growth and national expenditure levels than current expenditure.

Appendix IIb

Table A3: Difference in Cumulative Impulse Response to a Unit Broad Dollar Shock, Small vs Large Government

The Fiscal Channel	Total Expenditure	Current Expenditure	Capital Expenditure
Europe			
Gov't Expenditure:			
1st year	-2.746701*	0.194981**	-1.032358*
2nd year	-2.371682*	0.140162**	-2.321964*
3rd year	-4.320421*	-0.070842**	-2.675266*
5th year	-8.72869*	-0.576898**	-1.938688*
10th year	-38.37661*	-1.010481*	0.30408**
20th year	-186.01359*	-1.132378*	0.294046**
Economic Growth:			
1st year	26.1995*	-14.63032*	-4.26712*
2nd year	74.13436*	-8.27033*	-19.606077*
3rd year	112.9373*	5.49932*	-21.391745*
5th year	115.405836*	20.43962*	16.19737*
10th year	31.18039*	-2.86926*	74.52364*
20th year	36.11388*	-0.23758**	56.84194*
Asia			
Gov't Expenditure:			
1st year	0.060529**	1.356527*	-1.787502*
2nd year	0.918629**	3.416266*	-4.264376*

3rd year	-0.289898**	4.533022*	-7.166307*
5th year	-9.71936*	2.611601*	-13.162125*
10th year	-38.13058*	-3.961849*	-20.057502*
20th year	-34.81896*	-2.498306*	-17.823316*
Economic Growth:			
1st year	-20.47122*	-3.51715*	-37.137738*
2nd year	83.00769*	-124.01478*	-50.069583*
3rd year	122.76019*	-165.76363*	-56.647776*
5th year	140.82093*	-189.64057*	-60.682598*
10th year	120.11637*	-181.69916*	-64.30102*
20th year	137.35119*	-113.03221*	-63.01481*
Africa			
Gov't Expenditure:			
1st year	1.322712*	1.997554*	-0.245487**
2nd year	1.137715*	3.844771*	-0.944458**
3rd year	-1.734825*	4.210708*	-2.416706*
5th year	-14.01358*	0.518301**	-6.610475*
10th year	-41.9219*	-9.847057*	-11.98479*
20th year	-40.71967*	-9.172844*	-9.09978*
Economic Growth:			
1st year	13.072139*	13.974222*	-16.340453*
2nd year	1.75049*	-29.59783*	-37.42841*
3rd year	-15.59043*	-28.38738*	-52.398411*
5th year	-46.22617*	0.19097**	-66.101826*
10th year	-62.61142*	24.197971*	-64.350689*
20th year	-59.06048*	21.241252*	-62.966871*
North America			
Gov't Expenditure:			
1st year	-1.795155*	0.412647**	-1.573499*
2nd year	-3.925125*	1.266173*	-3.179244*
3rd year	-5.290384*	2.382094*	-4.704822*
5th year	-6.24302*	4.63149*	-6.732072*
10th year	-6.43719*	8.05267*	-0.63429**
20th year	-6.96465*	11.803327*	5.57636*
Economic Growth:			
1st year	-27.76182*	-12.28222*	-14.571434*
2nd year	-46.35508*	-9.20191*	-31.478844*
3rd year	-54.37714*	-0.50492**	-48.978353*
5th year	-48.61657*	30.599811*	-80.939301*
10th year	-25.25256*	66.88517*	-112.267021*
20th year	-26.60482*	63.36228*	-110.054718*
South America			

Gov't Expenditure:			
1st year	-1.647201*	-1.255236*	1.747932*
2nd year	-3.671827*	-2.469628*	1.881969*
3rd year	-4.71227*	-3.706864*	1.526276*
5th year	-6.02667*	-4.414485*	3.213628*
10th year	-0.00039**	-1.741691*	13.787024*
20th year	-1.84358*	2.681642*	25.566874*
Economic Growth:			
1st year	21.56476*	8.54828*	-6.01324*
2nd year	-1.65399*	-24.67665*	-41.05143*
3rd year	-22.15137*	-58.98088*	-51.73072*
5th year	-51.67454*	-87.86067*	-26.67298*
10th year	-60.66606*	-69.43648*	22.63109*
20th year	-56.68762*	-60.32049*	15.5982*
Australia			
Gov't Expenditure:			
1st year	-2.637791*	1.100811*	1.010102*
2nd year	-1.968338*	2.921695*	1.566231*
3rd year	0.528342**	6.329617*	2.159566*
5th year	12.229452*	15.343866*	3.699908*
10th year	36.33184*	41.813649*	7.820754*
20th year	24.95762*	104.326686*	10.999535*
Economic Growth:			
1st year	146.99723*	62.424997*	33.400788*
2nd year	184.36178*	114.71259*	38.233159*
3rd year	202.47033*	144.10778*	32.846618*
5th year	278.52472*	167.62664*	31.097911*
10th year	379.47859*	153.11915*	30.202338*
20th year	357.22823*	150.781*	30.443786*
Overall			
Gov't Expenditure:			
1st year	-1.384703*	0.538606**	-0.92439**
2nd year	-2.855224*	1.157613*	-2.294637*
3rd year	-5.277162*	1.595492*	-4.1004*
5th year	-12.59612*	1.785653*	-7.930897*
10th year	-27.52998*	0.849576**	-11.11372*
20th year	-27.21715*	0.163206**	-7.24262*
Economic Growth:			
1st year	4.96875*	7.488368*	-20.583293*
2nd year	33.040287*	15.732884*	-38.005772*
3rd year	54.37861*	37.687356*	-46.542791*
5th year	68.59872*	77.83992*	-49.768249*
10th year	47.493858*	94.01911*	-45.586198*

20th year	46.443789*	89.27456*	-45.99861*

Note: *, ** represent 90 and 95 percent confidence interval (10 and 5 percent significance levels respectively) of IRFs (difference in IRFs) that do not lie on zero

Table A3 reveals the cumulative differences between small and large government expenditure and economic growth responses to a unit positive BDI shock. In the short run for Europe, expansion in total and capital expenditure due to unexpected rise in BDI is of significantly higher magnitude than that of current expenditure. In the medium to long run, total expenditure accelerates at a significantly much larger scale than large and small current and capital expenditures. For economic growth, total expenditure experiences the most effect in the short to medium term but by the long run, capital expenditure bears the brunt of the shock effects.

Meanwhile, Asia's short run indicates that the responses of current and capital expenditure due to unforeseen increase in BDI is significantly greater than total expenditure. In the medium to long run, total expenditure accelerates at a much bigger magnitude, followed by capital and eventually current government expenditure. Similarly, economic growth responds greatest to capital expenditure in the first year but by the long run, total and current expenditures receive significantly larger volume of changes in response to BDI shocks.

Furthermore, Africa's short run implies that cumulative differences for total and current expenditure is significantly higher than that of capital spending in the short run. However, total spending bears greater responses to BDI shocks in the long run. As for output levels, current and capital spending initially have greater significant responses than total expenditure but by the long term, total and capital expenditures receive the most effects of BDI shocks.

Furthermore, North America's short run indicates that accumulated differences for total and capital expenditure is significantly higher than that of current spending from the short to medium term of government size and growth levels. This also applies for South America although current and total expenditure takes the majority of effects on output and government size in the immediate periods. Notwithstanding, by the long run, total and current spending has greater responses to BDI shocks than capital expenditures while for economic growth of Northern and Southern America, current and capital spending significantly exceeds total expenditure.

In the case of Australia, total and current expenditure mostly have the largest significant differential responses of government size and economic growth from the short to long run. For the aggregation of countries irrespective of continents, total and capital expenditure significantly had the most influence on government size while current spending contributed most to economic growth in response to BDI shock.

Appendix III: Impulse Responses Total Expenditure:

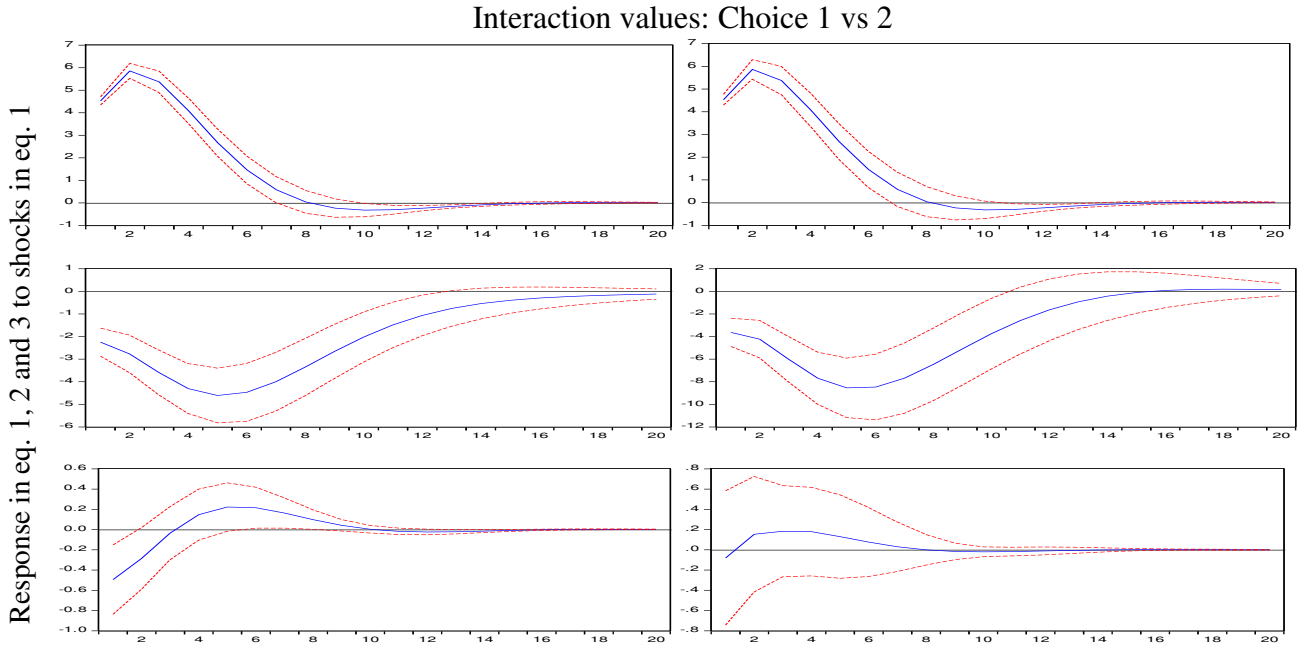


Figure A2. Impulse Responses of Government Total Spending and Economic Growth to one standard deviation broad dollar shock (rows) at different levels of government spending to GDP ratios (columns): G/Y equals 30 and 70 percent. Horizontal axes reflect years after shocks and vertical axes represent percentage responses.

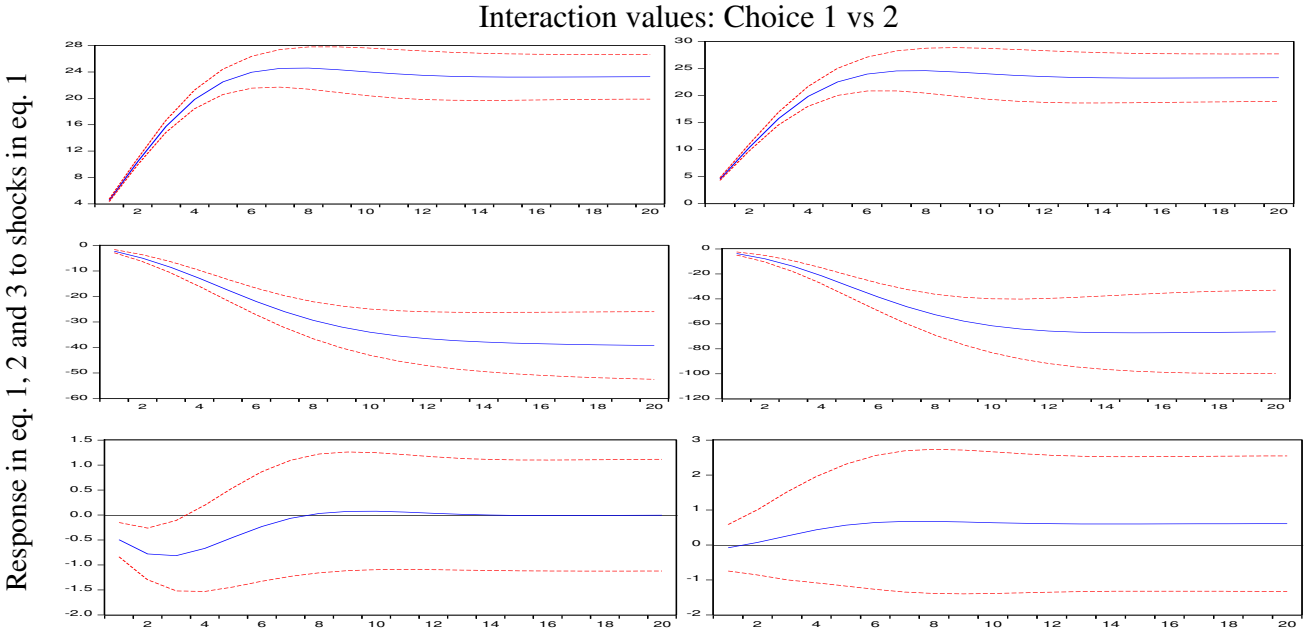


Figure A3. Cumulative Impulse Responses of Government Total Spending and Economic Growth to one standard deviation broad dollar shock (rows) at different levels of government spending to GDP ratios (columns): G/Y equals 30 and 70 percent. Horizontal axes reflect years after shocks and vertical axes represent percentage responses.

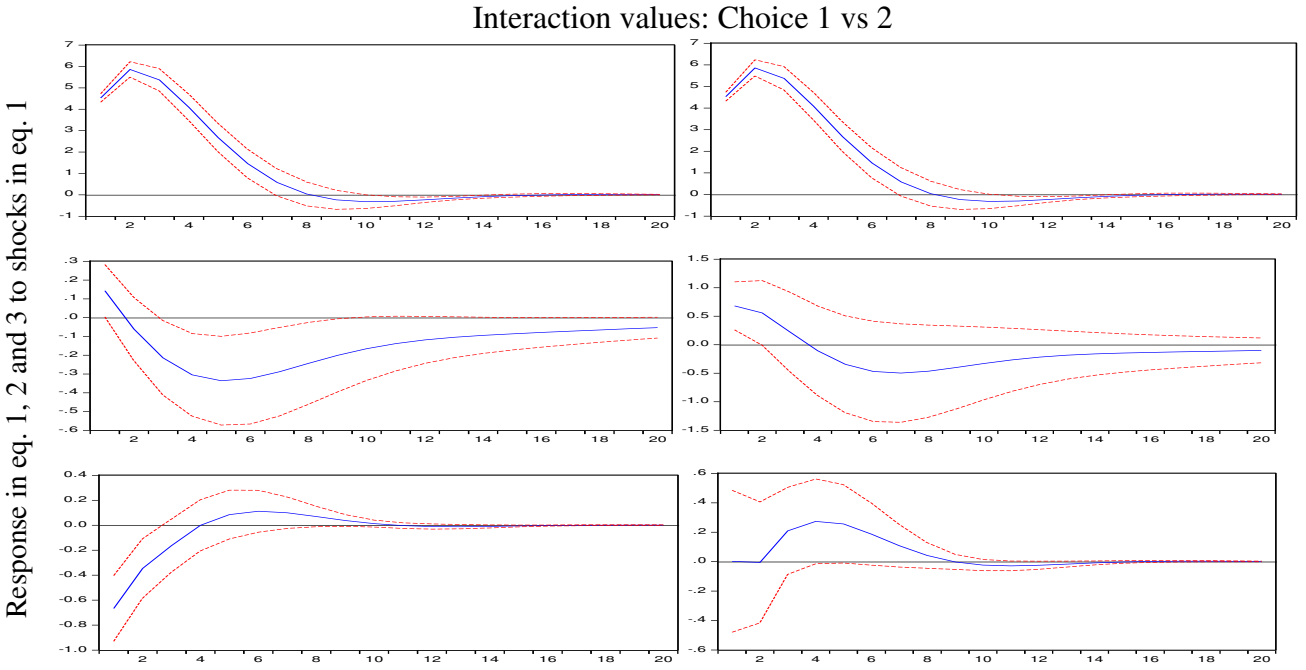


Figure A4. Impulse Responses of Government current spending and economic growth to one standard deviation broad dollar shock (rows) at different levels of government spending to GDP ratios (columns): G/Y equals 30 and 70 percent. Horizontal axes reflect years after shocks and vertical axes represent percentage responses.

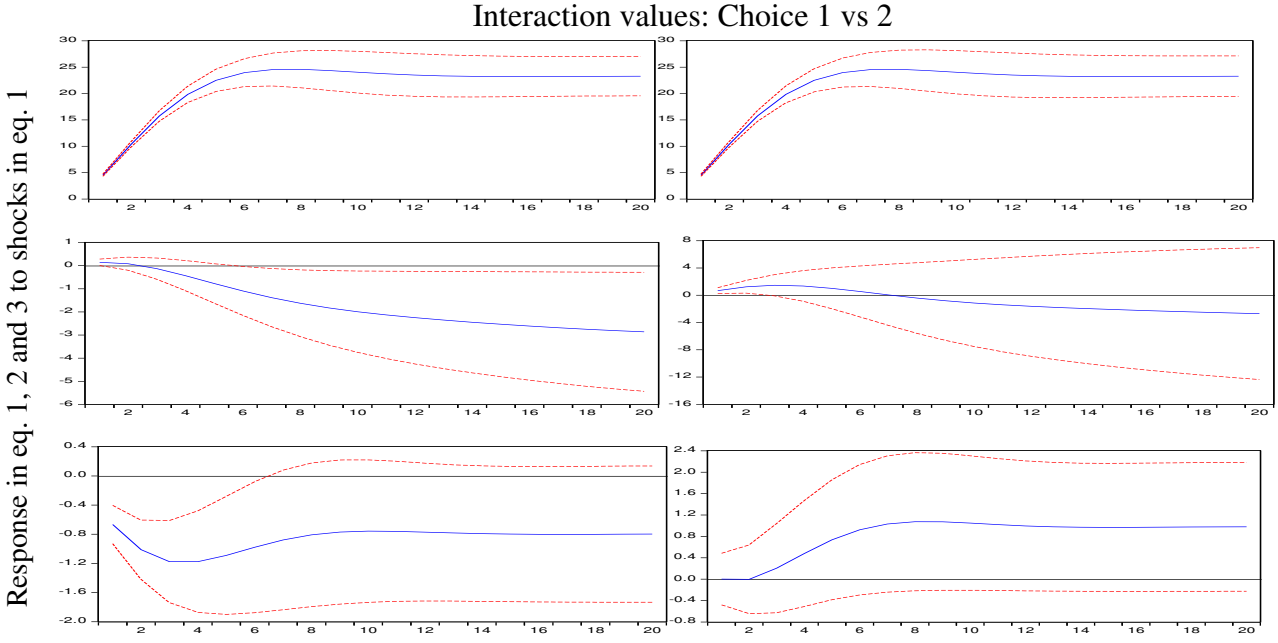


Figure A5. Cumulative Impulse Responses of Government current spending and economic growth to one standard deviation broad dollar shock (rows) at different levels of government spending to GDP ratios (columns): G/Y equals 30 and 70 percent. Horizontal axes reflect years after shocks and vertical axes represent percentage responses.

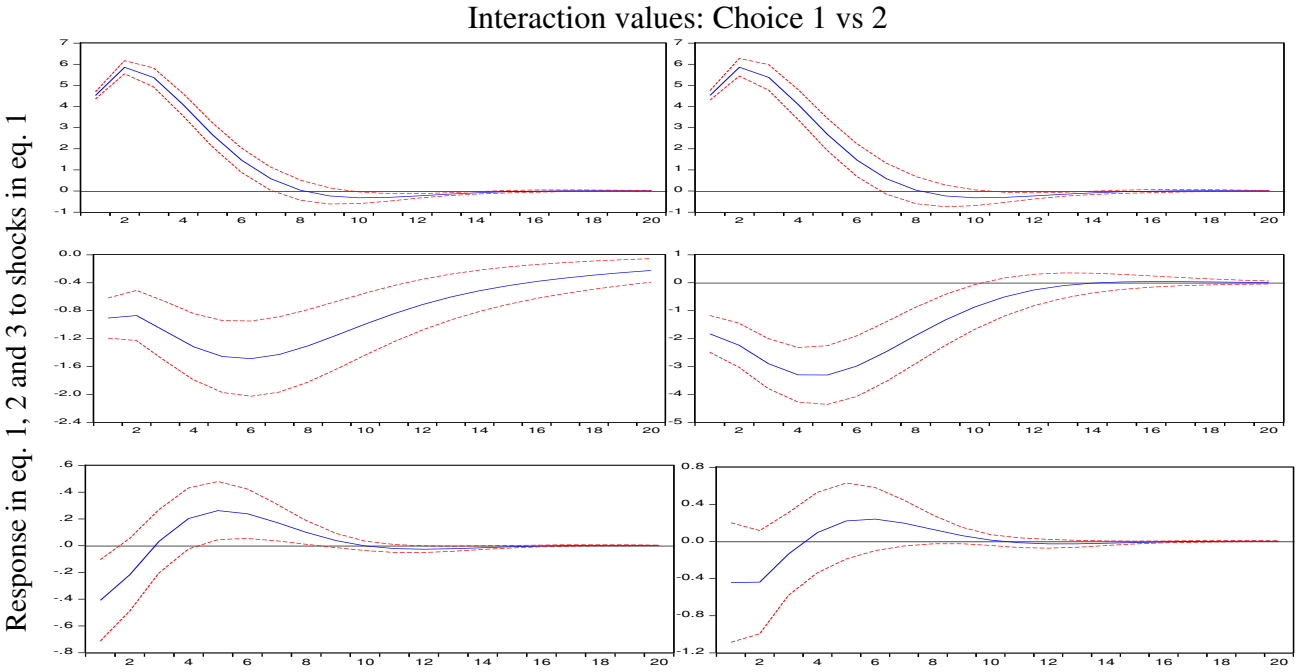


Figure A6. Impulse Responses of Government capital spending and economic growth to one standard deviation broad dollar shock (rows) at different levels of government spending to GDP ratios (columns): G/Y equals 30 and 70 percent. Horizontal axes reflect years after shocks and vertical axes represent percentage responses.

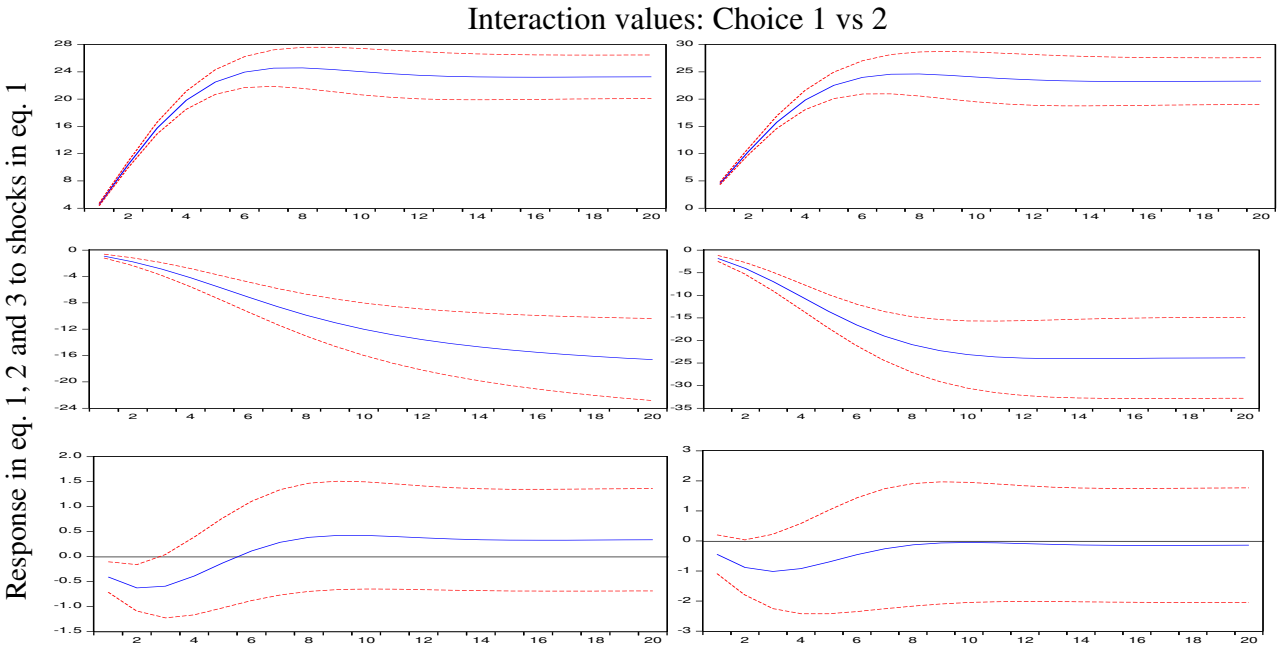


Figure A7. Cumulative Impulse Responses of Government capital spending and economic Growth to one standard deviation broad dollar shock (rows) at different levels of government spending to GDP ratios (columns): G/Y equals 30 and 70 percent. Horizontal axes reflect years after shocks and vertical axes represent percentage responses.