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0.1 Abstract

Does foreign aid work or not? This question is as old as aid itself. Since the aftermath of the Marshall Plan of 1948, the world has seen a huge surge in the amount of foreign aid given to developing countries. Although foreign aid is one of the key policy tools at the disposal of high-income countries to assist low- and middle-income countries, geared toward the alleviation of poverty. However, there is much controversy surrounding the allocation and effectiveness of foreign aid.

This thesis revisits the debate on the effectiveness of foreign aid in enhancing economic growth in the recipient country, and it also estimates the size of both the aid and fiscal multipliers in Sub-Saharan Africa (SSA). Recently, the SSA has received more foreign aid than any other region worldwide, which indicates the need to understand the macroeconomic and institutional factors that influence the effectiveness of foreign aid and the size of both the aid and fiscal multipliers in this region.

Chapter 1 of this thesis focuses on the impact of aid on growth in developing countries. Chapters 2 and 3 estimate the size of both aid and government spending multipliers in the SSA, using a linear and nonlinear model, respectively.

Chapter 1 seeks to answer the question of what is the effect of foreign aid on growth in developing countries. However, this chapter gives a detailed review of the foreign aid literature by first looking at the factors that determine the allocation of foreign aid by donors and then looking at the effects of aid on growth with respect to the key factors that determine the allocation of foreign aid.

Adopting the so-called "kitchen-sink" technique as in Wooldridge (2004), this chapter studies the impact of foreign aid on economic growth from a macro-counterfactual perspective. Specifically, our control function technique follows the "Coppola et al. (2018)" approach.

We perform first- and second-stage regressions to assess the impact of aid on growth in 38

developing countries. In the first stage, we run regressions explaining how and why foreign aid is allocated across countries within our study sample, while in the second stage, we use the significant variables from the first stage to assess whether foreign aid has any impact on growth in our study sample. We found that measures of poverty alleviation, political factors, policy quality, social policy, and macroeconomic indicators are the main factors that influence aid allocation. On the impact of aid on growth, we found that multilateral aid (both from the World Bank (WB) and OECD database) has a significant positive effect on short-term growth in developing countries. Furthermore, for the SSA sub-sample, our results also show a significant positive relationship between aid and growth in the short term. These results satisfy the conditions necessary for the "kitchen-sink" approach, and we had good diagnostics tests for our various specifications.

Chapter 2 estimates the size of both the aid and government spending multipliers in SSA using a linear model. Although there exist some studies in this literature that estimate the size of fiscal multipliers in low-income countries (LICs), however, to our knowledge, this chapter is the only one that seeks to discern the state-specific heterogeneity on the size of both aid and government spending multipliers across 30 SSA countries.

Using the Bayesian panel VAR model with cross-sectional heterogeneity for 23 SSA countries from 1983 to 2017, with shocks to both aid and government consumption identified through the generalized impulse response function (GIRF). For the baseline specification we found that: (i) Consistent with the aid-growth literature, an unexpected aid shock has an overall positive effect on GDP, government consumption, and investment in the SSA. Aid multipliers are higher in the medium term; (ii) As expected, we saw that an unexpected government spending shock also leads to a positive impact on aid, GDP, and investment in the SSA both in the short and medium term, thus suggesting that the demand effect is taking place; (iii) We found robust aid and government spending multipliers ranging from [-0.64, 2.72] and [-0.38, 4.56], respectively.

These results show that there exists much heterogeneity in SSA countries, thus, indicating

that the effects of both aid and government consumption shock are mainly based on some country characteristics. Overall, these results are robust to changing the sample size, the lag structure to two years, the time period, and to adding the US exogenous variable to the baseline specification.

Chapter 3 estimates the size of both the aid and government spending multipliers in SSA using a nonlinear model. Thus, this chapter seeks to investigate the nonlinearity that influences the size of both aid and government spending multipliers at different levels of financial openness, and trade openness in SSA. Therefore, the chapter seeks to answer the following questions; What is the size of the government spending and aid multipliers in the SSA? To what extent does the degree of financial openness and trade openness influence the size of the aid and government spending multiplier in SSA?

To capture the dynamic relationship that exists between government spending, aid, and other macroeconomic indicators (that is, total investment, trade openness, financial openness, and GDP), we use an interacted panel vector autoregressive model (IPVAR-X), as in Sá et al. (2014), and Di Serio et al. (2020). This empirical methodology is adopted in this study because it allows us to evaluate the reactions of both aid and government spending at different levels of financial openness and trade openness. In the same setup, we are able to evaluate all the combinations chosen for our interaction terms without the need to restrict the sample. This is especially important in light of the available SSA data.

Overall, we found that an unexpected shock to either aid or government spending has a positive effect on output and investment in SSA. Thus, with respect to the interaction terms considered, we found both aid and government spending multipliers are higher when the economy is financially open, and has low trade openness in the short-term (years 1 and 2), with multipliers ranging from [0.1-0.8] and [0.3-1.7], respectively. These results are consistent with those found in the aid fiscal behavior literature and the predictions of the traditional Mundell-Fleming model. Thus, we confirm that aid serves as additional funding for government spending in SSA.

To my late uncle Abdou Jammeh (may Allah the Almighty have Mercy on him and grant him Jannatul-Firdaws).

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Contents

Chapter 1

A Counter-Factual Analysis on the Impact of Foreign Aid on Economic Growth

1.1 Introduction

The foreign aid literature continues to be plagued with the absence of robust conclusive findings on the effects of aid on growth, and there is still no concession in this literature on adage questions like when, how, and where is aid most effective? What are some of the economic, social, political, and geopolitical factors that determine and/or influence the allocation and effectiveness of foreign aid in various countries with respect to the various donors (i.e., bilateral and multilateral donors)? What are the most effective empirical techniques to evaluate the impact of aid, of course, with respect to the endogeneity of aid? Although there is no doubt that the USA-sponsored Marshall Plan of 1948, wherein they provided financial support for the reconstruction of Europe, which was severely destroyed by the fury of the Second World War was effective, Moyo (2009). Since the Marshall Plan of 1948, there has been an overwhelming increase in the volume of aid that was given to poor underdeveloped countries by various donors. Therefore, in their seminal paper, Dollar et al. (2000) use a new database from the World Bank on foreign aid to examine the relationships between foreign

aid, economic policy, and growth of per capita GDP, however, they found that aid has a positive impact on growth in developing countries with good fiscal, monetary and trade policies, but has little effect in the presence of poor policies. Collier and Dollar (2002) use the World Bank Country Policy and Institutional Assessment (CPIA) as a measure of policy quality and show that aid can promote economic growth and reduce poverty in recipient countries if the quality of their policies is sufficiently high.

In this paper, we study the impact of foreign aid on economic growth from a macroeconomic perspective, which explores the counterfactual approach to studying the impact of aid on growth, which has been neglected in the foreign aid literature. Although, there are some papers in this literature that investigate the impact of aid on growth from a macro counterfactual approach (see Dreher and Langlotz (2020), and Arndt et al. (2015)). However, none of these studies adopted the so-called "kitchen-sink" technique as in Heckman and Hotz (1989), and Wooldridge (2004), this approach deals with the endogeneity problem of aid by using selection on observable, as opposed to selection on unobservable. The main novelty of this paper is our adoption of the Kitchen Sink technique for studying the impact of aid on growth, following the "Coppola et al. (2018)" approach, which studies EU funds by looking at it from a macro-counterfactual perspective. Here, we run first- and second-stage regressions to assess the impact of aid on growth in 38 developing countries. In the first stage, we run regressions explaining how and why foreign aid is allocated across countries within our study sample, while in the second stage, we use the significant variables from the first stage to assess whether foreign aid has any impact on growth in our study sample. Another novelty of this study is that, to our knowledge, this paper is the only one that simultaneously investigates the determinants of aid allocation and uses those significant determinants of aid allocation to investigate the impact of aid on growth. This paper also adds to the aid-growth literature by looking at the factors that influence donor aid-allocation decisions, and to what extent aid impact growth for the SSA sub-sample (i.e., this sub-sample includes 18 SSA countries for which we have data on). Given the fact that the SSA receives more aid

than any other region globally and is still considered the poorest region on the globe, thus the justification to zoom in on the SSA sub-sample and investigate how aid impact growth in this region. For the purpose of robustness, we did another estimation of the second-stage specification using the inverse propensity weighting (ipw) technique similar to those in the following studies (Glynn and Quinn (2010), Jordà and Taylor (2016), Blackwell and Glynn (2018), and Naimi et al. (2014)).

We found a robust specification for the allocation of aid; this was obtained after performing estimations with various specifications. Thus, using this preferred robust specification, we found that measures of poverty alleviation, political factors, policy quality, social policy, and macroeconomic indicators as the main factors that influence the allocation of aid. On the impact of aid on growth, we found that multilateral aid (both ODA [1] and OECD [2]) has a positive statistically significant effect on short-term growth in developing countries. Furthermore, our results are even more statistically significant for our SSA sub-sample. These results satisfy the conditions necessary for the "kitchen sink" approach, and we had good diagnostics tests for our various specifications. Moreover, these results are confirmed by our estimations using the IPW technique for the entire study sample and the SSA sub-sample.

The remaining sections of this paper are organized as follows: The second section focuses on reviewing the existing literature; the third section is focused on the data, variables & methodology, whiles the fourth section looks at the main results; and the fifth section is the final part, which also serves as the concluding section of this chapter.

1.2 Literature Review

Since the Second World War, the world at large and developing countries, in particular, have seen an unprecedented increase in the amount of foreign aid received from OECD countries and other non-OECD countries. Foreign aid is considered one of the main policy

[1] Official Development Assistance (ODA), world bank database
[2] OECD DAC2a database

tools at the disposal of the developed world to help their underdeveloped counterparts in different regions of the world. Thus, the need for economists and other social scientists to have a robust theoretical and empirical understanding of its dynamics, to henceforth better inform governments and policymakers.

As mentioned above, the Marshall Plan of 1948, by the US to support Europe after the Second World War, has seen great success, which to some extent leads to a great confidence among governments and policymakers, to believe that foreign aid is, of course, one of the most effective approaches to alleviating poverty around the world. In this brief review of the foreign aid literature, we adopt the Alesina and Dollar (2000)'s approach of classifying the studies on foreign aid into the following two parts: One part studies the key determinants of foreign aid (i.e., donor motives), while the other part focuses on the impact of foreign aid on growth in the receiving countries (i.e. the impact of foreign aid).

1.2.1 The Determinants of Foreign Aid (i.e., Donor Motives)

Schraeder et al. (1998) argued that the ongoing debate on foreign aid regimes remains trapped in some sort of an intellectual vacuum, due to the lack of scholarly understanding of the determinants of the various foreign aid programs. In their paper on "Clarifying the Foreign Aid Puzzle", with a particular focus on African countries, their results clearly reject the assertion that foreign aid serves as an altruistic tool for foreign policy. They also found that donor motives, with respect to different donors, matter with respect to the following: their position in the world order, strategic interest, and relationship with former colonies.

Maizels and Nissanke (1984), in their paper "Motivations for Aid to Developing Countries", which is considered one of the pioneering works on the determinants of aid. They study the allocation of aid from the principal bilateral donors and multilateral aid agencies to recipient countries, using cross-country multiple regressions for two periods, 1969-1970 and 1978-1980, using alternative recipient needs and donor interest models. Their results reiterate previous studies that bilateral aid allocations are made largely in support of donors' perceived foreign

economic, political, and security interests. While, on the other hand, aid flows from multilateral sources, as expected, are allocated essentially on recipient need criteria.

Alesina and Dollar (2000), in their paper on "Who Gives Foreign Aid to Whom and Why?" Where they focused on the allocation of bilateral aid, they studied the pattern of the allocation of foreign aid from various donors to receiving countries. They found that to a great extent, the direction of foreign aid is influenced as much by political and strategic factors as by the economic needs and policy performance of the recipients. Colonial past and political alliances were also found to be major determinants of foreign aid. Furthermore, they also found that countries that democratize receive more aid, ceteris paribus. In the same vein, Dollar et al. (2000), using different regression specifications, asked whether donor governments and traditional aid agencies allocate more aid to countries with good policies. Thus, they found that the quality of policy has little impact on the allocation of aid. Alesina and Weder (2002), in their paper on "Do Corrupt Governments Receive Less Foreign Aid?" They found a negative answer to this question. In particular, they found that more corrupt governments receive as much foreign aid as less corrupt governments, the United States government gives more aid to more corrupt governments, thus, the level of aid a country receives tends to increase corruption in the long run. In addition, they found a 'voracity effect' of foreign aid.

Chong and Gradstein (2008), in their paper on "What determines foreign aid? The donors' perspective." They study the factors affecting the support for foreign aid among voters in donor countries, which they argued has been neglected in the foreign aid literature. They found that individual satisfaction with their own government performance and their relative income are positively related to the willingness to provide foreign aid. Moreover, when they used actual donor country data, they found that aid is negatively affected by its own government's inefficiency. Berthélemy (2006), argued that aggregating donors is valid only under the assumption that all donors behave the same, which seems to be false. Thus, he

studied the different behavior of donors, using a three-dimensional panel dataset, combining donor, recipient, and time dimensions, indicating a lot of heterogeneity in donor behavior. However, he found that most donors behave in an egoistic way: except for one donor, all other donors partially target their assistance to their most important trading partners. However, most donors give some support to the neediest recipient countries. Furthermore, on average, donors target recipients with better governance indicators, such as democracy or the absence of violent conflicts. In essence, he found that bilateral aid serves as a complement to multilateral financial institutions.

Kilby and Dreher (2010), in their paper on "The impact of aid on growth revisited: Do donor motives matter?" examines the homogeneity assumption (i.e., that donor motives do not influence aid effectiveness) by developing an aid allocation model in which recipient government policy choices link donor motives to the impact of aid. They test this assumption by including an estimate of need-based aid in a cross-country time-series growth regression. However, their test rejects the homogeneity assumption, which, to some extent, should make us more cautious in the interpretation of past research results. They construct their measure of need-based aid, for the thirteen largest bilateral aid donors using annual data on aid flows to 117 countries for the period 1974–2001.

Hoeffler and Outram (2011), study the allocation of foreign aid, in their analysis, they allowed for the donor as well as recipient-specific effects. Using a sample of 22 Development Assistance Committee (DAC) donors and 168 recipient countries, from 1980 to 2004. Adopting the Alesina and Dollar (2000)'s estimation approach, they found strong evidence that donors act out of their self-interest, as expected. However, they also found that unobserved recipient effects matter in the allocation of aid (i.e., some country fixed effects can scale up allocation by a factor of 100), which they believe indicates our shallow understanding of donor motives.

1.2.2 The Impact of Foreign Aid

The ongoing debate on whether aid works or not is as old as aid itself, and up to recent times, there is still no agreed-upon finding with regard to the effect of foreign aid. Although in the foreign aid literature, there exist many different findings (i.e. positive, negative, and no impact) with regard to the impact of foreign aid on growth. In addition, the cross-country study of the impact of foreign aid on growth to a great extent focuses on specific conditions with respect to the aid-growth relationship. Dollar et al. (2000), study the effect of aid on growth, conditional on economic policy, using a panel of 56 developing countries from 1970-1993 for six four-year time periods. They found that to some extent, aid has a positive effect on growth in developing countries with good policies. Hansen and Tarp (2001), in a panel framework, studied the aid-growth relationship and found that aid increases the growth rate, this result is not conditional on 'good' policy, but they also found that the estimated impact of aid is highly responsive to the choice of the estimator and the set of control variables considered. Using both theoretical and empirical analysis, Dalgaard et al. (2004), study the impact of aid conditional on a country's location (i.e. geography), overall they found that aid has been effective in increasing growth, but the size of the effect depends on climate-related circumstances. In their paper "Aid and Growth: What does cross-country evidence really show?" Rajan and Subramanian (2008), study all developing countries that received aid during the postwar period for which data are available, using a valid instrument, and found that there is no robust positive effect of aid on growth.

Werker et al. (2009), study the impact of transfers from wealthy OPEC nations to their poorer Muslim allies, using oil price fluctuations. They considered all non-oil producing developing countries from 1960-2003. They found that Foreign Aid affects most components of GDP, but it has no statistically significant impact on prices or economic growth. Adopting the same estimation technique and study sample as that of Rajan and Subramanian (2008), Arndt et al. (2015), used an extended dataset from 1970-2007, they did not find aid to be harmful to growth, rather, they found aid has enhanced structural change, reduced poverty,

and stimulated growth. Thus, this leads to questioning the findings of Rajan and Subramanian (2008) and also to be somewhat skeptical of the empirical findings on the aid-growth nexus. Concerning the endogeneity of aid, Clemens et al. (2012) argued that there exist no valid instruments for foreign aid, and thus they did their estimations solely based on OLS, with lagged aid and country-fixed effects. They find that a one-percentage point increase in aid / GDP leads to a 0.3 to 0.5 percentage point increase in investment / GDP and a 0.1 to 0.2 percentage point increase in the GDP/capita growth rate.

In dealing with the endogeneity of aid in growth models, Galiani et al. (2017) used "income threshold" (which is set by IDA) [3]. Their sample comprised 35 countries that crossed the IDA income threshold from below between 1987-2010. They found that a sudden reduction in aid after crossing the IDA threshold has a significant negative effect on growth. Thus, reducing the aid-GNI ratio by one percentage point from its average value at the time of crossing decreases the real per capita GDP growth by approximately 0.35 percentage points. In general, their results indicate that foreign aid increases economic growth among poor countries where aid is a considerable source of funding. However, Dreher and Langlotz (2020) uses an excludable instrument (i.e., donor government fractionalization) to test the effect of bilateral aid on economic growth using a sample of 97 recipient countries over the 1974–2013 period. They nuanced the work of Galiani et al. (2017), and other works that relied on IV, arguing that the previous studies using IV did not satisfy the exclusive restriction condition for a valid instrument. Thus they found a positive but insignificant effect of aid on growth.

In the midst of the ongoing aid effectiveness debate, there exists another strand of research in the literature, that aid has a positive impact on economic growth but with diminishing returns. Which they argue is mainly due to the fact that foreign aid improves economic growth up to a certain threshold but, beyond which its impact starts to decline (e.g. Hansen and Tarp (2000), Hansen and Tarp (2001); Lensink and White (2001); Wagner (2014); Harb and Hall (2019)). However, Yahyaoui and Bouchoucha (2020), studied a sample of 48 African

[3] the International Development Association (IDA), the World Bank's grant and concessional loan program for low-income countries)

countries for the period 1996–2014, using OLS, FMOLS (fully modified OLS), and SGMM (system GMM) models. They found aid to be ineffective in terms of growth and with increasing returns. In addition, they found that good institutions promote the effectiveness of aid. Roodman (2007) and Easterly et al. (2004), nuanced the cross-country findings of the seminal paper by Dollar et al. (2000). In particular, using the same empirical specification as that of Dollar et al. (2000), but with a longer sample, these authors found that the results in Dollar et al. (2000), are very fragile and in general, Roodman (2007), found that most of the earlier empirical studies on the aid-growth nexus also suffer from this problem.

From the above review of the existing aid literature, it could be clearly seen that little or no study has been devoted to the study of aid from a macro-counterfactual perspective. It is also noted from the literature that; the selection bias of aid allocation has not been rigorously addressed. Although there have been previous studies on key determinants of aid to developing countries (i.e., these studies are mainly based on outdated data), no recent study has focused exclusively on the key determinants of aid to the SSA, which is currently the highest aid recipient region globally. Furthermore, it can be seen that no previous study aims to simultaneously study the determinants of aid (that is, donor motives) and the impact of aid on growth, by assessing how the former influences the latter. Since unemployment is at an all-time high level in most developing countries, the SSA is not an exception. Therefore, from the survey of the literature highlighted above, there have been no studies exploring the impact of aid on employment in recipient countries.

In light of the above concerns, this study seeks to add to the existing aid-growth literature, by studying the impact of aid on growth from a macro-counterfactual perspective, which allows us to address the issue of selection bias of aid. The study also focused on the key determinants of aid allocation to the SSA, using recently available data. It also simultaneously studies the key determinants of aid and the effect of aid on growth, by using the former to assess the effectiveness of the latter, which is done by adopting the Coppola et al. (2018) approach. This estimation technique is as well used in this study to give a rigorous

treatment of the selection bias of aid allocation policy. Furthermore, our study adds to the existing aid-growth literature, by exclusively discerning the effect of aid on unemployment for the SSA sub-sample and how this promotes economic growth in this region.

1.3 Methodology and Data

1.3.1 Methodology

In this paper we seek to discern the subtle relationship between aid (i.e., Official Development Assistance (ODA)) and growth (measured by GDP per capita), using the Coppola et al. (2018) empirical approach, who developed a fixed-effect dynamic panel analysis of the allocation mechanisms of European (and national) funds across Italian regions. This, they argue, was the foundation for their novel assessment of the impact of regional policies on GDP per capita, which also helped them to address the fund allocation policy selection bias through a control-function approach. Thus, in order to address these issues, we adopt their panel specification for a GDP growth equation:

$$\begin{aligned} D.y_{it} &= a_1 y_{it-1} + a_{2j} Aid_{jit} + a_3 gfi_{it} + a_4 fdi_{it} + \\ & a_5 D.pop_{it} + a_{6j} W_{it-1} + a_i + a_t \end{aligned} \tag{1.1}$$

Where $i = 1, ...38$ refers to countries, $t = 1, ...n$ refers to years, and $j = 1, ...m$ refers to the type of aid being considered; variables a_i and a_t are, country and year fixed effects, respectively. The dependent variable $D.y_{it}$ is the (natural logarithmic) variation of GDP per capita; y_{it-1} is the lagged dependent variable, which allows for the dynamic structure inherent in the data; Aid_{jit} refers to the aid (ODA) (whose types are indexed by j) spent in a country. Equation (1.1) is compatible with both Solow's neoclassical approach and with other growth models (see, Puigcerver-Peñalver et al. (2007)).

It also includes gfi_{it}, the (log of the) gross private investment per capita; $D.pop_{it}$, the

(log) variation of population and fdi_{it} is the (log) of foreign direct investment per capita. [4] While the vector W_{it-1} [5] includes variables that determine the allocation of aid (i.e., donor motives), such as; conflict, democracy, corruption, infant mortality rate, unemployment, etc. Thus, W_{it-1} represents our control function, and as well serves as our counterfactual, equation (1.1) is in conformity with Wooldridge (2004). Who shows that such an equation can consistently estimate the average partial effect (i.e., the average treatment effect) of the policy on the response, given that aid is a continuous variable, has a good functional form, absence of serial correlation for residuals, and are a linear homoskedastic function of W_{it-1} and X_{it} (the latter being the vector of other regressors in equation (1.1)).

This regression framework allows us to deal with the argument that the effectiveness of aid is conditional on good policy, as in Dollar et al. (2000). To this goal, we control for country differences in factors included in X_{it}, geared towards assessing the impact of national policies. Thus, to achieve this, we estimate a variant of equation (1.1), which is as follows:

$$\begin{aligned} D.y_{it} &= a_1 y_{it-1} + a_{2j} Aid_{jit} + a_{3'j} q_i Aid_{jit} + a_4 gfi_{it} + \\ & a_5 fdi_{it} + a_6 D.pop_{it} + a_{7j} W_{it-1} + a_i + a_t \end{aligned} \tag{1.2}$$

where the interaction term between q_i and aid allows for the assessment of the impact of policy quality on the aid-growth nexus in the respective countries within our sample. We use the following variables from the World Bank, World governance indicator (WB GDI); (Political stability and absence of violence/terrorism, Government effectiveness, Economic freedom, and rule of law),[6] as our measures of policy quality.

Thus, given our dynamic panel specifications described above, we explored various lags of aid (i.e., both ODA and OECD), variation in population, and found that our preferred spec-

[4] All flows (i.e., $D.y_{it}$, Aid_{jit}, fdi_{it} and gfi_{it}) are taken in per capita terms at constant prices.

[5] For the purpose of restricting W_{it-1} to only the set of relevant variables, we estimate an auxiliary regression in which aid is a function of all potential W_{it-1} and select a parsimonious specification consistent with good diagnostics. We use lagged values of W to avoid some potential endogeneity problems and because we find that the best fit for our model is achieved with the one-year lagged values.

[6] See, Appendix A, Table A.0.1 for the definition of these variables.

ification[7] for equation (1.1) is the one-year lag of the following variables: trade, mortality, total schooling, agricultural value added, political stability, and property rights. This specification satisfies all the conditions required for the adoption of the 'kitchen sink' technique, we use this specification in the 2nd-stage to assess the impact of aid on growth as well. We use a generalized least squares regression approach that allows for cross-section dependence in our model. As required by the CFA, we did diagnostic tests for autocorrelation, omitted variable bias, and heteroskedasticity, which shows that our model is free from both autocorrelation and omitted variable bias but suffers from heteroskedasticity. However, we dealt with the presence of heteroskedasticity in our model by following the technique suggested by Thursby (1982), since our model has good diagnostic tests (i.e., based on the absence of both autocorrelation and omitted variable), Thursby (1982) argues that in such models heteroskedasticity only affects the error terms and not our parameters of interest and is not due to misspecification of our model.

However, for the entire study sample the RESET test is not very good, which could be due to the huge heterogeneity in the entire study sample. But we observe that our RESET test for the SSA sub-sample is quite good, due to the less heterogeneity in the SSA sub-sample.

The aid data (i.e., both ODA and OECD) tends to be too noisy, thus we constructed country dummies for some of the countries in our sample that have aid values that are quite abnormal. We constructed country dummies for the following countries: Botswana, Cameroon, Congo, Rep., Congo, Rep., Congo, Dem. Rep., Congo, Dem. Rep., Egypt, Arab Rep., Gabon, Mauritius, Panama, Philippines, and Sri Lanka. These country dummies are included in the first-stage estimations, for the second-stage estimations, we included only country dummies that were statistically significant from the first-stage estimations. However,

[7]We selected our preferred specification to obtain the set of relevant Wit-1 variables by using a stepwise regression procedure. First, we considered a wide range of potential determinants of aid allocation, such as lagged values of GDP per capita, gross fixed investment, unemployment rate, trade, FDI, primary school enrolment, total schooling, agriculture value added, political and institutional variables, among others, and both ODA and OECD aid. We then eliminated the variables that were not significant or had the wrong sign and checked the diagnostics of the resulting specification. We repeated this process until we obtained a satisfactory model that had a good fit and consistent diagnostics. We did this procedure separately for ODA and OECD aid.

these country dummies are seldom significant in the second-stage estimations, thus we did not present them in our regression results.

1.3.2 Data

We conduct our empirical analysis using panel data of 38 developing countries, from 1996-2018, this sample is a complete representation of the under-developed world. The selection of our final sample is based on the availability of data, moreover, due to data unavailability, we had to drop almost 15 countries from our original study sample. Although we drop about 15 countries from our original study sample, we still argue that this does not bias our sample, since the dropping of countries was purely random, thus, these countries are heterogeneous, i.e., include both SSA, East Asia, and South American countries.

We take the OECD Development Assistance Committee (DAC)2a data on Aid (ODA) [8] disbursements to countries and regions as our aid variable, this is in conformity with the current literature. For robustness checks, we decided to also include the World Bank's World Development Indicators (WB WDI), Net official development assistance and official aid received (constant 2015 US$), Net official development assistance received (constant 2015 US$), and Net bilateral aid flows from DAC donors, Total (current US$) as additional aid variables. A prior, we expect a small significant positive relationship between our aid variable and growth.

The independent variables considered in this paper include, amongst others; GDP per capita (i.e., growth variable), GDP per capita, PPP (for robustness checks), Foreign direct investment, net inflows (% of GDP); Trade (% of GDP), School enrolment, primary (% gross); Mortality rate, infant (per 1,000 live births); Employment to population ratio, 15+, total (%); Unemployment total (% of total labour force), Population (total), Control of Corruption: Estimate, Political Stability, and Absence of Violence/Terrorism: Estimate, Government Effectiveness: Estimate, Rule of Law: Estimate, Polity, & Polity transition (democracy variable, will be used for further robustness checks), natural disaster, conflict,

[8] See, Appendix A, Table A.0.1 for the definition of these variables.

economic freedom, Corruption Perception Index (CPI), Democracy (Political Rights (PR)) & Civil Liberty (CL). As already highlighted in our methodology section, the Coppola et al. (2018) technique is highly sensitive to the number of explanatory variables used. Thus, for our results to be robust, we need as many explanatory variables as possible in our first-stage regression (i.e., determinants of aid-allocation decision). Notwithstanding, all the explanatory variables included in this study are based on what we have reviewed from the existing literature.

1.4 Main Results

We now present the results we obtain from our regression framework. First, we present the results from the first-stage estimations. Based on Tables 1 and 2, for both types of aid (i.e., OECD and ODA), we found that on average a 1 percent change in lagged aid, decreases current aid by 0.73 and 0.66 percentage points for ODA and OECD aid respectively, and lagged GDP per capita negatively affects current aid. Agricultural value-added, property rights and trade are the main factors that influence donors' aid allocation decisions. As expected we found a negative relationship between aid and mortality, this is in line with Berthélemy (2006) (i.e., a one percent decrease in infant mortality rate, corresponds to a 0.008 percentage points increase in aid), as it is argued in this literature, this measure shows that donors do care about the recipient's needs. Our results clearly show that institutional variables (i.e., property rights and political stability), economic variables (i.e., trade), and social policy variables (i.e., mortality) influence donor aid allocation decisions.

These results are similar to those that we found for our sub-sample of 18 SSA countries, which clearly show that our results are robust to various specifications and samples. However, for our SSA sub-sample, we found that both the lagged variation in the population and the unemployment rate are key determinants in the donor aid allocation decision. As expected, we found that a 1% decrease in the unemployment rate is associated with a 0.0267 percentage point increase in OECD aid. We also found a positive relationship between the variation in

the SSA population and the amount of aid the region receives from multilateral donors (see Appendix B: SSA-Table 6). To our knowledge, these findings are novel as they expand our understanding of the determinants of aid to the SSA, which until now has been neglected in this literature.

Overall, we found measures of poverty, political factors, policy quality, social policy, and macroeconomic indicators as the main factors that influence the allocation of aid from donors to recipients. Our results nuance some of the findings in this literature that found donor self-interest variables as the main determinants of aid allocation to developing countries, as in Kilby and Dreher (2010), and Hoeffler and Outram (2011).

Table 1: First-Stage ODA, World Bank

	Dependent variable: ln(ODA to GDP) (first difference)				
lagged_Independent variable	(1)	(2)	(3)	(4)	(5)
oda_gdp	-0.736***	-0.731***	-0.739***	-0.741***	-0.753***
	(-21.02)	(-20.61)	(-21.13)	(-21.38)	(-21.73)
gdp_per capita	-0.789**	-0.806***	-0.994***	-1.269***	-1.263***
	(-3.19)	(-3.32)	(-3.85)	(-4.65)	(-4.70)
investment	-0.0174	-0.00326	-0.0321	-0.0467	
	(-0.49)	(-0.10)	(-0.91)	(-1.36)	
population	0.562	0.576	0.813*	0.580	0.649
	(1.42)	(1.44)	(1.98)	(1.35)	(1.55)
trade	0.0981				
	(0.73)				
total schooling		-0.113			-0.0438
		(-1.14)			(-0.89)
mortality		-0.00728**			-0.00683
		(-2.61)			(-1.67)
agric value added			-1.325**	-1.493***	-1.257**
			(-3.05)	(-3.47)	(-3.01)
autocratic				-0.00376	
				(-0.27)	
economic freedom				-0.0444	
				(-0.88)	
property rights				0.101**	0.105**
				(2.84)	(2.96)
political stability				0.0999*	0.0673
				(2.51)	(1.70)
trends	Yes	Yes	Yes	Yes	Yes
Observations	798	798	798	798	798

Note: *** p<0.01, ** p<0.05, * p<0.10.
The following are the p-values associated with our various diagnostics test:
abar , lags(1) Pr > z = 0.8151; ovtest, Prob > F = 0.0000; hettest, Prob > chi2 = 0.0000

Table 2: First-Stage OECD AID

	Dependent variable: ln(OECD to GDP) (first difference)				
lagged_Independent variable	(1)	(2)	(3)	(4)	(5)
oecd_gdp	-0.661***	-0.669***	-0.656***	-0.656***	-0.681***
	(-20.51)	(-20.82)	(-20.78)	(-20.90)	(-21.38)
gdp_per capita	-0.787**	-0.698**	-0.870***	-1.060***	-1.167***
	(-3.00)	(-2.98)	(-3.32)	(-3.88)	(-4.26)
investment	-0.0305	-0.00157	-0.0325	-0.0411	
	(-0.73)	(-0.04)	(-0.78)	(-0.98)	
population	0.674	0.599	0.736	0.612	0.730
	(1.53)	(1.47)	(1.65)	(1.38)	(1.66)
trade	0.268				0.355**
	(1.88)				(2.58)
total schoolin		-0.148			-0.0922
		(-1.56)			(-1.65)
mortality		-0.00837**			-0.00809*
		(-3.22)			(-2.10)
unemployment		-0.0114			-0.0185*
		(-1.43)			(-2.13)
agric value added			-1.056*	-1.130**	-0.858*
			(-2.51)	(-2.69)	(-2.11)
property rights				0.111**	0.122***
				(2.98)	(3.31)
political stability				0.0823*	0.0921*
				(2.07)	(2.23)
trends	Yes	Yes	Yes	Yes	Yes
Observations	798	798	798	798	798

Note: *** p<0.01, ** p<0.05, * p<0.10.
The following are the p-values associated with our various diagnostics test:
abar , lags(1) Pr > z = 0.5570; ovtest, Prob > F = 0.4068; hettest, Prob > chi2 = 0.0000

In Tables 3 and 4 we present the results for our second-stage estimations for both ODA and OECD aid, with the various control variables akin to a typical Solow growth model.

We found that lagged foreign aid has a positive significant impact on growth (GDP per capita (current)), thus on average an increase in lagged ODA and OECD aid by one percentage point of GDP leads to an increase in growth with a magnitude of 0.014 and 0.011 percentage points, respectively (as shown in Equation (2) of Tables 3 and 4). Thus, we argue that our findings are robust to specifications with either ODA or OECD aid, we also got the expected signs for both investment and variations in population as in a typical Solow growth model. These results are in-line with the strand of this literature that founds aid to have a positive significant impact on growth regardless of the policy quality of the recipient country (see, Hansen and Tarp (2001), Clemens et al. (2012), and Galiani et al. (2017)).

Moreover, as argued by Dollar et al. (2000), we interact aid with our measures of institutional quality, but found OECD aid to be only significant with our measure of educational attainment (i.e., aid interacted with total schooling (oecd-schooling), see equation (5) of Table 4). However, we found that the interaction terms between aid and our measures of freedom and political quality are insignificant (i.e., aid interacted with both property rights (oecd-property rights) and with political stability (oecd-political stability)). These results are contrary to those of Dollar et al. (2000) who found that ceteris-paribus aid is only significant in the presence of good institutions.

Our SSA sub-sample results are in-line with those of Hansen and Tarp (2001), and Galiani et al. (2017), we found that for the SSA both types of aid increase growth in the short-term with or without the presence of good policy quality. Therefore, confirming that the results with our entire study sample are robust. Thus, we found that on average an increase in lagged OECD aid by one percentage point of GDP leads to an increase in growth with a magnitude of 0.0379 percentage points (as shown in equation (2) of Table 8), similar results are obtained for ODA aid as well. However, this effect tends to disappear for both types of aid as we add more control variables to our core-specification, thus suggesting that even this

SSA sub-sample results are not very robust to various specifications and that they should be viewed with some degree of caution.

Using the inverse propensity weighting (ipw) for robustness test shows that our results with the kitchen-sink technique are robust. Thus, with the ipw we found that both types of aid have a positive effect on growth, however with statistically significant effects only for ODA aid (on average an increase in lagged ODA aid by one percentage point of GDP leads to an increase in growth with a magnitude of 0.003 percentage points (as shown in equation (2) of Table 9)). As opposed to the estimations using the kitchen-sink technique, the country dummies used in the ipw estimations were statistically significant for Panama as shown in Table 9.

Table 3: Second-Stage Official Development Assistance (ODA), World Bank

	Dependent variable: ln(GDP_per capita) (first difference)				
lagged_Independent variable	(1)	(2)	(3)	(4)	(5)
gdp_per capita	-0.235***	-0.214***	-0.254***	-0.248***	-0.232***
	(-11.20)	(-9.34)	(-11.72)	(-11.87)	(-11.06)
oda_gdp	0.000880	0.0144*	0.000351	0.000444	0.000618
	(0.76)	(2.33)	(0.32)	(0.41)	(0.50)
investment	0.0315***	0.0298***	0.0252***	0.0286***	0.0302***
	(6.14)	(5.77)	(4.76)	(5.50)	(5.89)
population	-0.0494	-0.0659*	-0.0508	-0.0495	-0.0479
	(-1.53)	(-2.00)	(-1.59)	(-1.52)	(-1.47)
Fitted values		0.0179*			
		(2.22)			
trade			0.0246*	0.0219*	
			(2.56)	(2.29)	
total schooling			0.00786*		
			(2.29)		
agric value added			-0.127***	-0.129***	
			(-3.49)	(-3.56)	
property rights			0.000827		
			(0.39)		
mortality				-0.000519	
				(-1.28)	
democracy				-0.000729	
				(-0.98)	
conflict				0.00249	
				(0.72)	
oda and property rights					0.00340
					(1.40)
oda and political stability					-0.00545
					(-1.74)
trends	Yes	Yes	Yes	Yes	Yes
Observations	798	798	798	798	798

Note: *** p<0.01, ** p<0.05, * p<0.10.
Equation (2) is our preferred specification
The following are the p-values associated with our various diagnostics test:
abar , lags(1) Pr > z = 0.0703; ovtest, Prob > F = 0.6002; hettest, Prob > chi2 = 0.0000

Table 4: Second-Stage OECD AID

	Dependent variable: ln(GDP_per capita) (first difference)				
lagged_Independent variable	(1)	(2)	(3)	(4)	(5)
gdp_per capita	-0.236***	-0.222***	-0.254***	-0.249***	-0.229***
	(-11.29)	(-10.17)	(-11.76)	(-11.95)	(-10.89)
oecd_gdp	0.00137	0.0111*	0.000668	0.000825	0.00279*
	(1.29)	(2.40)	(0.64)	(0.82)	(2.36)
investment	0.0314***	0.0297***	0.0252***	0.0286***	0.0315***
	(6.11)	(5.72)	(4.76)	(5.51)	(6.15)
population	-0.0492	-0.0653*	-0.0507	-0.0493	-0.0506
	(-1.53)	(-1.97)	(-1.59)	(-1.52)	(-1.57)
Fitted values		0.0146*			
		(2.16)			
trade			0.0234*	0.0205*	
			(2.38)	(2.10)	
total schooling			0.00796*		
			(2.32)		
agric value added			-0.127***	-0.129***	
			(-3.51)	(-3.57)	
political stability			0.00548		
			(1.81)		
primary schooling				0.00259	
				(0.50)	
democracy				-0.000715	
				(-0.96)	
conflict				0.00268	
				(0.77)	
oecd and primary schooling					0.0107**
					(2.74)
oecd and property rights					-0.000431
					(-0.24)
oecd and political stability					0.00260
					(0.91)
trends	Yes	Yes	Yes	Yes	Yes
Observations	798	798	798	798	798

Note: *** p<0.01, ** p<0.05, * p<0.10.
Equation (2) is our preferred specification
The following are the p-values associated with our various diagnostics test:
abar , lags(1) Pr > z = 0.0708; ovtest, Prob > F = 0.5487; hettest, Prob > chi2 = 0.0000

1.5 Concluding Remarks

In conclusion, this paper studies the impact of foreign aid on growth in 38 developing countries from 1996 to 2018, using a CFA (i.e., "kitchen-sink" technique) to account for the potential selection bias resulting from the aid-allocation mechanism. Thus, this identification technique for the aid-allocation mechanism is both a novel and robust addition to the aid-growth literature. In general, our results show that multilateral aid (both ODA and OECD) has a significant positive effect on short-term growth in developing countries.

Furthermore, concerning the factors that influence donor's aid-allocation decisions, overall, we found measures of poverty, political factors, policy quality, social policy, and macroeconomic indicators as the main factors that influence the allocation of aid from donors to recipient countries. These results are in-line with (see Alesina and Dollar (2000); and Berthélemy (2006)). However, contrary to Kilby and Dreher (2010), and Hoeffler and Outram (2011)), we found that donor self-interest variables do not influence donor aid-allocation decisions in the short-term. This concurs with the notion that aid is an altruistic tool of the developed world's foreign policy.

Thus, this study contributes to the foreign aid literature by enhancing our understanding of the various factors that influence donors' aid allocation decisions. It also tells us to what extent does, donor aid allocation decisions influence the impact of aid on growth in developing countries. Thus, we recommend donors to continue supporting low and middle-income countries through foreign aid, but by ensuring that the aid they give is sufficient enough to achieve the desired outcome. Donors should also consider investing in new technologies that improve recipient countries' self-reliance through investments in agriculture (which employs more than half the population in developing countries), women, youth, and other productive sectors of the economy, thereby harnessing the enormous resources in these countries.

Appendices

Appendix A

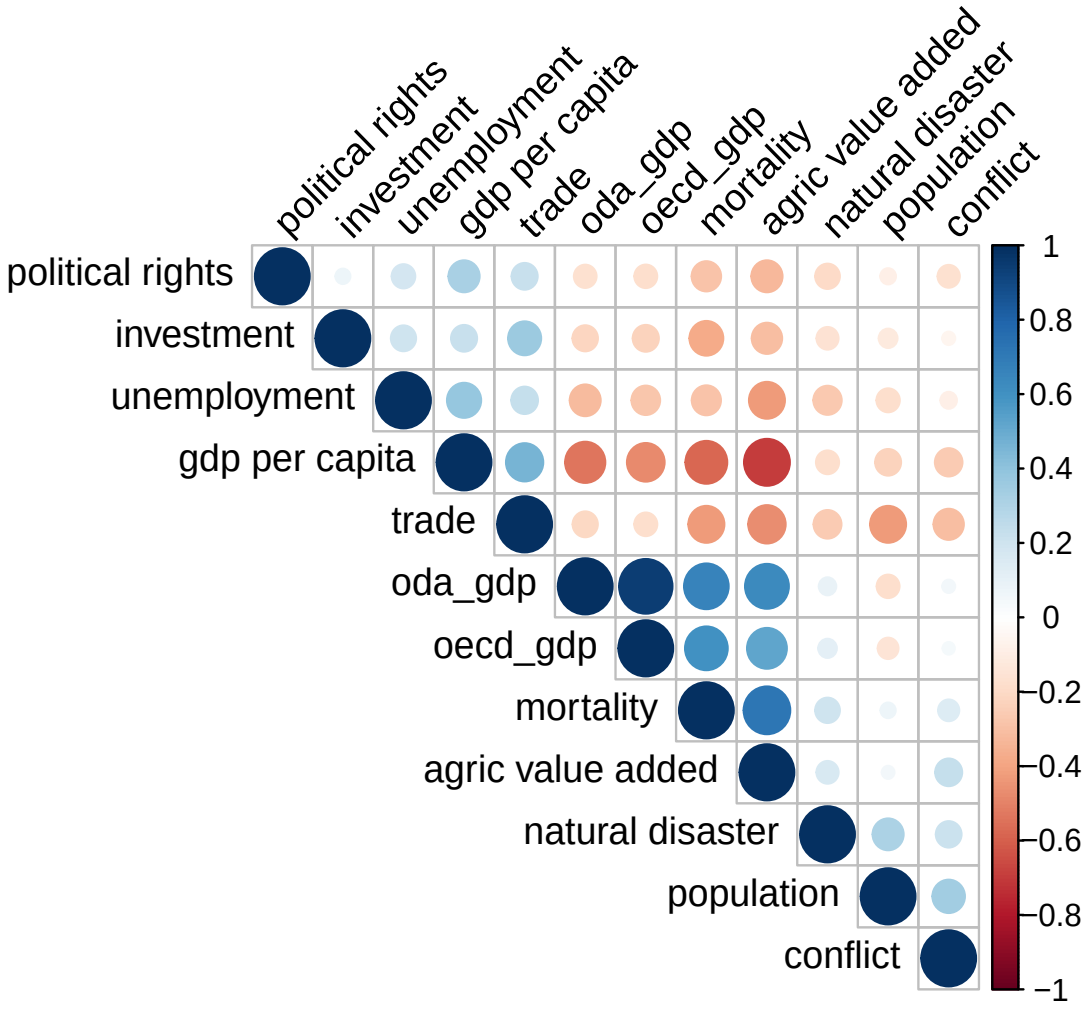
SUMMARY STATISTICS, SAMPLE, ROBUSTNESS CHECKS (SSA SUB-SAMPLE & IPW RESULTS), DEFINITION OF VARIABLES & SUMMARY OF THE LITERATURE REVIEW

SUMMARY STATISTICS OF AID-GROWTH NEXUS VARIABLES

Characteristic	N = 874[1]
gdp per capita	1,918 (832, 3,703)
oda_gdp	0.02 (0.01, 0.07)
oecd_gdp	0.015 (0.006, 0.040)
investment	0.21 (0.17, 0.26)
population	11,000,000 (5,400,000, 32,000,000)
trade	0.63 (0.46, 0.85)
mortality	40 (25, 66)
unemployment	5 (3, 10)
agric value added	0.15 (0.09, 0.25)
Unknown	3
natural disaster	493 (56%)
conflict	208 (24%)
political rights	4.84 (4.40, 5.30)

[1] Median (IQR); n (%)

A CORRELOGRAM SHOWING THE CORRELATION BETWEEN AID-GROWTH NEXUS VARIABLES



Positive correlations are displayed in blue and negative correlations in red color. The color intensity and the size of the circle are proportional to the correlation coefficients. On the right side of the correlogram, the legend color shows the correlation coefficients and the corresponding colors.

Study Sample of 38 Developing Countries

Albania	Benin
Bangladesh	Bolivia
Botswana	Cameroon
Congo, Dem. Rep.	Congo, Rep.
Dominican Republic	Algeria
Egypt	Gabon
Guatemala	Honduras
Kenya	Kyrgyz Republic
Morocco	Mali
Mozambique	Mauritania
Namibia	Niger
Pakistan	Paraguay
Rwanda	Sudan
Sri Lanka	Mauritius
Panama	Philippines
Senegal	Sierra Leone
El Salvador	Togo
Tunisia	Tanzania
Uganda	South Africa

Results of First-Stage and Second-Stage Estimations with the SSA Sub-Sample

SSA-Table 5: First-Stage ODA, World Bank

	Dependent variable: ln(ODA to GDP) (first difference)				
lagged_Independent variable	(1)	(2)	(3)	(4)	(5)
oda_gdp	-0.681***	-0.684***	-0.678***	-0.689***	-0.703***
	(-13.28)	(-13.54)	(-13.66)	(-13.77)	(-14.29)
gdp_per capita	-1.156***	-1.066**	-1.519***	-1.449***	-1.524***
	(-3.56)	(-2.95)	(-4.45)	(-3.88)	(-4.24)
investment	-0.0172	-0.00186	-0.0454	-0.0555	
	(-0.44)	(-0.05)	(-1.13)	(-1.41)	
population	1.273*	1.254*	1.353*	1.195*	1.313*
	(2.39)	(2.22)	(2.49)	(2.07)	(2.36)
trade	0.223				
	(1.16)				
primary schooling		0.580			
		(1.78)			
unemployment		-0.0106			
		(-0.84)			
agric value added			-1.875***	-1.901***	-1.852***
			(-3.65)	(-3.65)	(-3.70)
conflict			-0.0513		
			(-0.98)		
economic freedom				-0.0427	
				(-0.65)	
property rights				0.117*	0.101*
				(2.18)	(1.96)
political stability				0.0632	0.0480
				(1.13)	(0.89)
trends	Yes	Yes	Yes	Yes	Yes
Observations	798	798	798	798	798

Note: *** p<0.01, ** p<0.05, * p<0.10.
The following are the p-values associated with our various diagnostics test:
abar , lags(1) Pr > z = 0.2664; ovtest, Prob > F = 0.0987; hettest, Prob > chi2 = 0.0000

SSA-Table 6: First-Stage OECD AID

	Dependent variable: ln(OECD to GDP) (first difference)				
lagged_Independent variable	(1)	(2)	(3)	(4)	(5)
oecd_gdp	-0.652***	-0.654***	-0.646***	-0.647***	-0.685***
	(-13.11)	(-13.44)	(-13.38)	(-13.63)	(-14.05)
gdp_per capita	-1.510***	-1.216**	-1.771***	-1.769***	-1.706***
	(-4.05)	(-3.07)	(-4.67)	(-4.29)	(-4.26)
investment	-0.0260	-0.0137	-0.0483	-0.0585	
	(-0.55)	(-0.29)	(-1.01)	(-1.25)	
population	1.746**	1.732**	1.852**	1.669*	1.806**
	(2.74)	(2.70)	(2.97)	(2.56)	(2.89)
trade	0.229				0.141
	(1.07)				(0.69)
total schooling		-0.448			-0.0339
		(-1.78)			(-0.41)
unemployment		-0.0267			-0.0407**
		(-1.84)			(-2.76)
agric value added			-1.509**	-1.495**	-1.606**
			(-2.75)	(-2.76)	(-3.04)
control for corruption				-0.0411	
				(-0.34)	
autocratic				0.0132	
				(0.50)	
property rights				0.158**	0.150*
				(2.63)	(2.55)
political stability				0.0489	0.0832
				(0.83)	(1.35)
trends	Yes	Yes	Yes	Yes	Yes
Observations	378	378	378	378	378

Note: *** p<0.01, ** p<0.05, * p<0.10.
The following are the p-values associated with our various diagnostics test:
abar , lags(1) Pr > z = 0.4368; ovtest, Prob > F = 0.4068; hettest, Prob > chi2 = 0.0000

SSA-Table 7: Second-Stage ODA, World Bank

	Dependent variable: ln(GDP_per capita) (first difference)				
lagged_Independent variable	(1)	(2)	(3)	(4)	(5)
gdp_per capita	-0.220***	-0.118**	-0.216***	-0.234***	-0.219***
	(-6.56)	(-2.74)	(-6.26)	(-6.90)	(-6.48)
oda_gdp	0.00447	0.0498***	0.00267	0.00312	0.00174
	(1.44)	(3.92)	(0.82)	(1.00)	(0.53)
investment	0.0140	0.0123	0.0109	0.0127	0.0139
	(1.94)	(1.73)	(1.47)	(1.77)	(1.90)
population	-0.0276	-0.116	-0.0278	-0.0172	-0.0297
	(-0.47)	(-1.84)	(-0.47)	(-0.29)	(-0.50)
Fitted values		0.0650***			
		(3.66)			
trade			0.0170	0.0185	
			(0.94)	(1.04)	
agric value added			-0.159***	-0.154***	
			(-3.43)	(-3.34)	
property rights			0.00667		
			(1.31)		
mortality				-0.00109	
				(-1.63)	
primary schooling				0.00167	
				(0.15)	
conflict				0.0108*	
				(2.04)	
oda and schooling					-0.0304*
					(-2.16)
oda and property rights					0.000369
					(0.05)
oda and political stability					-0.0443***
					(-3.95)
trends	Yes	Yes	Yes	Yes	Yes
Observations	378	378	378	378	378

Note: *** p<0.01, ** p<0.05, * p<0.10.
Equation (2) is our preferred specification
The following are the p-values associated with our various diagnostics test:
abar , lags(1) Pr > z = 0.4520; ovtest, Prob > F = 0.0422; hettest, Prob > chi2 = 0.0003

SSA-Table 8: Second-Stage OECD AID

	Dependent variable: ln(GDP_per capita) (first difference)				
lagged_Independent variable	(1)	(2)	(3)	(4)	(5)
gdp_per capita	-0.219***	-0.117*	-0.213***	-0.233***	-0.221***
	(-6.57)	(-2.39)	(-6.20)	(-6.91)	(-6.51)
oecd_gdp	0.00518	0.0379**	0.00399	0.00415	0.00344
	(1.81)	(3.13)	(1.33)	(1.45)	(1.12)
investment	0.0136	0.0117	0.0104	0.0122	0.0105
	(1.89)	(1.64)	(1.41)	(1.70)	(1.42)
population	-0.0240	-0.108	-0.0263	-0.0145	-0.0344
	(-0.41)	(-1.64)	(-0.44)	(-0.25)	(-0.57)
Fitted values		0.0496**			
		(2.77)			
trade			0.0146	0.0163	
			(0.80)	(0.91)	
total schooling			0.00785		
			(1.14)		
agric value added			-0.157***	-0.153***	
			(-3.39)	(-3.33)	
political stability			0.00391		
			(0.65)		
property rights			0.00700		
			(1.38)		
democracy				0.00115	
				(0.83)	
conflict				0.0105*	
				(2.00)	
oecd and schooling					-0.0294*
					(-2.47)
oecd and property rights					-0.00448
					(-0.66)
trends	Yes	Yes	Yes	Yes	Yes
Observations	378	378	378	378	378

Note: *** p<0.01, ** p<0.05, * p<0.10.
Equation (2) is our preferred specification
The following are the p-values associated with our various diagnostics test:
abar , lags(1) Pr > z = 0.4370; ovtest, Prob > F = 0.0264; hettest, Prob > chi2 = 0.0005

Table 9: IPW estimation for ODA & OECD AID

	Dependent variable: ln(ODA & OECD to GDP) (first difference)	
lagged_Independent variable	(1)	(2)
gdp_per capita	0.920***	0.936***
	(0.012)	(0.012)
oecd_gdp	0.002	
	(0.001)	
oda_gdp		0.003***
		(0.001)
investment	0.010**	0.010***
	(0.004)	(0.004)
population	-0.004	-0.014
	(0.050)	(0.050)
MUS_b	0.019	0.020
	(0.017)	(0.017)
PAN_a	0.046**	0.056***
	(0.022)	(0.021)
PAN_b	0.025*	0.029**
	(0.015)	(0.015)
Constant	-0.0003	-0.00001
	(0.001)	(0.001)
trends	Yes	Yes
Observations	760	760
R^2	0.900	0.903
Adjusted R^2	0.899	0.902
Residual Std. Error (df = 752)	0.029	0.028
F Statistic (df = 7; 752)	840.867 ***	869.889***

Note: *** p<0.01, ** p<0.05, * p<0.10.
MUS_b, PAN_a, and PAN_b are country dummies for Mauritius and Panama

Table A.0.1: **Description of the variables**

Variables	**Definition**	**Source**
ODA [1]	Net ODA consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants provided to DAC-approved recipients with the promotion of economic development as its main objective.	(WB WDI) [2]
Disbursements	A disbursement is the placement of resources at the disposal of a recipient country or agency, or in the case of internal development-related expenditures, the outlay of funds by the official sector. It can take several years to disburse a commitment.	OECD CRS
Commitments	Total commitments per year comprise new undertakings entered in the year in question (regardless of when OECD disbursements are expected) and additions to agreements CRS made in earlier years.	OECD CRS
Multilateral	Aid given by a multilateral organization whose membership is made up of member governments, who collectively govern the organization and are its primary source of funds.	OECD DAC2a
Bilateral	Aid given by a government directly to the government of another country.	OECD DAC2a

Table continues on next page

Description of the variables (Continued)

Variables	Definition	Source
Grants	Transfers made in cash, goods or services for which no repayment is required. Excludes technical assistance grants.	WB WDI
AID_WB	Net official development assistance (ODA) consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients.	WB WDI
AID_OECD	Destination of Official Development Assistance Disbursements. Geographical breakdown by donor, recipient and for some types of aid (e.g. grant, loan, technical co-operation) on a disbursement basis (i.e. actual expenditures). The data cover flows from all bilateral and multilateral donors except for Tables DAC 1, DAC 4, DAC 5 and DAC 7b which focus on flows from DAC member countries and the EU Institutions.	OECD DAC2a

Table continues on next page

Description of the variables (Continued)

Variables	Definition	Source
GDP	GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products.	WB WDI
GDP per capita	GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products.	WB WDI
Trade (% of GDP)	Trade is the sum of exports and imports of goods and services WB WDI measured as a share of GDP.	WB WDI
Investment	Gross fixed capital formation, private sector (gross outlays by the private sector on additions to fixed domestic assets), measured as a share of GDP.	WB WDI
Foreign direct investment	Foreign direct investment are the net inflows of invest to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor.	WB WDI

Table continues on next page

Description of the variables (Continued)

Variables	Definition	Source
Population, total	Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. The values shown are midyear estimates.	WB WDI
Agriculture	Agriculture, forestry, and fishing, measured as a share of GDP. For VAB countries, gross value added at factor cost is used as denominator.	WB WDI
Primary schooling	Average years of primary schooling attained (age 15-64).	Barro-Lee dataset
Total schooling	Average years of total schooling attained (age 15-64).	Barro-Lee dataset
Mortality rate, infant	Infant mortality rate is the number of infants dying before reaching one year of age, per 1,000 live births in a given year.	WB WDI

Table continues on next page

Description of the variables (Continued)

Variables	Definition	Source
Employment to population ratio	Employment to population ratio is the proportion of a country's population that is employed. Employment is defined as persons of working age who, during a short reference period, were engaged in any activity to produce goods or provide services for pay or profit, whether at work during the reference period (i.e., who worked in a job for at least one hour) or not at work due to temporary absence from a job, or to working-time arrangements. Ages 15 and older are generally considered the working-age population.	WB WDI
Unemployment, total	Unemployment refers to the share of the labor force that is without work but available for and seeking employment.	WB WDI
Control of Corruption	Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e., ranging from approximately -2.5 to 2.5.	WD WGI [3]

Table continues on next page

Description of the variables (Continued)

Variables	Definition	Source
Political Stability	Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood of political instability and/or politically- motivated violence, including terrorism. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e., ranging from approximately -2.5 to 2.5.	WD WGI
Government Effectiveness	Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e., ranging from approximately -2.5 to 2.5.	WD WGI

Table continues on next page

Description of the variables (Continued)

Variables	Definition	Source
Rule of Law	Rule of Law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e., ranging from approximately -2.5 to 2.5.	WD WGI
Democracy (Polity V)	Polity V is a cross-national, time-series and polity-case formats coding democratic and autocratic "patterns of authority" and regime changes in all independent countries with total population greater than 500,000 in 2018 (167 countries in 2018)	Center for Systemic Peace
Natural disaster	EM-DAT is a global database on natural and technological disasters, containing essential core data on the occurrence and effects of more than 21,000 disasters in the world, from 1900 to present.	EM-DAT International Disaster database
Conflict	Level of conflict: 0 = no conflict; 1 = minor conflict, 25-999 battle- related deaths in a given year; 2 = war, at least 1000 battle-related deaths in a given year.	UCDP/PRIO Armed Conflict Dataset

Table continues on next page

Description of the variables (Continued)

Variables	Definition	Source
Economic freedom	This is a disaggregated dataset of economic freedom, including the "Economic Freedom Summary Index" and "Ranking" of countries. The summary index is obtained using the following 5 categories: Size of Government, Legal System and Property Rights, Sound Money, Freedom to Trade Internationally and Regulation.	Economic Freedom Dataset
Protection of property rights (property rights)	One of the components of the "legal systems and property rights" area, scored from 0 (lowest) to 10 (highest) based on various sources of information.	Economic Freedom Dataset
Corruption Perception Index (CPI)	CPI Score relates to perceptions of the degree of corruption as seen by business people and country analysts, and ranges between 10 (highly clean) and 0 (highly corrupt).	Transparency International database
Democracy	Index of combined political rights and civil liberties: 2 = Not Free; 1 = Partly Free; 0 = Free.	Freedom House database

[1]Official Development Assistance (ODA)
[2]World Bank, World Development Indicators (WB WDI)
[3]World Bank, World Governance Indicators (WB WGI)

Table A.0.2: **A Summary of the Literature Review on the Determinants & Impact of Foreign Aid**

Authors	**Data**	**Methodology**	**Results**
Maizels and Nissanke (1984)	80 developing countries in 1969-70 and 1978-80.	cross-country multiple regressions	Bilateral aid, Donor Motives (Economic, political and security interests) matters. While, on the other hand, Multilateral aid, recipient needs matters.
Schraeder et al. (1998)	36 African countries 1980 - 1989	Generalized Least Squares, Error Components (GLSE)	Aid is not an altruistic tool for foreign policy. Donor motives, with respect to different donors, matters (i.e., their position in the world order, strategic interest and relationship with former colonies.)
Alesina and Dollar (2000)	Developing countries (All OECD-DAC Recipient), average five-year periods 1970–74 and 1990–94.	Ordinary Least Squares (OLS) and a Two-Stage Least-Squares (2SLS)	Political and strategic factors as by the economic needs and policy performance of the recipients, Colonial past and political alliances, and democratization matters.

Table continues on next page

A Summary of the Literature Review on the Determinants & Impact of Foreign Aid

Authors	Data	Methodology	Results
Dollar et al. (2000)	56 developing countries and six four-year time periods, 1970–1973 until 1990– 1993	OLS & 2SLS	The quality of policy has little impact on the allocation of aid.
Alesina and Weder (2002)	70 developing countries 1970-95	OLS & TOBIT	A positive relationship between Aid and Corruption.
Berth elemy (2006)	137 recipient countries and 22 donors of the OECD-DAC. 1980-1999	Standard Heckman maximum-likelihood model, OLS & Fixed Effects (FE) model.	Trade, Need based aid, Good governance indicators (i.e., democracy, peace, etc.,) matters.
Chong and Gradstein (2008)	22 donor countries 1973–2002	Panel and Dynamic panel data regressions.	Individual satisfaction with own government, Relative income, inefficiency of donor government matters
Kilby and Dreher (2010)	117 developing countries, 1974–2001.	OLS	Donor motives matters, Need based aid

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A Summary of the Literature Review on the Determinants & Impact of Foreign Aid

Authors	Data	Methodology	Results
Hoeffler and Outram (2011)	22 (DAC) donors and 168 recipient countries, 1980-2004.	OLS & 2SLS	Donor motives (Self-interest), Unobserved recipient effects matters.
Dollar et al. (2000)	56 developing and six four-year time periods from 1970–1973 until 1990– 1993.	OLS & 2SLS	In the presence of good policy, aid has a positive effect on growth.
Hansen and Tarp (2001)	56 developing countries, five periods 1974–1977 to 1990–1993	OLS, GMM, FE	Aid increase growth regardless of policy quality (highly sensitive to the choice of estimator and the set of control variables.)
Dalgaard et al. (2004)	56 developing countries 1970-1993	Pooled OLS, IV & GMM	Aid-Growth (increase), Climate-related circumstances matter.
Easterly et al. (2004)	62 developing and six four-year time periods from 1970–1973 until 1990– 1997.	OLS and 2SLS	Aid-Growth (Negative effect)

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A Summary of the Literature Review on the Determinants & Impact of Foreign Aid

Authors	Data	Methodology	Results
Rajan and Subramanian (2008)	All post-war developing countries that have received aid and for which data are available, 1960-2000	OLS, IV & GMM	Aid-Growth (No robust positive effect)
Werker et al. (2009)	All non-oil producing developing countries, 1960-2003	OLS & IV	Aid-Growth (No statistically significant effect)
Arndt et al. (2015)	All developing countries for which data is available 1970-2007	OLS & IV	Aid-Growth (enhanced structural change, reduced poverty, and stimulated growth.)
Dreher et al. (2016)	54 countries 1974–2009	OLS	The effect of aid on growth is reduced by temporary UNSC membership (i.e. short-term political favoritism reduces the effectiveness of aid)

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A Summary of the Literature Review on the Determinants & Impact of Foreign Aid

Authors	Data	Methodology	Results
Galiani et al. (2017)	35 countries that crossed the IDA income threshold from below between 1987-2010	OLS & IV	Aid-Growth nexus (Positive)
Harb and Hall (2019)	25 developing countries 1984 to 2008.	Panel Smooth Transition Regression Model (PSTR).	Aid-Growth (Diminishing returns) effect
Yahyaoui, and Bouchoucha (2020)	48 African countries 1996–2014	OLS, FMOLS (fully modified OLS), and SGMM (system GMM) models.	Aid ineffective in terms of growth & with increasing returns. Good institutions promote aid effectiveness.

Chapter 2

Aid and Government Consumption Multipliers in Sub-Saharan African (SSA) Countries

2.1 Introduction

Given the vast literature on the size of fiscal multipliers, one might be tempted to ask why would one write another paper on this topic? To answer this question, we first acknowledge the voluminous literature on the size of fiscal multipliers however, the main focus of research in this literature has been on estimating the size of fiscal multipliers in advanced economies. According to the World Bank, World Development Indicator, on average net official development assistance (ODA), including grants and concessional loans to low-income countries (LICs), accounts for 11.9 percent of national income in LICs from 2000 to 2014 (World Bank (2016)). Therefore, since SSA is the largest aid recipient globally, there is a need to understand the state-specific heterogeneity of aid multipliers across SSA countries. Thus, by focusing on SSA countries, this research improves our understanding of both aid and fiscal multipliers in this region, which to our knowledge has not received much attention

in the literature. Furthermore, to our knowledge, there exist no studies that seek to estimate state-specific aid and government consumption multipliers for the SSA.

On the size of fiscal multipliers [1] in Middle and low-income countries, Wang and Wen (2013) using an SVAR approach, found high fiscal multipliers (when looking at provincial expenditures) in 29 Chinese provinces ranging from 1.7 to 2.8. Estevão and Samaké (2013) found that the fiscal multipliers in Central America (including Dom. Rep. and Panama), EME, LIC, and SSA are 0.01, -0.44, 0.34, 0.17, and 0.25, respectively. They also found that the positive effects of fiscal consolidation tend to be higher in LICs, particularly in heavily-indebted poor countries (HIPCs).

Tang et al. (2013) using SVAR and time-varying VAR models, found relatively low fiscal multipliers ranging from -0.3 to 0.4 in five ASEAN[2] countries (Indonesia, Malaysia, Philippines, Singapore, and Thailand). Jooste et al. (2013) found that fiscal multipliers in South Africa are 0.3, and were more effective during countercyclical policy periods. Using OLS, FE, and RE, Karras (2011) found that fiscal multipliers in 61 developed and developing countries ranged from 0.8 to 0.98. Kraay (2012) found fiscal multipliers ranging from 0.48 to 0.67 in 29 primarily LICs, which were found to be influenced by underlying country characteristics and the identification strategy used. However, Kraay (2014) using data from 102 developing countries from 1970 to 2010 using OLS and 2SLS method estimates that the government consumption multipliers are 0.4. Another study by Chian Koh (2017) using data from 120 countries from 1960-2014 using the SVAR model estimates fiscal multipliers ranging from 0.4 to 1.8, with multipliers lower in LICS compared to those found in advanced economies. Shen et al. (2018) studied LICs from 2000-2015, using the New Keynesian Small Open Economy model, and found that fiscal multipliers in LICs range from 0.3 to 0.4. Whiles, a more recent study by Sheremirov and Spirovska (2022) studied 129 countries (36 advanced, 93 develop-

[1] Although, the studies cited in this literature review estimated various Fiscal stimulus measures (i.e., total public spending (or by components such as consumption, and investment); revenue, deficits, or monetary multipliers), however, the figures cited in this study reflect only those of total public spending (i.e., the consumption component)

[2] Association of Southeast Asian Nations

ing) from 1988-2013 using Local Projections and found that multipliers are relatively large (above one) in advanced economies, compared to those found in LICs.

Since the Marshall Plan of 1948, there has been an overwhelming increase in the volume of aid that was given to poor underdeveloped countries by various donors. Although foreign aid is given by various donors with the objective that it will serve as a complement to government spending, this is seldom the case. There is growing research on the fungibility of aid, (i.e., when the total government spending increases less than the total amount of foreign aid in the recipient developing economies (see, Feyzioglu et al. (1998), Kaya and Kaya (2020)). Unlike estimating the size of fiscal multipliers, there are few or no studies that estimate the size of aid multipliers and their effects on key macroeconomic indicators.

Therefore, Burnside and Dollar (2000) using data from 56 developing countries from 1970-1993 found that, in the presence of good policies that promote growth fiscal, monetary, and trade policies, aid had a positive effect on growth. Similarly, Alesina and Weder (2002) using data from 70 developing countries from 1970-1995, found a positive relationship between aid and corruption. While some studies like Hansen and Tarp (2001), Dalgaard et al. (2004), and Arndt et al. (2015) found that aid increases growth regardless of policy quality, reduces poverty, and that the magnitude of the effect depends on climate-related circumstances and its highly sensitive to the choice of the estimator and the set of control variables used. However, Easterly et al. (2004) found that even in the presence of good policies, aid does not boost growth. Galiani et al. (2017) using data from 35 countries that crossed the IDA income threshold from below between 1987-2010 found that aid has a positive effect on growth and investment. More recently, Dreher and Langlotz (2020) found that aid has a positive but insignificant effect on growth, increases investment and consumption, but decreases net export. However, Harb and Hall (2019) using data from 25 developing countries between 1984-2008, found aid has a positive effect on growth but with diminishing returns effect.

In general, the literature suggests that foreign aid can have a positive effect on economic growth, consumption, and investment in developing countries, but it is highly dependent on the policies, macroeconomic conditions, and governance indicators of the recipient countries. Although there exist other studies in the literature that estimate the size of fiscal multipliers in LICs (Shen et al. (2018), Chian Koh (2017), and Kraay (2014)), to our knowledge, this current study is the only one that seeks to discern the state-specific heterogeneity in the size of both aid and fiscal multipliers in 30 SSA countries.

Using the Bayesian panel VAR model with cross-sectional heterogeneity, with shocks to both aid and government consumption identified through the generalized impulse response function (GIRF). For the baseline specification we found that: (i) Consistent with the aid-growth literature, an unexpected aid shock has an overall positive effect on GDP, government consumption, and investment in the SSA. Aid multipliers are higher in the medium-term for the baseline sample; (ii) As expected, we saw that an unexpected government spending shock also leads to a positive impact on aid, GDP, and investment in the SSA in the short and medium-term, thus suggesting that the demand effect has taken place.

This chapter proceeds as follows: section 2 outlines the Bayesian panel VAR model, Data & baseline specification, inference, and identification strategy, and how we compute the multipliers; section 3 discusses the main results; section 4 deals with the robustness concerns; and section 5 concludes.

2.2 Methodology

2.2.1 Bayesian Panel VAR Model

We consider a Bayesian panel VAR model with cross-sectional heterogeneity as in Destefanis et al. (2022), obtaining a unit-specific VAR model through a random coefficient model. For each country, the VAR model is described by Equation (2.1):

$$y_{i,t} = \Gamma_i z_i + A_1^1 y_{i,t-1} + ... + A_i^p y_{i,t-p} + \varepsilon_{i,t} \tag{2.1}$$

with

$$\varepsilon_{i,t} \sim N(0, \Sigma_i)$$

where $t = 1, \ldots, T$ represents the time dimension; $i = 1, \ldots, N$ represents the country dimension; $y_{i,t}$ is an $n \times 1$ vector of endogenous variables; z_i collects deterministic components; A_i and Γ_i are matrices containing the slope and intercepts; while p is the number of lags.

Adding over the T time periods, then writing in compact form, we have Equation (2.2):

$$y_i = X_i \beta_i + \epsilon_i \tag{2.2}$$

Adopting the random coefficient model, where X_i represents the entire set of predetermined endogenous variables, we assume that for each unit, β_i can be expressed as in Equation (2.3):

$$\beta_i = b + b_i \tag{2.3}$$

where $b_i \sim N(0, \Sigma_b)$, which implies that $\beta_i \sim N(b, \Sigma_b)$. Thus, coefficients will differ across units, but parameters will be drawn from a distribution with a similar mean and variance. This allows for cross-sectional (i.e., country) heterogeneity. We follow the hierarchical prior approach developed by Jarociński (2010) in this setting. For more technical details on the hierarchical priors, likelihood function, and posterior (see, Appendix B).

2.2.2 Data & Baseline Specification

We estimate Equation(2.1) for 23 SSA countries: Benin (BEN), Botswana (BWA), Burkina Faso (BFA), Burundi (BDI), Cameroon (CMR), Central African Republic (CAF), Chad (TCD), Comoros (COM), Eswatini (SWZ), Gabon (GAB), Gambia (GMB), Ghana (GHA), Kenya (KEN), Madagascar (MDG), Mauritius (MUS), Niger (NER), Nigeria (NGA),

Rwanda (RWA), Senegal (SEN), Sierra Leone (SLE), Sudan (SDN), Togo (TGO), Uganda (UGA), using annual data from 1983-2017. However, due to data availability, we had to limit this sample to 23 SSA countries, which is still a good representation of the entire SSA. The baseline specification includes variables that are commonly used in this literature (as early as Blanchard and Perotti (2002) and Ilzetzki et al. (2013)). Below is our baseline specification,,

$$y_{i,t} = [A_{i,t}, G_{i,t}, I_{i,t}, GDP_{i,t}],$$

where $A_{i,t}$ represents the net official development assistance and official aid received, sourced World Bank, world development index(WB, WDI); $G_{i,t}$ represents general government final consumption expenditure (percent of GDP), sourced (WB, WDI)); $I_{i,t}$ is the total Investment, sourced (WB, WDI), and $GDP_{i,t}$ represents the gross domestic product, sourced (WB, WDI). We considered all these variables in levels and normalized them using an estimate of the real potential GDP to avoid biases in the government spending multiplier calculation. [3]

2.2.3 Identification & computing multipliers

As in Destefanis et al. (2022), we impose some identification assumptions on σ_i. Given the reduced form, we use the generalized impulse response function (GIRF) identification strategy developed by Koop et al. (1996), to identify an unexpected shock to both aid and government spending. The GIRF identification strategy is adopted in this study because: it can provide unique multipliers that are not affected by the reordering of the vector of endogenous variables (see Destefanis et al. (2022)); Unlike the conventional impulse response function (IRF) approach that relies on orthogonalization and normality assumptions, the GIRF does not rely on any specific assumptions on the parameters and distribution of the model. Thus, it could be applied to any linear and nonlinear models (see, Koop et al. (1996); Pesaran and Shin (1998)); The GIRF approach is invariant to the ordering, scaling, and sign

[3]We normalize $A_{i,t}$, $G_{i,t}$, $I_{i,t}$, and $GDP_{i,t}$ to avoid biases in the government spending multiplier calculation, for more details on this see Di Serio et al. (2020), Di Serio et al. (2022).

of the variables, in comparison to the recursive, and the sign-restriction IRF approach that depends on the choice of a causal ordering, sign, and the normalization of the shocks (see, Pesaran and Shin (1998); Uhlig (2005)). [4] Upon identifying both the aid and government consumption shocks, we derive impulse response functions for 5 years time horizon for each draw from the posterior distribution. Then across the 10,000 draws, we compute the median response and save the 16th and 84th percentiles of their distribution as confidence bands.

The multipliers are computed following the approach of Gordon and Krenn (2010) and Ramey and Zubairy (2018), which avoids the potential bias that could arise from using logarithms to transform variables. Thus, we normalized the variables of interest by real potential GDP.[5] Cumulated multipliers are computed as the ratio of discrete approximations of the integral of the median IRFs of real output and government purchases over a given time horizon $h = 1, ..., H$:

$$M_h = \frac{\sum_{h=0}^{H} dGDP(h)}{\sum_{h=0}^{H} dG(h)} \tag{2.4}$$

where $dGDP_h$ and dG_h denote the value of the respective IRF on the horizon h. G is dependent on the case we are considering and could either be government spending or aid.

2.3 Baseline Results

2.3.1 Aid Impulse Responses

We now present the macroeconomic effects of a one-unit aid shock obtained for the baseline specification. In these figures, the median responses of each endogenous variable to

[4]Some of the limitations identified in the literature on adopting the GIRF identification strategy in a traditional VAR model are: lack of causal interpretation and structural information, no account for parameter uncertainty and confidence intervals, the potential for implausible or contradictory results, and extreme identification method that require the covariance matrix to be diagonal (see, Kilian and Lütkepohl (2017); Kim (2013); and Pesaran (2015)). However, we addressed all these limitations of the GIRF approach by our adoption of the Bayesian VAR (BVAR) model, which relies on posterior distributions to compute credible confidence intervals or standard errors for the impulse responses, instead of relying on point estimates. It also relies on prior distributions to incorporate prior information or beliefs about the VAR parameters. Moreover, by using the Bayesian hierarchical approach developed by Jarociński (2010), we allow for correlation among the shocks and estimate the covariance matrix from the data, rather than imposing it exogenously.

[5]we computed the real potential GDP using the Hamilton filter as in Hamilton (2018)

the aid shock are represented by the bold lines, while shaded areas represent the 16th and 84th confidence intervals of the impulse response functions (IRFs).

As expected, Figures 2.1-2.3 show that an unexpected aid shock has an overall positive effect on GDP for almost all the 23 countries considered in our baseline specification, these results are consistent with those found in the aid-growth literature (see Burnside and Dollar (2000), Hansen and Tarp (2001), and Arndt et al. (2015), etc.,). An aid shock induced an upward trend in both government consumption and investment; however, this effect lasted only in the medium term (2-5 years) for a few countries in our sample. For government consumption, we observed that the positive effects associated with an aid shock are only statistically different from zero in the medium term in Botswana (BWA), Burkina Faso (BFA), Burundi (BDI), Comoros (COM), Gambia (GMB), Madagascar (MDG), Mauritius (MUS), Rwanda (RWA), Senegal (SEN), Sierra Leon (SLE), and Uganda (UGA). Although investment has a positive effect in the medium term, which is statistically significant only in Botswana (BWA), Burkina Faso (BFA), Central African Republic (CAF), Chad (TCD), Ghana (GHA), Mauritius (MUS), Nigeria (NGA), Rwanda (RWA), and Togo (TGO). These results clearly show that there exists a great heterogeneity between SSA countries, indicating that the effects of aid are mainly influenced by country-specific macroeconomic conditions.

However, for a minority of the countries in the baseline sample (Cameroon (CMR), Mauritius (MUS), Niger (NER), and Nigeria (NGA)) we observed that an aid shock has a downward trend in government consumption. The results for these countries are consistent with the fungibility of aid hypothesis in the aid literature (see Kaya and Kaya (2020), and Feyzioglu et al. (1998)). Table 2.3.1 shows the cumulative aid multipliers for each of the 23 SSA countries in the baseline sample. These multipliers are computed on the basis of Equation (15) for 1-year, 2-year, and 5-year horizons. The entries highlighted in bold represent multipliers that are computed from impulse responses that are significantly different from zero. From Table 2.3.1 we could clearly see that the aid multipliers are a replica of the behavior we have described above about the impulse responses; therefore, in

the medium-term (5 years) multipliers are generally positive (with exceptions only in Benin (BEN) and Nigeria (NGA)).

Moreover, Table 2.3.1 also shows the high disparity that exists between aid multipliers across SSA. Consistent with the impulse responses of an aid shock, aid multipliers are higher in the medium term for the baseline sample. Impact multipliers range from (-0.64) in Nigeria (NGA) to (2.72) in Eswatini (SWZ). Whiles in the medium-term 5-year horizon aid multiplier ranges from (-0.31) in Nigeria (NGA) to (1.98) in Gabon (GAB). These results indicate that, although aid could have some immediate impact on the recipient economy (that is seldom the case). With the exception of Botswana, Chad, Eswatini, Gabon, Sudan, and Togo, the aid multipliers in the SSA are generally less than unity. However, aid is predominantly effective in the SSA with a year or two lag, suggesting that due to administrative and bureaucratic reasons, the impact of aid might not be immediately felt in the receiving country's economy.

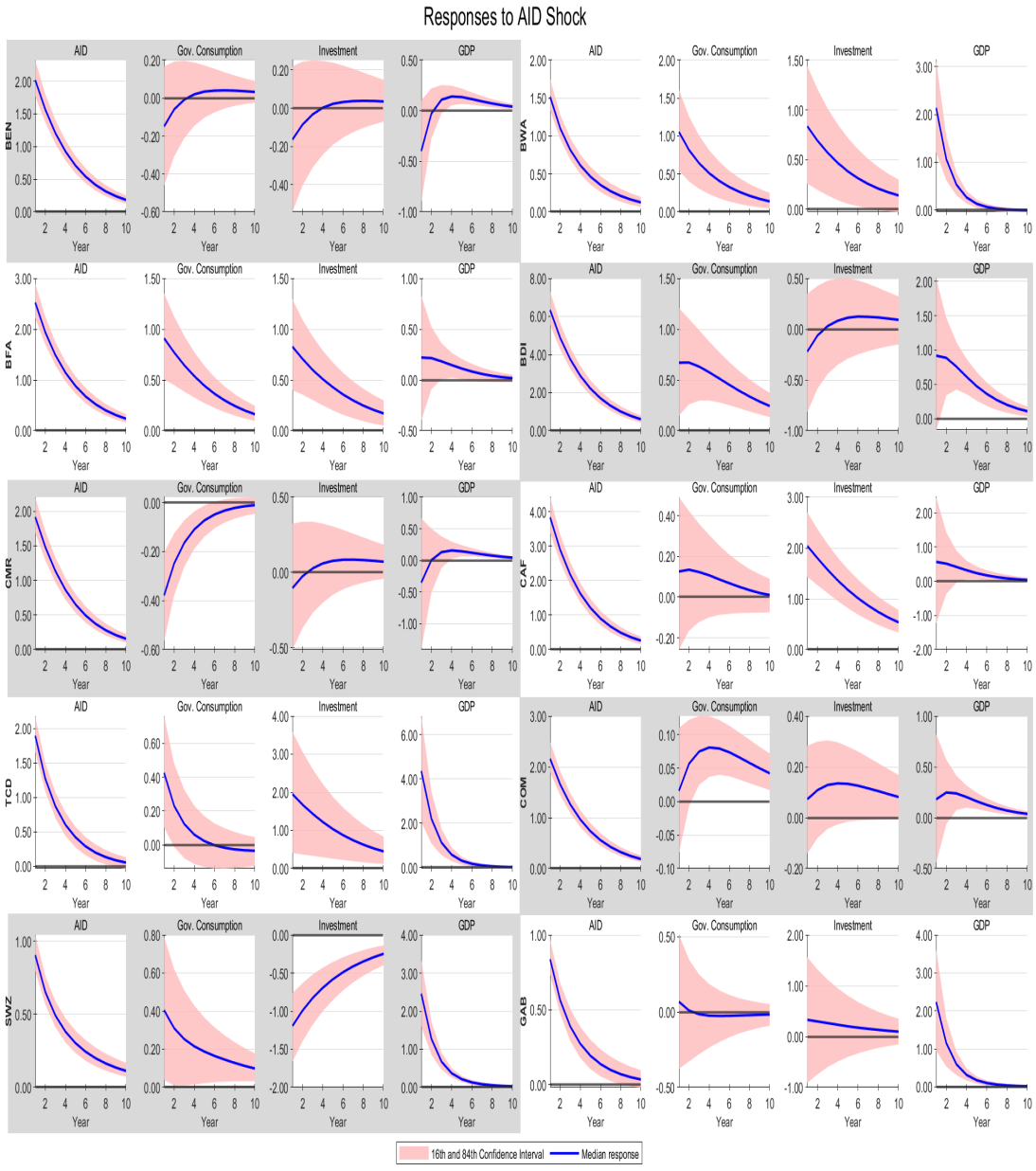


Figure 2.1: **IRFs to a one unit aid shock for the baseline specification, BPVAR. The solid blue lines represent the median response. The shadowed area represents the 16th and 84th confidence intervals of the IRFs**

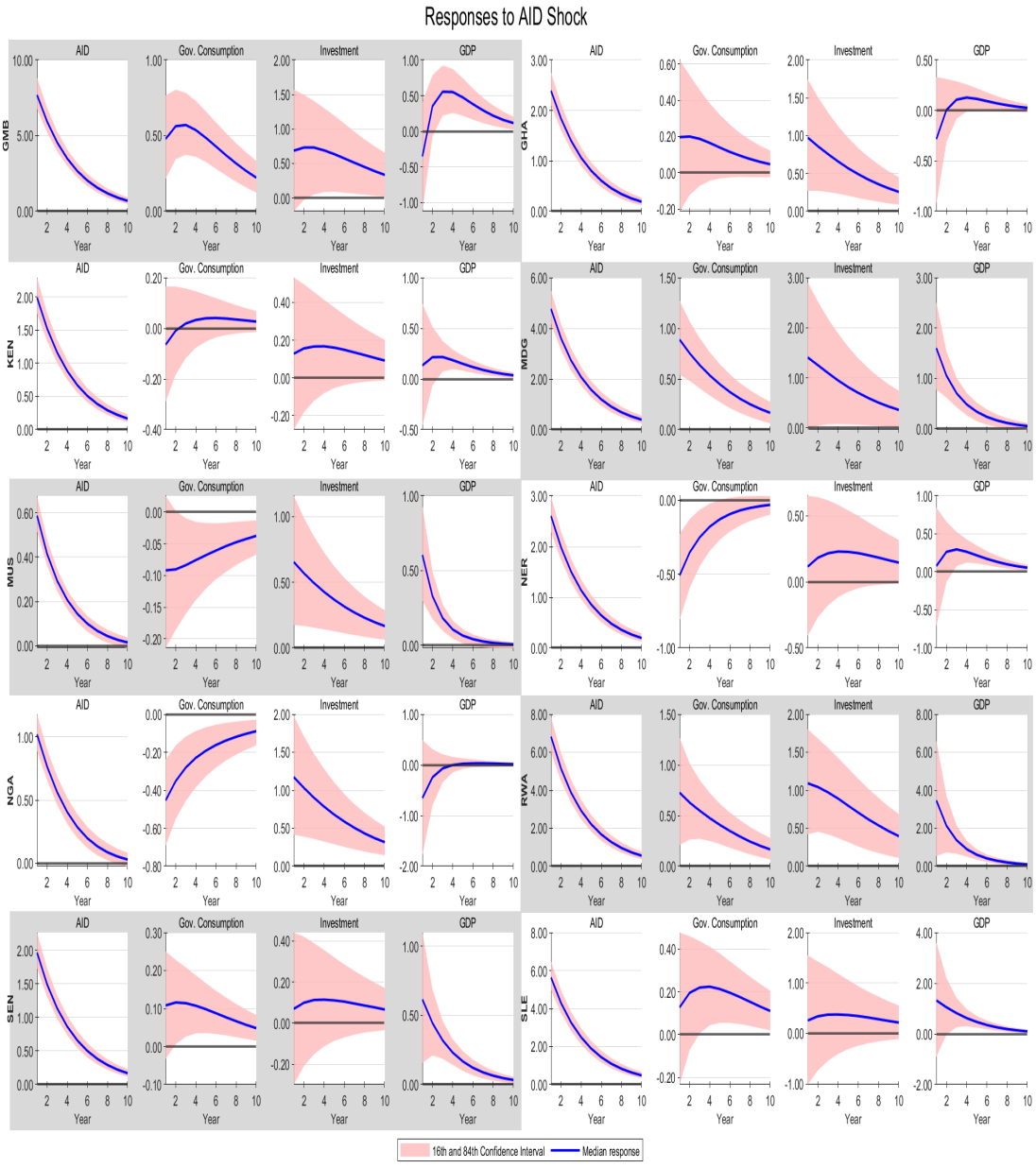


Figure 2.2: **IRFs to a one unit aid shock for the baseline specification, BPVAR. The solid blue lines represent the median response. The Shadowed area represents the 16th and 84th confidence intervals of the IRFs**

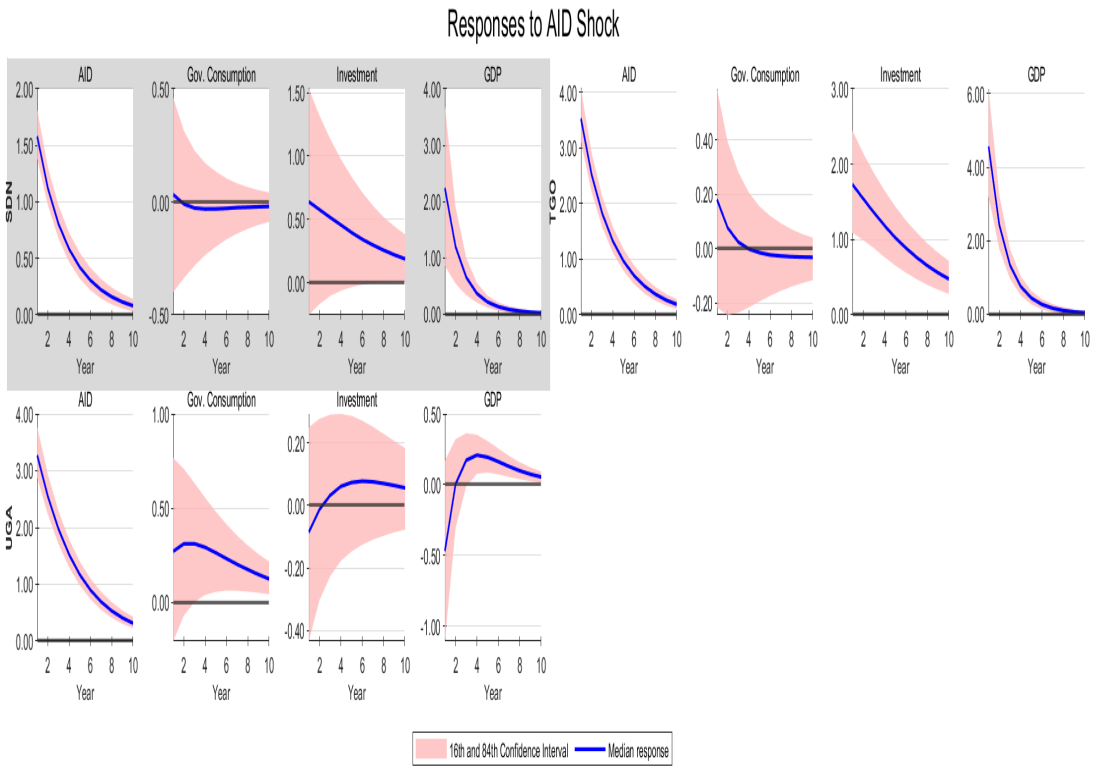


Figure 2.3: **IRFs to a one unit aid shock for the baseline specification, BPVAR. The solid blue lines represent the median response. The Shadowed area represents the 16th and 84th confidence intervals of the IRFs**

Table 2.3.1: **Aid & Government Consumption Multipliers for 23 SSA countries from 1985-2017**

	Aid Multipliers				Government Consumption Multipliers		
Units	year 1	year 3	year 5	Units	year 1	year 3	year 5
BEN	-0.20	-0.07	-0.01	BEN	**0.34**	0.17	0.09
BWA	**1.41**	**1.09**	**0.91**	BWA	**0.53**	0.33	0.23
BFA	0.09	**0.10**	**0.11**	BFA	0.09	0.02	-0.02
BDI	0.14	**0.17**	**0.18**	BDI	**0.93**	**0.64**	0.49
CMR	-0.18	-0.05	0.01	CMR	**3.26**	**2.46**	2.01
CAF	0.15	0.17	0.17	CAF	**1.24**	0.84	0.63
TCD	**2.30**	**1.90**	**1.69**	TCD	**3.13**	**2.36**	1.93
COM	0.08	**0.13**	**0.15**	COM	**5.26**	**4.25**	**3.66**
SWZ	**2.72**	**2.15**	**1.83**	SWZ	0.41	0.25	0.16
GAB	**2.67**	**2.23**	**1.98**	GAB	0.62	0.36	0.22
GMB	-0.05	**0.03**	**0.07**	GMB	**0.66**	**0.50**	0.41
GHA	-0.12	-0.03	0.01	GHA	**0.62**	0.38	0.26
KEN	0.07	**0.12**	**0.14**	KEN	**1.36**	**0.92**	0.69
MDG	**0.34**	**0.30**	**0.28**	MDG	**1.02**	**0.72**	0.57
MUS	**1.03**	**0.86**	**0.78**	MUS	-0.08	**-0.16**	**-0.20**
NER	0.03	**0.10**	**0.14**	NER	0.31	0.13	0.05
NGA	-0.64	-0.41	-0.31	NGA	-0.38	-0.30	-0.26
RWA	**0.51**	**0.44**	**0.40**	RWA	**4.56**	**3.58**	**3.01**
SEN	**0.31**	**0.30**	**0.29**	SEN	**1.49**	**1.04**	0.81
SLE	0.23	**0.24**	**0.24**	SLE	**3.06**	**2.28**	**1.85**
SDN	**1.42**	**1.17**	**1.04**	SDN	**1.06**	0.69	0.50
TGO	**1.29**	**1.06**	**0.94**	TGO	0.65	0.40	0.28
UGA	-0.14	-0.04	0.01	UGA	**0.37**	0.21	0.13

Note: Aid and government spending One-, three- and five-year cumulative multipliers. Bold entries represent multipliers that are derive from impulse response significantly different from zero.

2.3.2 Government spending Impulse Responses

Figures 2.4-2.6 present the macroeconomic effects of a one-unit government spending shock obtained for the baseline specification. Consistent with what we expect, a government consumption shock has a persistent positive impact on more than two-thirds of the baseline sample. These results could be explained by the fact that aid in the form of budget support is usually used by the recipient countries to finance the government budget deficit. Thus, enabling the recipient government to increase its spending in the medium term. However, for a minority of countries in the baseline sample, such as Cameroon, Gabon, Niger, and Nigeria, we observed a negative response of aid to the government consumption shock. Thus, confirming the heterogeneity that exists across SSA countries, as discussed above.

Again as we saw in the case of an aid shock, a government spending shock also leads to a positive impact on both GDP and investment in the SSA in the short and medium-term, thus suggesting that the demand effect has taken place, as expected. However, this positive effect is more persistent and statistically different from zero for GDP compared to investment. For the former, we could see this effect for almost more than half (about 15 countries) of our baseline sample, while the latter only in about 10 countries of the baseline sample.

Table 2.3.1 shows the heterogeneity that is inherent in the baseline sample, this could be clearly seen with the high disparity that exists between government consumption multipliers in the region. Consistent with the impulse responses of government consumption shock, we observe higher government consumption multipliers at impact for almost the entire baseline sample. With impact multipliers ranging from (-0.38) in Nigeria and (4.56) in Rwanda, this suggests the high potency of fiscal policy in the SSA in the short-term. In the medium-term from 3- to 5-year horizons, we observe a general decreasing trend of the government consumption multiplier. The 5-year government consumption multiplier ranges from (-0.26) in Nigeria to (3.01) in Rwanda, clearly showing the decreasing trend of fiscal policy in the medium term. For almost half of the baseline sample, the government consumption multipliers are greater than unity, but they are only statistically different from zero in Cameroon

(CMR), Central Africa rep (CAF), Chad (TCD), Comoros (COM), Kenya (KEN), Madagascar (MDG), Rwanda (RWA), Senegal (SEN), Sierra Leone (SLE), and Sudan (SDN). These fiscal multipliers are in the range of those found in the literature for LICs (see Kraay (2014), Chian Koh (2017), and Shen et al. (2018)).

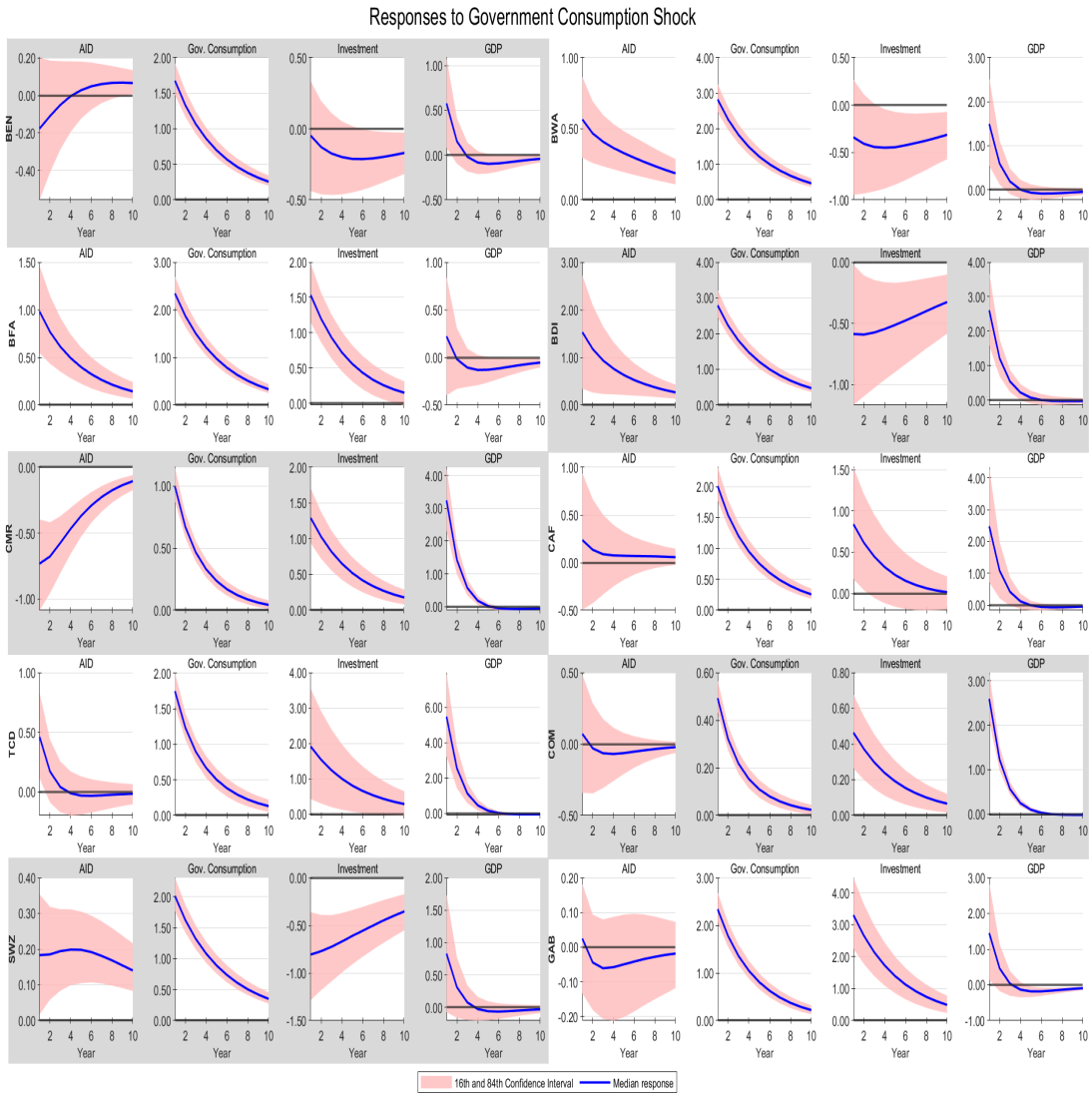


Figure 2.4: **IRFs to a one unit government consumption shock for the baseline specification, BPVAR. The solid blue lines represent the median response. The shadowed area represents the 16th and 84th confidence intervals of the IRFs**

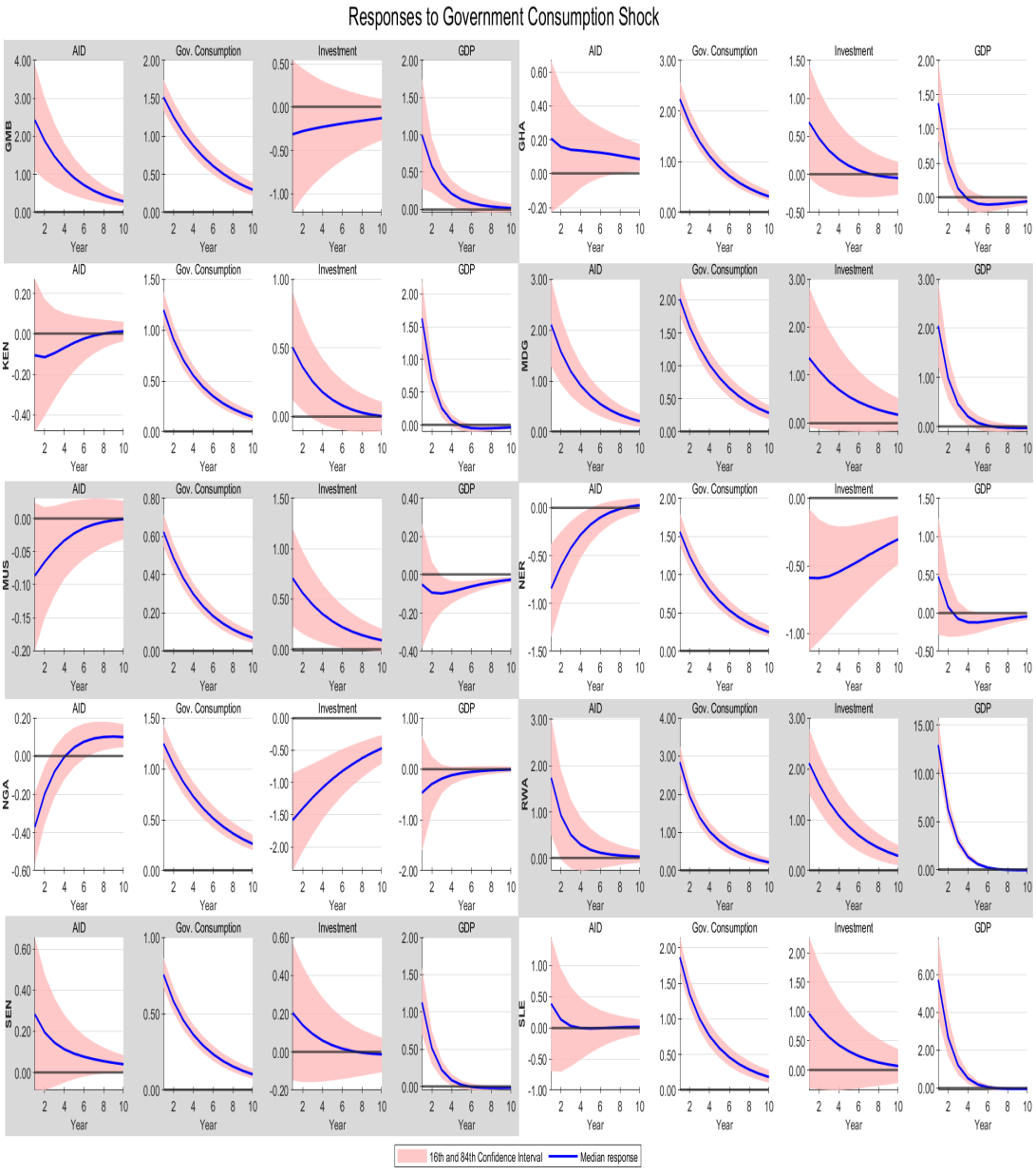


Figure 2.5: **IRFs to a one unit government consumption shock for the baseline specification, BPVAR. The solid blue lines represent the median response. The Shadowed area represents the 16th and 84th confidence intervals of the IRFs**

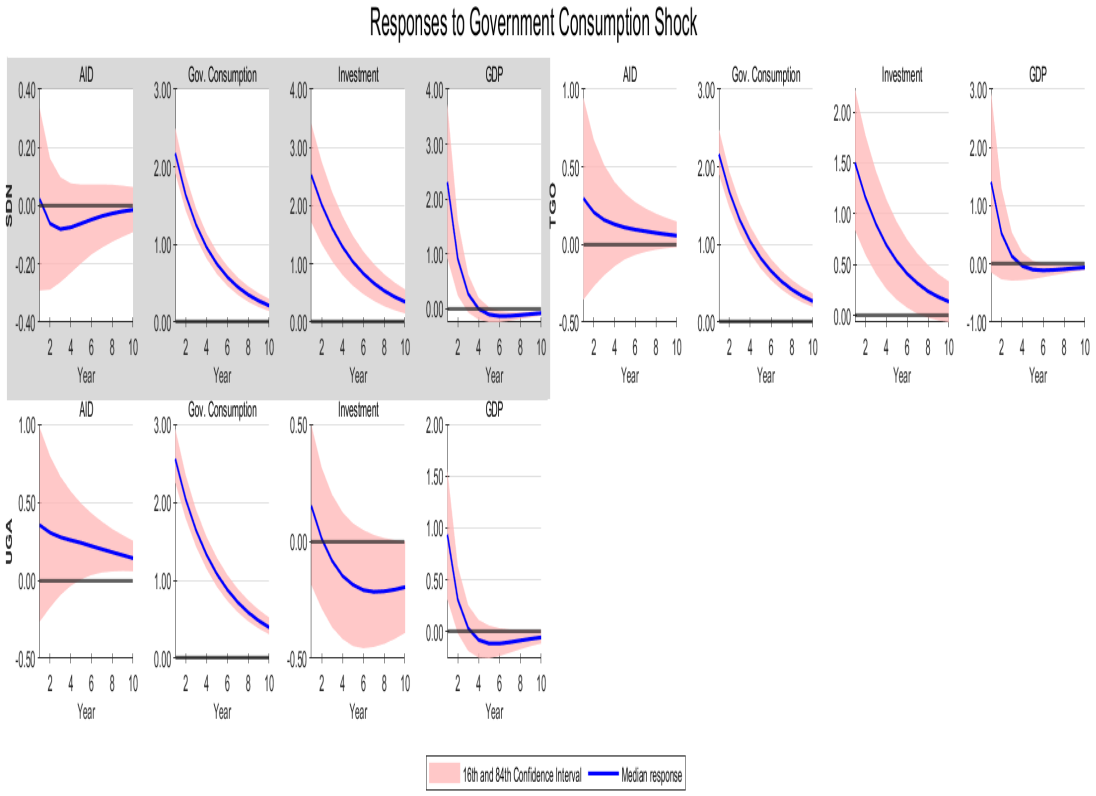


Figure 2.6: **IRFs to a one unit government consumption shock for the baseline specification, BPVAR. The solid blue lines represent the median response. The Shadowed area represents the 16th and 84th confidence intervals of the IRFs**

2.4 Robustness

For the purpose of robustness, we estimate Equation (2.1) for 30 SSA countries: Benin (BEN), Botswana (BWA), Burkina Faso (BFA), Burundi (BDI), Cameroon (CMR), Central African Republic (CAF), Chad (TCD), Comoros (COM), Eswatini (SWZ), Gabon (GAB), Gambia (GMB), Ghana (GHA), Guinea (GIN), Kenya (KEN), Madagascar (MDG), Mali (MLI), Mauritius (MUS), Mozambique (MOZ), Namibia (NAM), Niger (NER), Nigeria (NGA), Rwanda (RWA), Senegal (SEN), Sierra Leone (SLE), South Africa (ZAF), Sudan (SDN), Tanzania (TZA), Togo (TGO), Uganda (UGA), and Zambia (ZMB). Using annual data from 1994-2017.

We also estimate Equation (2.1), using a lag structure of two years, since the baseline results were produced using a uniform lag structure of one year. This was done to simplify the estimation process of the BPVAR model, which requires a large number of parameters. However, we acknowledge that using a longer lag structure would not be feasible due to limited degrees of freedom. Therefore, to test the robustness of our results, we examine the impact of using a two-year lag structure (L=2).

As an additional robustness check, we estimated Equation (2.1), by adding exogenous U.S. variables to the baseline specification, since the baseline specification includes variables that are specific only to SSA countries in our sample. This is done to check whether our baseline results are robust to external shocks. The U.S. variables as exogenous variables, includes the U.S. output gap, U.S. inflation, U.S. shadow rate and S&P 500 (see Di Serio et al. (2020), Amendola et al. (2020) and Wu and Xia (2016)).

2.4.1 Aid Impulse Responses

Figures C.1-C.3[6] confirm that the results we obtained from the baseline sample of 23 SSA countries are robust for an unexpected aid shock on GDP. Therefore, the baseline sample results are robust to both the number of SSA countries and the time horizon considered.

[6]See, APPENDIX C for the robustness check results (tables and figures)

As already described above, an unexpected aid shock has a persistent positive significantly different from zero impact on GDP in the SSA. In accordance with what we found for the baseline sample, an aid shock has a positive impact on both government consumption and investment, however, this effect lasts only in the medium term (2-5 years). Regardless of the huge heterogeneity that exists in the SSA, the results of the baseline sample are robust both to the number of countries and the time period considered.

Table C.0.1 shows the aid cumulative multipliers for each of the 30 SSA countries in the robustness sample. Aid multipliers are generally positive in the medium-term as in the baseline sample (although there exists some slight variation). However, Table C.0.1 shows the high heterogeneity that exists between the aid multipliers in SSA. Consistent with the impulse responses of an aid shock, aid multipliers are higher in the medium term for the baseline sample. Impact multipliers range from (-4.37) in South Africa (ZAF) to (1.55) in Chad (TCD). Whiles in the medium-term 5-year horizon aid multiplier ranges from (-2.70) in South Africa (ZAF) to (1.33) in Chad (TCD). Thus, indicating the efficacy of aid in SSA countries.

2.4.2 Government spending Impulse Responses

Figures C.4-C.6 confirm that the results we obtained from the baseline sample of 23 SSA countries for an unexpected government consumption shock are robust to both the number of SSA countries and the time horizon considered. Consistent with what we found for the baseline sample, a government spending shock leads to a positive impact on both GDP and investment in the SSA in the short and medium-term, thus suggesting that the demand effect is taking place as expected.

Table C.0.1 shows fiscal multipliers that are consistent with those we found for our baseline sample; it also clearly shows the heterogeneity that exists between the SSA countries. The impact multipliers range from (-0.54) in Nigeria (NGA) and (4.19) in Rwanda (RWA), thus suggesting the high potency of fiscal policy in the SSA. In the medium-term from 3-year to 5-year horizons, we generally observe a decreasing trend of the government consumption

multiplier. The 5-year government consumption multiplier ranges from (-0.35) in Nigeria (NGA) to (3.33) in Rwanda (RWA), clearly showing the decreasing trend of fiscal policy in the medium term.

Overall, these results confirm those found with only the baseline specification. They are robust to changing the sample size, lag structure, the time period, and adding the US exogenous variable to the baseline specification.

2.5 Concluding Remarks

Using the Bayesian panel VAR model with cross-sectional heterogeneity for 23 SSA countries from 1983 to 2017, with shocks to both aid and government consumption identified through the generalized impulse response function. For the baseline specification we found that: (i) Consistent with the aid-growth literature, an unexpected aid shock has an overall positive effect on GDP, government consumption, and investment in SSA. Aid multipliers are higher in the medium term for the baseline sample; (ii) As expected, we saw that an unexpected government spending shock also leads to a positive impact on aid, GDP, and investment in the SSA in the short and medium term, thus suggesting that the demand effect has taken place; (iii) These results show that there exists much heterogeneity in SSA countries, thus, indicating that the effects of both aid and government consumption shock are mainly based on some country characteristics. This heterogeneity among SSA countries could be explained by the inherent nonlinearities that exist between fiscal policy and the following variables: degree of trade openness, financial openness, level of public debt, exchange rate regime, composition of government spending, etc., (see, Ilzetzki et al. (2013), Chian Koh (2017), Huidrom et al. (2020)); (iv) Furthermore, these results are robust to changing the sample size, lag structure, the time period, and adding the US exogenous variable to the baseline specification.

Table 2.3.1 shows both the aid and government consumption cumulative multipliers for each of the 30 SSA countries in the baseline sample. These multipliers are computed based

on Equation (2.4) for the 1-year, 3-year, and 5-year horizons. Table 2.3.1 shows the high disparity between aid multipliers across the SSA. Consistent with the impulse responses of an aid shock, aid multipliers are higher in the medium term for the baseline sample. Impact multipliers range from (-0.64) in Nigeria (NGA) to (2.72) in Eswatini (SWZ). Whiles in the medium-term 5-year horizon aid multiplier ranges from (-0.31) in Nigeria (NGA) to (1.98) in Gabon (GAB).

We could also see from Table 2.3.1 the heterogeneity that is inherent in the baseline sample; this could be clearly seen with the high disparity that exists between government consumption multipliers across the region. Consistent with the impulse responses of government consumption shock, we observe higher government consumption multipliers at impact for almost the entire baseline sample. With impact multipliers ranging from (-0.38) in Nigeria and (4.56) in Rwanda, this suggests the high potency of fiscal policy in the SSA in the short-term. In the medium- term from 3- to 5-year horizons, we observe a general decreasing trend of the government consumption multiplier. The 5-year government consumption multiplier ranges from (-0.26) in Nigeria to (3.01) in Rwanda, clearly showing the decreasing trend of fiscal policy in the medium term.

In general, these results have huge policy implications for the SSA, as they reiterate the importance of both aid and fiscal policy in this region. Furthermore, it shows the need for more studies in the SSA on the key determinants of the size and impact of both aid and government consumption multipliers. This will allow us to explain the causes of the huge disparity in the size of the multipliers that is inherent across the region.

Appendices

Appendix B

TECHNICAL DETAILS FROM SECTION 2.2.1

Thus, in the hierarchical prior identification strategy, the set of vectors β_i (i = 1, 2, ..., N), the set of residual covariance matrix Σ_i (i = 1, ..., N), and the common mean and covariance of the VAR coefficients b and Σ_b are all treated as random variables and included in the estimation process. Representing β_i and Σ_i by β and Σ, then, $\beta = \{\beta_1,\ \beta_2,\ ..., \beta_N\}$ and $\Sigma = \{\Sigma_1,\ \Sigma_2,\ ..., \Sigma_N\}$ we can now write the complete posterior distribution as follows:

$$\pi(\beta, \Sigma, b, \Sigma_b|y) \propto \pi(y|\beta, \Sigma)\pi(\beta|b, \Sigma_b)\pi(b)\pi(\Sigma_b)\pi(\Sigma) \tag{B.1}$$

The posterior is proportional to the likelihood function $\pi(y|\beta, \Sigma)$, the priors for β and Σ_b, respectively $\pi(\beta|b, \Sigma_b)$ and $\pi(\Sigma)$, and the hyperpriors $\pi(b)$ and $\pi(\Sigma_b)$. Without aggregating the data, the likelihood functions is obtained as:

$$\pi(y|\beta, \Sigma) \propto \prod_{i=1}^{N} |\Sigma_i|^{-\frac{1}{2}} \exp^{-\frac{1}{2}(y_i - \bar{X}_i\beta_i)'(\Sigma_i)^{-1}(y_i - \bar{X}_i\beta_i)} \tag{B.2}$$

Since $\beta_i \sim N(b, \Sigma_b)$, then the prior density for β is:

$$\pi(\beta|b,\Sigma_b) \propto \prod_{i=1}^{N} |\Sigma_b|^{-\frac{1}{2}} \exp^{-\frac{1}{2}(\beta_i - b)'\Sigma_b^{-1}(\beta_i - b)} \tag{B.3}$$

For the hyperparameter b, the hyperprior will be a diffuse (improper) prior:

$$\pi(b) \propto 1 \tag{B.4}$$

We follow the VAR coefficient covariance matrix of a Minnesota prior as in Litterman (1986) to build a hyperprior for Σ_b), which relies on a covariance matrix Ω_b, with diagonal of dimension q × q, where q = n (np + q), the total number of coefficients in each unit. It is diagonal because it assumed that there is no covariance between the parameters. For the parameters in β, which relates endogenous variables to its own lags, the variance will be equal to Equation (B.5):

$$\sigma^2_{a_{ii}} = \left(\frac{1}{l^{\lambda_3}}\right)^2 \tag{B.5}$$

where l denotes the lag considered and λ_3 is a scaling coefficient that controls the speed at which increasing lags converge to zero with greater certainty.

The variance for cross-lag coefficients is given by Equation (B.6):

$$\sigma^2_{ij} = \left(\frac{\sigma_i^2}{\sigma_j^2}\right)\left(\frac{\lambda_2}{l^{\lambda_3}}\right)^2 \tag{B.6}$$

where σ_i^2 and σ_j^2 are scaling parameters that control for the relative coefficient sizes on variables i and j, which are obtained by fitting an autoregressive model pooling the data of all units for each endogenous variable since the variance is assumed to be constant across units. Thus, λ_2 denotes a cross-variable specific variance parameter.

For the intercepts (and eventually exogenous variables) the variance is given by Equation (B.7):

$$\sigma_{zi}^2 = \sigma_i^2(\lambda_4)^2 \tag{B.7}$$

where σ_i^2 is the residual variance of the autoregressive model for variable i, and λ_4 is a large variance parameter. The full covariance matrix is then defined as in Equation (B.8):

$$\Sigma_b = (\lambda_1 \otimes i_q)\Omega_b \tag{B.8}$$

where $(\lambda_1 \otimes i_q)$ is a q $\times$ q diagonal matrix. Taking Ω_b as fixed and known and treating λ_1 as a random variable implies that the full prior for Σ_b reduces to the determination of the prior only for λ_1. When the prior variance is null, that is, λ_1 is 0, all the β_is will take the value of the own mean b, and we obtain the pooled estimator. As $\lambda_1 \to \infty$, the prior becomes uninformative on b, there is no sharing of information between units, and the coefficients for each unit become their own estimates. Preferably, λ_1 should take intermediate values that balance individual and pooled estimates.

Thus, in this study, the prior distribution for λ_1 is an inverse gamma distribution expressed by Equation (B.9):

$$\lambda_1 \sim IG\left(\frac{s_0}{2}, \frac{v_0}{2}\right) \tag{B.9}$$

which implies that

$$\pi(\lambda_1|\frac{s_0}{2}, \frac{v_0}{2}) \propto \lambda_2^{\frac{s_0}{2}-1} e^{-\frac{v_0}{2\lambda_1}} \tag{B.10}$$

with values for $s_0, v_0 \leq 0.001$, which is a weakly informative prior that avoids sensitivity of the results to the choice of this prior.

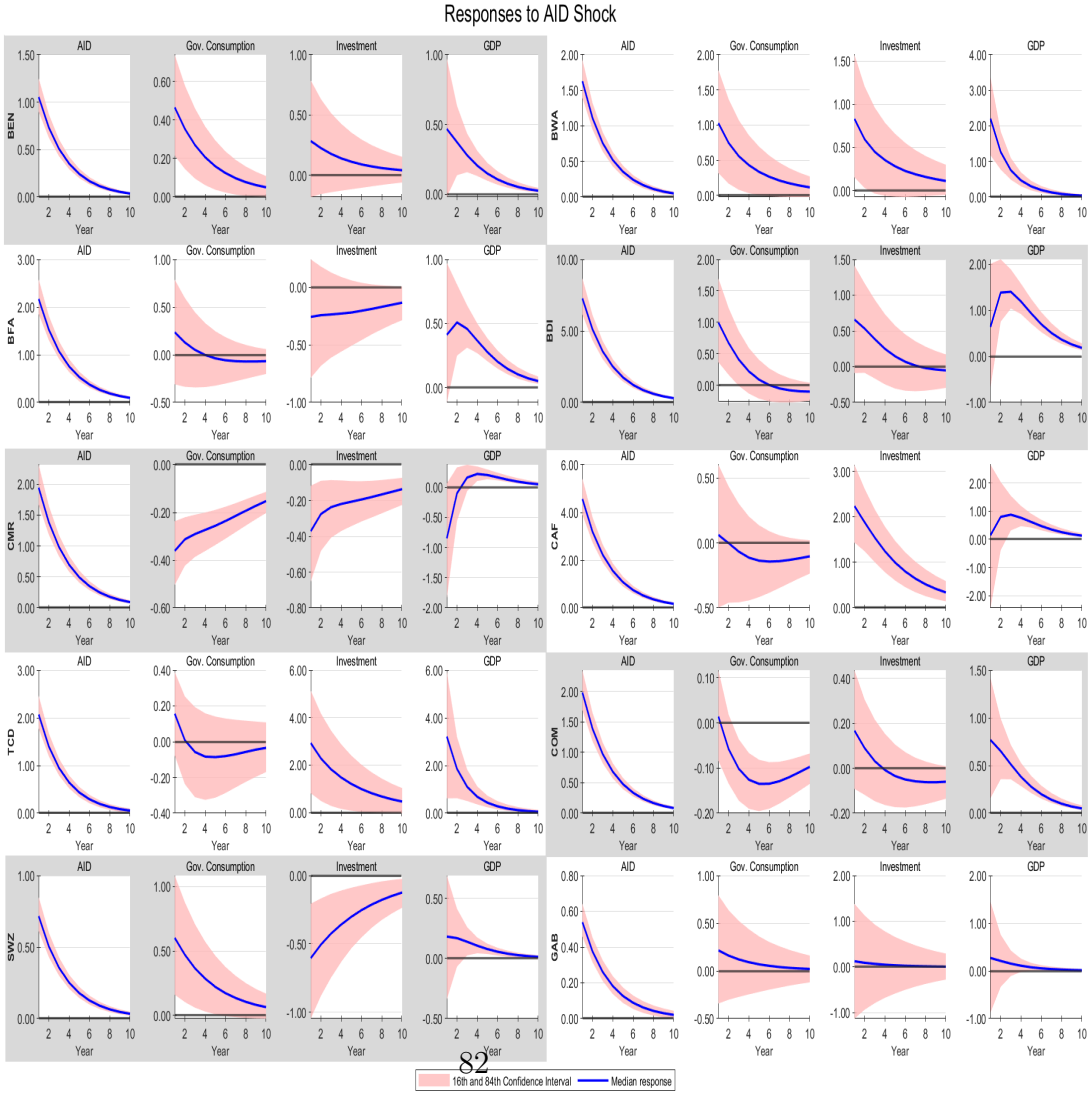
Therefore, considering the classical diffuse prior for Σ_i, whose full density is given by

$$\pi(\Sigma) \propto \prod_{i=1}^{N} |\Sigma_i|^{-\frac{n+1}{2}} \tag{B.11}$$

given that we now have all the elements required to build the full posterior, substituting in Equation (B.1), the likelihood function (Equation B.2), and the priors (Equations B.3, B.4, B.10, and B.11). But since this posterior does not allow for any analytical derivations of the marginal posteriors, one needs to rely on the numerical methods provided by the Gibbs sampler (see Jarociński (2010) for further details). Specifically, we take 20,000 draws via the Gibbs sampling, discarding the first 10,000 as burn-in draw.

Appendix C

ROBUSTNESS CHECK RESULTS



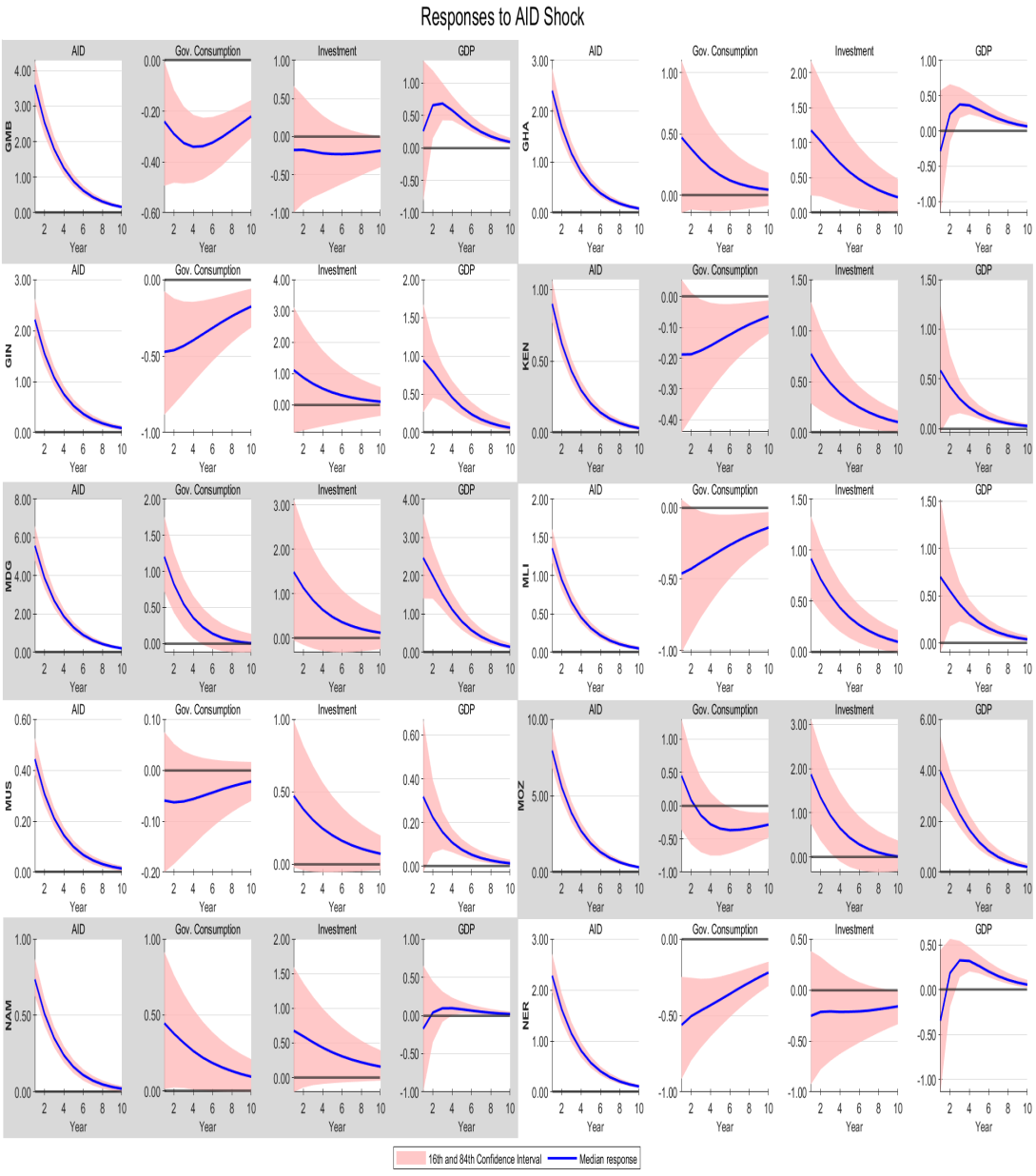


Figure C.2: **IRFs to a one unit aid shock for the robustness sample, BPVAR. The solid blue lines represent the median response. The shadowed area represents the 16th and 84th confidence intervals of the IRFs**

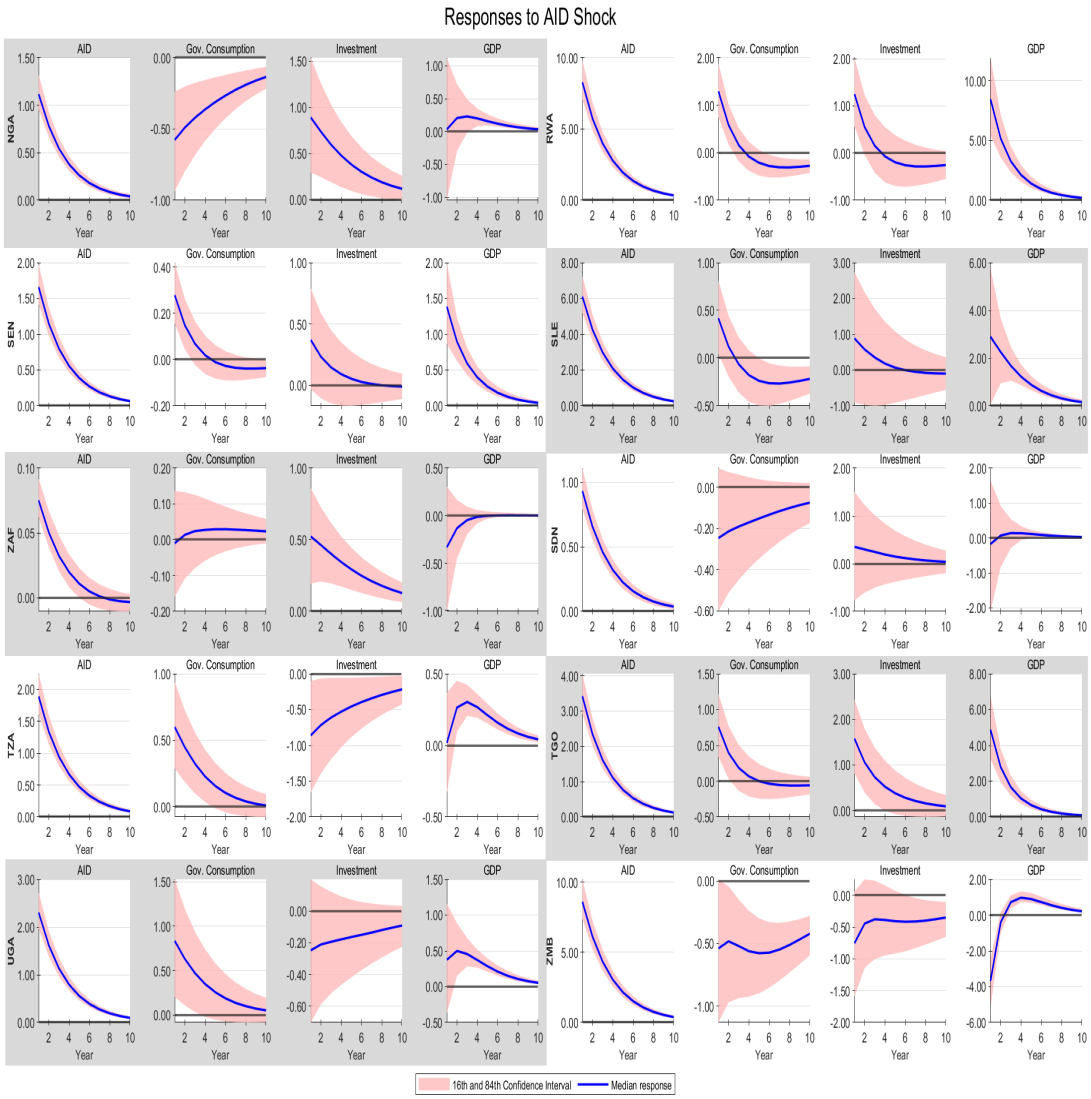


Figure C.3: **IRFs to a one unit aid shock for the robustness sample, BPVAR. The solid blue lines represent the median response. The shadowed area represents the 16th and 84th confidence intervals of the IRFs**

Table C.0.1: **Aid & Government Consumption Multipliers for 30 SSA countries from 1994-2017**

	Aid Multipliers				Government Consumption Multipliers		
Units	year 1	year 3	year 5	Units	year 1	year 3	year 5
BEN	0.44	**0.49**	**0.51**	BEN	0.01	0.04	0.04
BWA	**1.35**	**1.21**	**1.14**	BWA	**0.54**	**0.38**	0.29
BFA	0.19	**0.29**	**0.33**	BFA	0.02	0.02	0.02
BDI	0.09	**0.21**	**0.27**	BDI	**0.79**	**0.66**	**0.58**
CMR	-0.44	-0.18	-0.07	CMR	**3.97**	**2.64**	1.91
CAF	0.03	**0.18**	**0.25**	CAF	**1.31**	0.90	0.70
TCD	**1.55**	**1.40**	**1.33**	TCD	0.27	0.27	0.24
COM	**0.39**	**0.44**	**0.47**	COM	**3.61**	**2.77**	**2.28**
SWZ	0.25	**0.31**	**0.34**	SWZ	0.00	0.00	-0.01
GAB	0.50	0.54	**0.55**	GAB	**1.00**	**0.69**	0.52
GMB	0.07	**0.20**	**0.26**	GMB	**3.10**	**2.16**	1.65
GHA	-0.12	**0.06**	**0.15**	GHA	**0.75**	**0.52**	0.41
GIN	**0.43**	**0.49**	**0.52**	GIN	-0.17	-0.16	-0.15
KEN	0.65	**0.67**	**0.68**	KEN	0.49	0.29	0.21
MDG	**0.44**	**0.49**	**0.52**	MDG	**1.25**	**1.04**	**0.91**
MLI	0.51	**0.56**	**0.58**	MLI	0.32	0.18	0.13
MUS	0.72	**0.73**	**0.73**	MUS	-0.28	-0.20	-0.16
MOZ	**0.50**	**0.53**	**0.55**	MOZ	**1.11**	**0.79**	0.63
NAM	-0.24	-0.03	**0.07**	NAM	**0.74**	**0.51**	0.39
NER	-0.15	**0.03**	**0.12**	NER	**0.70**	0.38	0.24
NGA	0.03	0.19	**0.27**	NGA	-0.54	**-0.41**	**-0.35**
RWA	**1.02**	**0.94**	**0.90**	RWA	**4.19**	**3.65**	**3.33**
SEN	**0.84**	**0.80**	**0.78**	SEN	**1.49**	**1.25**	**1.10**
SLE	**0.47**	**0.51**	**0.53**	SLE	**2.15**	**1.70**	**1.44**
ZAF	-4.37	-3.17	-2.70	ZAF	**1.38**	**0.94**	0.72
SDN	-0.18	0.02	**0.12**	SDN	1.13	0.75	0.56
TZA	0.01	**0.14**	**0.20**	TZA	**0.45**	**0.37**	**0.32**
TGO	**1.42**	**1.26**	**1.19**	TGO	**1.40**	**1.06**	**0.88**
UGA	0.16	**0.26**	**0.31**	UGA	**0.27**	0.20	0.16
ZMB	**-0.43**	**-0.18**	**-0.06**	ZMB	**0.91**	0.51	0.33

Note: Aid and government spending One-, three- and five-year cumulative multipliers. Bold entries represent multipliers that are derive from impulse response significantly different from zero.

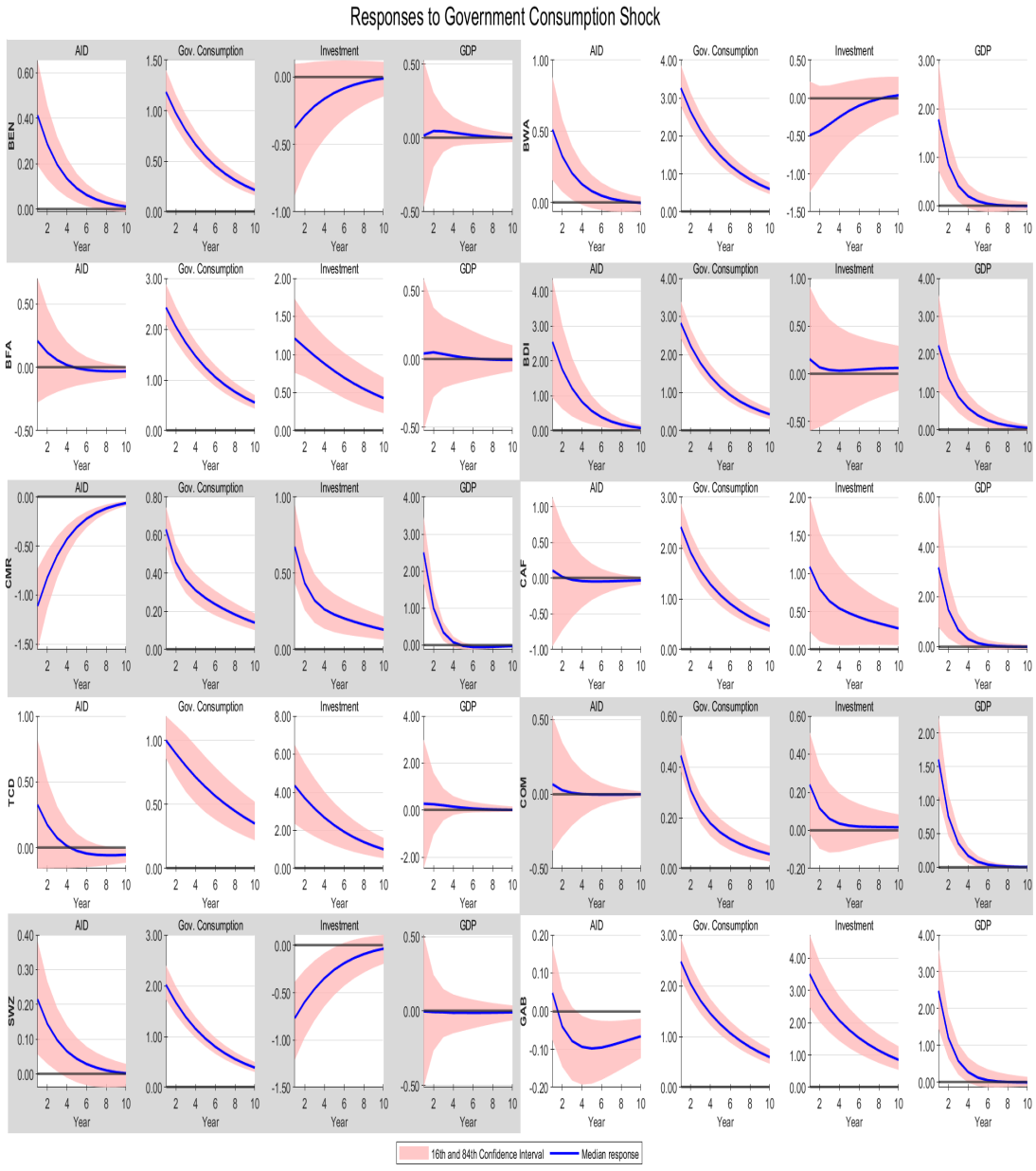


Figure C.4: **IRFs to a one unit government consumption shock for the robustness sample, BPVAR. The solid blue lines represent the median response. The shadowed area represents the 16th and 84th confidence intervals of the IRFs**

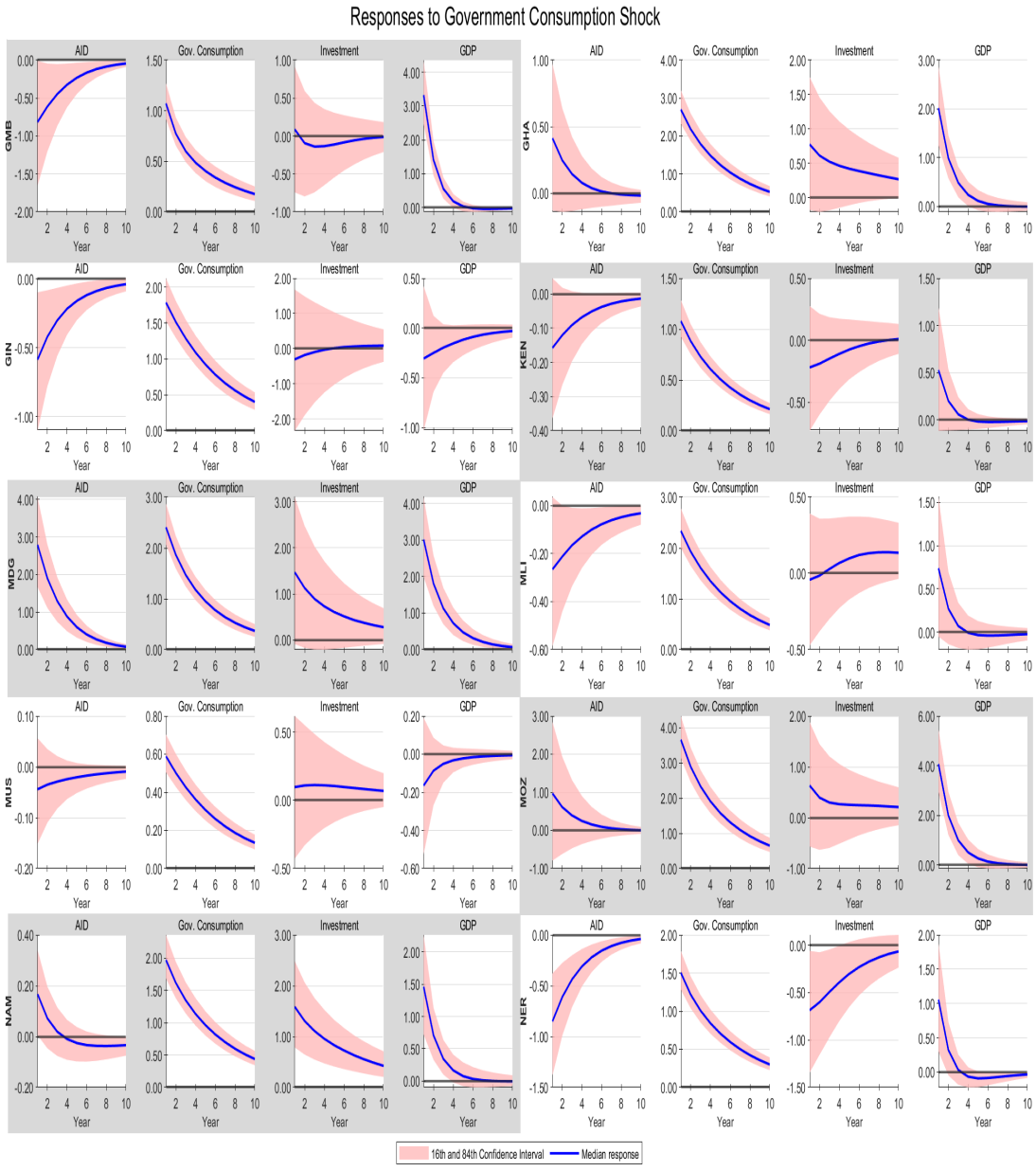


Figure C.5: **IRFs to a one unit government consumption shock for the robustness sample, BPVAR. The solid blue lines represent the median response. The shadowed area represents the 16th and 84th confidence intervals of the IRFs**

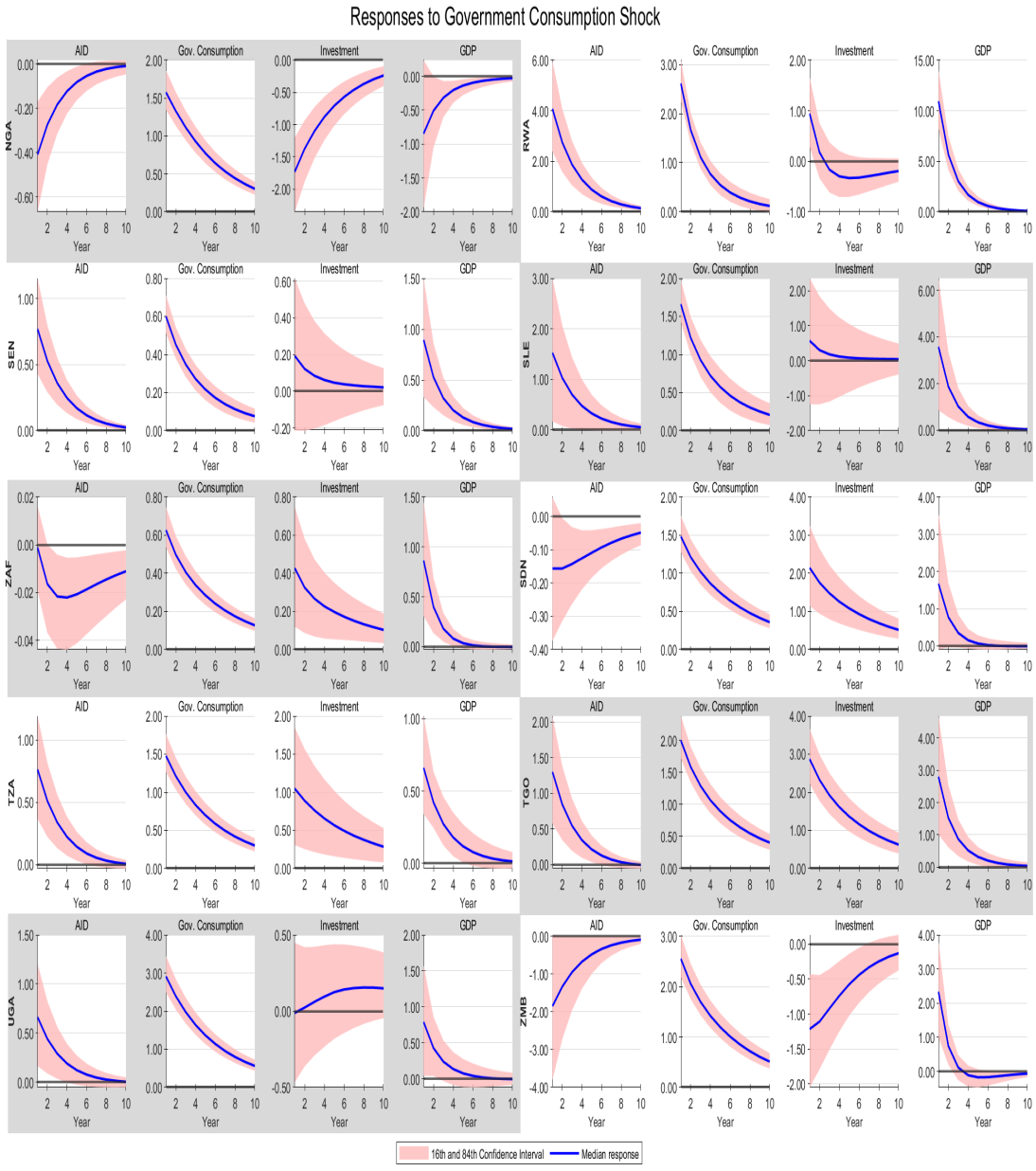


Figure C.6: **IRFs to a one unit government consumption shock for the robustness sample, BPVAR. The solid blue lines represent the median response. The shadowed area represents the 16th and 84th confidence intervals of the IRFs**

Table C.0.2: **2-years lags**
Aid & Government Consumption Multipliers for 23 SSA countries from 1985-2017

	Aid Multipliers				Government Consumption Multipliers		
Units	year 1	year 3	year 5	Units	year 1	year 3	year 5
BEN	**-0.31**	-0.23	**-0.11**	BEN	0.25	0.09	0.02
BWA	**1.07**	0.83	**0.52**	BWA	**0.38**	**0.19**	**0.09**
BFA	0.02	0.02	0.02	BFA	-0.23	**-0.22**	-0.17
BDI	**0.19**	0.15	0.12	BDI	**0.87**	**0.56**	**0.33**
CMR	0.41	0.36	0.26	CMR	**3.63**	**3.02**	**2.06**
CAF	0.3	0.28	0.2	CAF	0.8	0.54	0.29
TCD	**1.98**	**1.7**	**1.14**	TCD	**3.03**	**2.41**	**1.61**
COM	-0.25	-0.17	-0.08	COM	**4.88**	**4.26**	**3.16**
SWZ	**3.05**	**2.36**	**1.52**	SWZ	0.42	0.2	0.1
GAB	**2.6**	**2.25**	**1.54**	GAB	**0.81**	**0.6**	**0.31**
GMB	0.09	0.09	0.08	GMB	**0.82**	0.52	0.3
GHA	-0.06	-0.02	0	GHA	**0.75**	**0.49**	**0.27**
KEN	**0.27**	**0.24**	0.17	KEN	**0.83**	**0.55**	**0.3**
MDG	**0.26**	**0.22**	0.15	MDG	**1.17**	**0.84**	**0.51**
MUS	0.29	0.32	0.21	MUS	0.31	0.21	**0.06**
NER	-0.03	0.01	0.04	NER	0.16	0	-0.04
NGA	-0.34	-0.16	-0.08	NGA	0.37	0.13	0.06
RWA	**0.77**	**0.62**	**0.42**	RWA	**4.42**	**3.7**	**2.67**
SEN	**0.53**	**0.44**	0.3	SEN	**1.53**	**1.11**	**0.68**
SLE	0.24	0.2	0.15	SLE	**3.17**	**2.53**	**1.7**
SDN	**1.43**	**1.21**	**0.81**	SDN	**1.17**	**0.86**	**0.49**
TGO	**1.18**	**1.01**	**0.68**	TGO	0.72	0.49	**0.25**
UGA	**-0.33**	**-0.24**	**-0.13**	UGA	**0.35**	**0.17**	**0.07**

Note: Aid and government spending One-, three- and five-year cumulative multipliers. Bold entries represent multipliers that are derived from impulse responses significantly different from zero.

Table C.0.3: **Baseline plus US exogenous variables**
Aid & Government Consumption Multipliers for 23 SSA countries from 1985-2017

	Aid Multipliers				Government Consumption Multipliers		
Units	year 1	year 3	year 5	Units	year 1	year 3	year 5
BEN	-0.11	**0.02**	**0.06**	BEN	**0.4**	**0.16**	**0.07**
BWA	**1.27**	**1.08**	**0.99**	BWA	**0.46**	**0.24**	**0.15**
BFA	0.25	**0.24**	**0.23**	BFA	0.16	**0.02**	**-0.04**
BDI	0.07	**0.14**	**0.16**	BDI	**1.07**	0.72	0.58
CMR	0.09	**0.19**	**0.22**	CMR	**3.57**	**2.96**	**2.72**
CAF	0.05	0.11	0.13	CAF	0.7	0.43	0.32
TCD	**1.9**	**1.74**	**1.67**	TCD	**3.16**	**2.58**	2.33
COM	0.18	**0.23**	**0.25**	COM	**5.09**	**4.31**	**3.95**
SWZ	**2.37**	**2.09**	**1.95**	SWZ	**0.69**	**0.41**	**0.3**
GAB	**2.85**	**2.73**	**2.68**	GAB	0.32	**0.1**	0.01
GMB	-0.04	**0.05**	**0.07**	GMB	**0.64**	0.47	0.39
GHA	0.01	**0.07**	**0.08**	GHA	**0.64**	**0.38**	**0.27**
KEN	0.07	**0.15**	**0.17**	KEN	**1.43**	**1**	**0.83**
MDG	**0.4**	**0.39**	**0.38**	MDG	**1.02**	**0.75**	0.62
MUS	**0.8**	**0.81**	**0.81**	MUS	-0.13	**-0.29**	**-0.35**
NER	0.05	**0.16**	**0.2**	NER	-0.04	**-0.2**	**-0.26**
NGA	-0.31	-0.13	-0.06	NGA	-0.03	**-0.15**	**-0.19**
RWA	**0.57**	**0.55**	**0.54**	RWA	**4.55**	**3.74**	**3.37**
SEN	**0.45**	**0.45**	**0.45**	SEN	**1.4**	**1**	**0.83**
SLE	0.27	**0.31**	**0.32**	SLE	**3.43**	**2.73**	2.42
SDN	**1.74**	**1.61**	**1.56**	SDN	**1.03**	0.69	0.55
TGO	**1.47**	**1.34**	**1.29**	TGO	0.71	0.43	0.32
UGA	-0.04	0.02	0.04	UGA	**0.42**	**0.22**	**0.14**

Note: Aid and government spending One-, three- and five-year cumulative multipliers. Bold entries represent multipliers that are derived from impulse responses significantly different from zero.

Chapter 3

Spending Multipliers and Openness: An Empirical Analysis on Sub-Saharan Africa (SSA) Countries

3.1 Introduction

The results obtained from chapter 2 of this thesis show the need to understand what are some possible plausible explanations for the huge heterogeneity that exists between SSA countries on the size of both the aid and fiscal multipliers. This heterogeneity among SSA countries could be explained by the inherent nonlinearities that exist between fiscal policy and the following variables: degree of trade openness, financial openness, level of public debt, exchange rate regime, composition of government spending, etc., (see, Ilzetzki et al. (2013), Chian Koh (2017), and Huidrom et al. (2020)).[1] However, the COVID-19 pandemic has also put fiscal policy in the spotlight of global policy discussions and led to a huge increase in the adoption of fiscal policy as a stabilization tool. The COVID-19 pandemic has highlighted the importance of foreign aid since many donors were focusing on their domestic needs to

[1]However, due to data limitations, the analysis of this chapter is limited to only trade openness and financial openness.

curb the virus, thus a reduction in the amount of aid given to developing countries. However, due to the adverse effects of the pandemic, the IMF has provided debt relief to many Sub-Saharan Africa (SSA) countries. These events point to the urgent need to understand the macroeconomic dynamics of foreign aid.

Thus, this research seeks to investigate the non-linearity that influences the size of the fiscal and aid multipliers at different levels of financial openness and trade openness in SSA. We, therefore, seek to answer the following questions; What is the size of the fiscal and aid multiplier in the SSA? How does the level of financial openness influence the size of the aid and government spending multiplier? How does the level of trade openness impact the size of the fiscal and aid multiplier?

Despite the widespread research on the size of the fiscal multipliers especially in the developed world, there is still no consensus in this literature on what is the size of fiscal multipliers. Inaccurate estimates of fiscal multipliers could lead to major growth forecast errors (Blanchard and Leigh (2013)). However, one could ask why we investigate the behavior of multipliers with respect to financial openness and trade openness. This is obvious, given the huge reliance of this region on international trade and the increasing effects of globalization. Also from chapter 2 of this thesis, our results highlight the need to understand the possible explanations of the heterogeneity of fiscal multipliers in SSA countries. The wide range of fiscal multiplier estimates found in this literature is mainly due to differences in the approaches used to identify the underlying fiscal shocks, and in the model specifications (see Caldara and Kamps (2017), Caldara and Kamps (2008), Chahrour et al. (2012), Ramey (2016), and Ramey and Zubairy (2018)). Thus, there is a need for continued research on the size of the fiscal multiplier, especially for SSA countries.

Regarding the size of fiscal multipliers for low-income countries, Ilzetzki and Végh (2008) found that cumulative fiscal multipliers reach their peak at 0.63 for developing countries and 0.91 for advanced countries. Kraay (2012), and Kraay (2014) estimate the size of the government spending multiplier on impact, to be (0.48 to 0.67) for 29 low-income countries and 0.4

for 102 developing countries, respectively. Ilzetzki et al. (2013), estimates the government consumption multiplier for 44 countries from 1960– 2007, both on impact and in the long run, is (0.39 to 0.57) and (1.5 to 1.6), respectively. Using a structural panel VAR model for 120 countries from 1960–2014, Chian Koh (2017) found that fiscal stimulus (measured by shocks in government consumption) has an expansionary effect on output, with multipliers in the range of 0.4–1.8. Thus, he found that fiscal multipliers are larger in advanced economies when public debt is low, at a high level of financial development, in a financial crisis, and during business cycle downturns.

While Ramey (2019)'s survey of the literature found fiscal spending multipliers to be in the 0.6-1 range, Caldara and Kamps (2017) found that increase in government spending provides more stimulus than tax cuts, and that the one-year median tax multiplier ranges between –0.5 and –0.7, while the spending multiplier ranges between 1 and 1.3. Hlaváček et al. (2021) adopting a regime-switching model, studies the size of the fiscal multiplier for 17 developing countries from 1995Q1–2015Q4, using a non-linear panel threshold vector autoregression (PTVAR) model. They found that the response of GDP to government expenditure shock during a recovery period in developing countries is twice that of developed ones. Moreover, studies comparing the effectiveness of fiscal policy in developed and developing countries mainly use linear models (see, Ilzetzki and Végh (2008); Kraay (2012); Estevão and Samaké (2013), Ilzetzki et al. (2013), and Chian Koh (2017)), these studies found that fiscal multipliers are larger in advance countries compared to those in developing economies.

However, among other studies, Batini et al. (2014) found that the main causes of the difference between the size of fiscal multiplier for developed and developing countries could be the result of systematic disparity in the structure of GDP, labor market mechanisms, availability, and source of financial resources, smoothness of consumption behavior, and efficiency of public administration and management. Huidrom et al. (2020) examine why fiscal multipliers (fiscal stimulus measured by government consumption shocks and fiscal position

by government debt-to-GDP ratio) vary depending on the initial fiscal position of a country. They used an Interacted Panel Vector Autoregressive (IPVAR) model to estimate fiscal multipliers for 34 countries (19 advanced and 15 developing) over the period 1980Q1-2014Q1. They found that fiscal multipliers are smaller when the fiscal position is weak (high debt). They also found that this effect operates through two channels: a Ricardian channel, where households reduce consumption in anticipation of future tax hikes when debt is high; and an interest rate channel, where fiscal stimulus raises sovereign risk premia and borrowing costs when debt is high. Whiles, Hory (2016) investigates the heterogeneity of fiscal multipliers (measured by government consumption shocks) between emerging market economies (EMEs) and advanced economies (AEs). Using a Panel Vector Autoregressive (PVAR) model and an Interacted Panel Vector Autoregressive (IPVAR) model to estimate fiscal multipliers for 48 countries (24 EMEs and 24 AEs) over the period 1990-2013. She founds that fiscal multipliers are smaller in EMEs than in AEs, and that this difference is explained by several factors, such as the degree of trade openness, the level of public debt, the savings rate, the unemployment rate, and the financial development. Given the limited external validity of the findings in the literature, as in Owyang et al. (2013), who shows that findings on the size of the fiscal multiplier for the United States do not necessarily apply to Canada. Thus, we might not be able to make some generalizations of fiscal multipliers from advanced economies to those of low-income countries, there is a need to study the size of the fiscal multipliers in the SSA, which has been neglected in this literature.

Although foreign aid is given by various donors with the objective that it will serve as a complement to government spending, this is seldom the case. There is growing research on the fungibility of aid, (i.e., when the total government spending increases less than the total amount of foreign aid in the recipient developing economies (see, Feyzioglu et al. (1998), Kaya and Kaya (2020)). Unlike estimating the size of fiscal multipliers, there are few or no studies that estimate the size of aid multipliers and their effects on key macroeconomic indicators. Although there exist studies that study the nonlinearity present in the aid-growth

nexus. However, these studies tend to mainly focus only on the impact of aid on growth and/or institutions (see, Hansen and Tarp (2001); Lensink and White (2001); Clemens et al. (2012); Wagner (2014); Harb and Hall (2019)), ignoring the non-linearity that exist between aid and other key macroeconomic indicators. Thus, to our knowledge, this study is the only one that seeks to estimate the nonlinearity that influences the size of aid multipliers for SSA countries at different levels of financial openness and trade openness.

In order to capture the dynamic relationship that exists between government spending, aid, and other macroeconomic indicators (that is, total investment, trade openness, and GDP, etc.), we use an interacted panel vector-autoregressive model (IPVAR-X), as in Sá et al. (2014), and Di Serio et al. (2020). This empirical methodology is adopted in this study because it allows us to evaluate the reactions of both aid and government spending at different levels of financial openness, and trade openness. In the same setup, we are able to evaluate all the combinations chosen for our interaction terms without the need to restrict the sample. This is especially important in light of the available SSA data. While both the Threshold VAR and the Smooth Transition VAR use the information of each state under consideration separately, the Interacted Panel VAR model uses all the information available in the sample. Moreover, it has the capacity to capture both the abrupt and the smooth policy changes inherent in our baseline specification.

Adopting the interaction panel VAR model, the main novelty of this study is that, it's the first to compute both aid and government spending multipliers for 22 SSA countries using the Cholesky identification technique. This current study is also the only one that seeks to understand how the aid multiplier behaves under different levels of financially open, and trade-open economies in the SSA.

In a nutshell, the main findings of this study are as follows: (i) Consistent with the literature on aid fiscal behavior, and the predictions of the traditional Mundell-fleming model, we found that with respect to the interaction term we considered (that is, financial openness,

and trade openness), an unexpected aid shock has a positive impact on government spending, output, and investment in SSA. The aid multiplier is higher if the economy is financially open, and has low trade openness. These results also confirm that aid serves as additional finance for government spending in SSA; (ii) In general, we found that an unexpected government spending shock has a positive impact on output, and investment in SSA. However, government spending multipliers are higher in economies that are financially open, and have low trade openness.

The paper proceeds as follows: section 2 outlines the Interacted panel VAR model, Data & baseline specification, inference, and identification strategy, and how we compute the multipliers; section 3 discusses the main results; section 4 deals with the robustness concerns; and section 5 concludes.

3.2 Methodology

3.2.1 Interacted Panel VAR Model

We use a non-linear panel Interacted Vector Auto-Regressive (I-VAR) approach developed by Towbin and Weber (2013) and Sá et al. (2014) to estimate an interacted panel VAR (IPVAR) model, which is similar to Di Serio et al. (2022). This model is used due to its incorporation of interaction terms. The model specification takes the following recursive form:

$$B_t Y_{i,t} = k + \sum_{k=1}^{L} \Gamma_k Y_{i,t-k} + \sum_{m=1}^{N} k_m^1 X_{i,t,m} + \sum_{k=1}^{L} \sum_{m=1}^{N} \Gamma_{k,m}^1 X_{i,t,m} Y_{i,t-k} + \varepsilon_{i,t} \tag{3.1}$$

where $t = 1, ..., T$ denotes the time dimension; $i = 1, ..., I$ denotes countries, $k = 1, ..., L$ represents the lag structure, and $m = 1, ..., N$ denotes the number of interaction terms. The vector of endogenous variables is denoted by Y_t a $q \times 1$ vector. k is the intercept, Γ_k is a $q \times q$ matrix of autoregressive coefficients, and $\varepsilon_{i,t} \sim N(0, \Sigma_i)$ is the vector of residuals. It could influence both the dynamic relationship between endogenous variables and their level, through $\Gamma_{k,m}^1$ and k_m^1 respectively.

The matrix B_t is a $q \times q$ lower triangular matrix with ones on the main diagonal. Each

component $B_t(w,q)$ represents the contemporaneous effect of the qth-ordered variable on the wth-ordered variable. It is constructed as follows:

$$B_t = \begin{cases} B_t(w,q) = 0 & \text{for } q > w \\ B_t(w,q) = 1 & \text{for } q = w \\ B_t(w,q) = B(w,q) + \sum_{m=1}^{N} B_m^1(w,q) X_{i,t,m} & \text{for } q < w \end{cases} \tag{3.2}$$

where $B_m^1(w,q)$ are regression coefficients that capture the relationship with contemporaneous marginal effects of a change in the interaction terms. The recursive form of the matrix B_t implies that the covariance matrix of the residuals, Σ, is diagonal (for more details on the interacted VAR framework see, for example, Sá et al. (2014)).

3.2.2 Data & Baseline Specification

We estimate an open-economy Interacted panel VAR model for 22 SSA countries: Benin, Botswana, Burundi, Cameroon, Central African Republic, Chad, Comoros, Eswatini, Gabon, The Gambia, Ghana, Kenya, Madagascar, Mauritius, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Sudan, Togo, and Uganda. Using annual data from 1983-2017. Our baseline specification includes variables that are commonly used in this literature (as early as Blanchard and Perotti (2002), and Ilzetzki et al. (2013)).

Our decision to estimate the IPVAR model in light of the above sample and the following variables are influenced by the availability of data, and by what we have reviewed in the existing literature in particular, the works of (Ilzetzki et al. (2013), Kraay (2012), Kraay (2014), Chian Koh (2017), Alnashar et al. (2017) and Kumwenda et al. (2022)), respectively.

Below is the baseline specification for estimating equation (3.1), the vector of endogenous variables,

$$Y_{i,t}' = [A_{i,t}, G_{i,t}, I_{i,t}, GDP_{i,t}],$$

where $A_{i,t}$ represents the Net official development assistance and official aid received,

sourced from the World Bank, world development indicators (WB, WDI); $G_{i,t}$ represents General government final consumption expenditure (percent of GDP), sourced (WB, WDI)); $I_{i,t}$ is the Total Investment, sourced (WB, WDI), and $GDP_{i,t}$ represents the gross domestic product, sourced (WB, WDI). We considered all these variables in real terms and in levels and normalized them using an estimate of the real potential GDP to avoid biases in the aid and government spending multiplier calculation. [2] We considered the following variables as interaction terms: the degree of trade openness, measured by the trade-to-GDP ratio, countries with an average trade-to-GDP ratio less than 60% are considered as 'low trade openness', and all others as 'high trade openness' (WB, WDI), and for Financial openness, we used the normalized version based on the Chinn-Ito index (see Chinn and Ito (2006)). [3] However, in order to estimate a parsimonious model, we use a lag structure of 1 year. Interaction variables are added to the model with a lag of 1 year in order to avoid possible endogeneity problems.

3.2.3 Inference and identification

To capture parameter uncertainty, we use Bayesian estimation by setting an uninformative normal Wishart prior (see Sá et al. (2014)). We first estimate the structural recursive model described in Equation (3.1), where the covariance matrix Σ is diagonal. Thus, we proceed by estimating the model equation by equation. The recursive-form parameters are then drawn from the posterior, [4] and then evaluated at a predetermined value for the interaction terms. The reduced form parameters are calculated by inverting the matrix B_t.

Given the reduced form, we use a Cholesky identification strategy to identify first an unexpected shock to aid, then to government spending. In particular, the aid and government consumption variables are ordered first and second, in such a way that they do not contemporaneously respond to GDP shocks, however, a GDP shock affects these variables

[2] We normalize $A_{i,t}$, $G_{i,t}$, $I_{i,t}$, and $GDP_{i,t}$ to avoid biases in the aid and government spending multiplier calculation, for further details see Di Serio et al. (2020), Di Serio et al. (2022).

[3] The Chinn-Ito index (KA_OPEN) is an index measuring a country's degree of capital account openness.

[4] To avoid the possibility of having explosive IRFs we discarded explosive draws from the unrestricted posterior (see, Cogley and Sargent (2005) and Sá et al. (2014)).

with a lag. [5]

In addition, we assume that the amount of aid received by a country does not depend on its country-specific economic situation, thus, we consider it as the first-ordered endogenous variable. We make 20,000 draws from the posterior distribution and, after discarding the first 10,000 parameter draws as burn-in draws, we use the median over the last 10,000 draws as our central estimate of interest. We account for parameter uncertainty by saving the 16th and 84th percentile of the impulse response function (IRF) distribution as confidence bands.

3.2.4 Multipliers

Our model is estimated using $A_{i,t}$, $G_{i,t}$, $I_{i,t}$, and $GDP_{i,t}$ in levels and are normalized using an estimate of the real potential GDP [6]. According to Ramey and Zubairy (2018) the traditional method of using log levels requires an ex-post conversion to dollar equivalents of the estimated elasticities can result in significant bias. This issue is more pronounced in nonlinear models as in our case. This is because the conversion of estimated elasticities to dollar equivalents after the calculation requires a factor based on the average ratio of GDP to government spending, which can lead to inaccuracies.

Thus, using the type of normalization just described, there is no need to carry out the ex-post conversion that is usually followed in the existing literature (see, Ramey (2011)). The cumulative multipliers are computed as the ratio of discrete approximations of the integral of the median IRFs of real output, aid, and government purchases over a given time horizon $h = 1, ..., H$:

$$M_h = \frac{\sum_{h=0}^{H} dGDP(h)}{\sum_{h=0}^{H} dG(h)} \tag{3.3}$$

where $dGDP_h$ and dG_h denote the value of the respective IRF on the horizon h. G is dependent on the case we are considering and could either be government spending or aid.

[5] This casual ordering is based on the seminal paper by Blanchard and Perotti (2002), who argues that the reactions of fiscal variables to a shock in the real economy are delayed due to decision and implementation lags.

[6] we computed the real potential GDP using the Hamilton filter as described in Hamilton (2018)

3.3 Main Results

In this section, we report the results of the baseline specification interacted with financial openness and trade openness. Subsection 3.1 shows the impulse responses and multipliers of an unexpected aid shock when interacted with financial openness and trade openness. Whiles, subsection 3.2 shows impulse responses and multipliers of an unexpected government spending shock when interacted with the financial openness, and trade openness variables.

3.3.1 Aid Impulse Responses

Financial openness

Here we present the macroeconomic effects of a one-unit aid shock obtained for our baseline specification interacted with the financial openness variable. In the figure, bold lines represent the median responses of each endogenous variable to the aid shock, while shaded areas represent the 16th and 84th confidence intervals of the impulse response functions (IRFs).

Figure 3.1 presents the macroeconomic effects of a one-unit aid shock obtained for our baseline specification interacted with the financial openness. As expected output, investment, and government spending respond positively to an unexpected aid shock. In both cases, the effect of this shock is more persistent with statistical significance for economies that are financially open compared to those that are financially closed. However, in a financially open economy, an increase in international capital flows would lead to an appreciation of the exchange rates thereby reducing net exports. Thus, to counter these effects, we expect the government to implement a fiscal expansion (using the aid funds as a complement to its spending), which is consistent with our findings.

Table 3.3.1 reports the cumulative aid multipliers at several time horizons, as in Eq. 3.3, based on the above impulse responses. Overall, both in the short- and medium-term, multipliers are higher in financially open economies compared to financially closed economies. These results confirm those of the impulse responses already discussed above. At a one-year

horizon, the point estimate is 0.71, and 0.19 for financially open and financially closed economies, respectively. Whiles, at the five-year horizon we have a point estimate of 0.45, and 0.44 for financially open and financially closed economies, respectively. However, these results clearly show that over time the difference between these two stances becomes trivial in these economies.

Table 3.3.1: **Financial openness**

	AID			GOV. CONS.		
Year	not_open	open	prob (not_open−open)>0	not_open	open	prob (not_open−open)>0
Year 1	0.19	0.71	5.22%	1.09	1.19	39.45%
Year 2	0.28	0.60	9.10%	0.99	0.63	87.73%
Year 3	0.34	0.53	21.31%	0.91	0.39	95.51%
Year 4	0.40	0.48	36.53%	0.84	0.28	96.43%
Year 5	0.44	0.45	48.68%	0.78	0.22	96.17%

Note: Cumulative aid and government spending multipliers at several time horizons and probabilities for differences in multipliers for the IPVAR-X model: Aid multipliers are higher in financially open economies with low probabilities of having positive differences between the two sets of multipliers. Government spending multipliers are higher in financially not open economies, with high probabilities of having positive differences between the two sets of multipliers only for year 3, year 4, and year 5.

However, one might ask whether the difference between the two sets of multipliers is statistically significant. To answer this, we verify that the probability of having no difference between the multipliers computed in the two instances is very low. We follow an approach analogous to (see Caggiano et al. (2015), Di Serio et al. (2020) and Amendola et al. (2020)) we compute empirical distributions of the differences computed as multipliers based on the economy being financially not open minus financially open and verify whether a very large part of the distributions is located above zero.

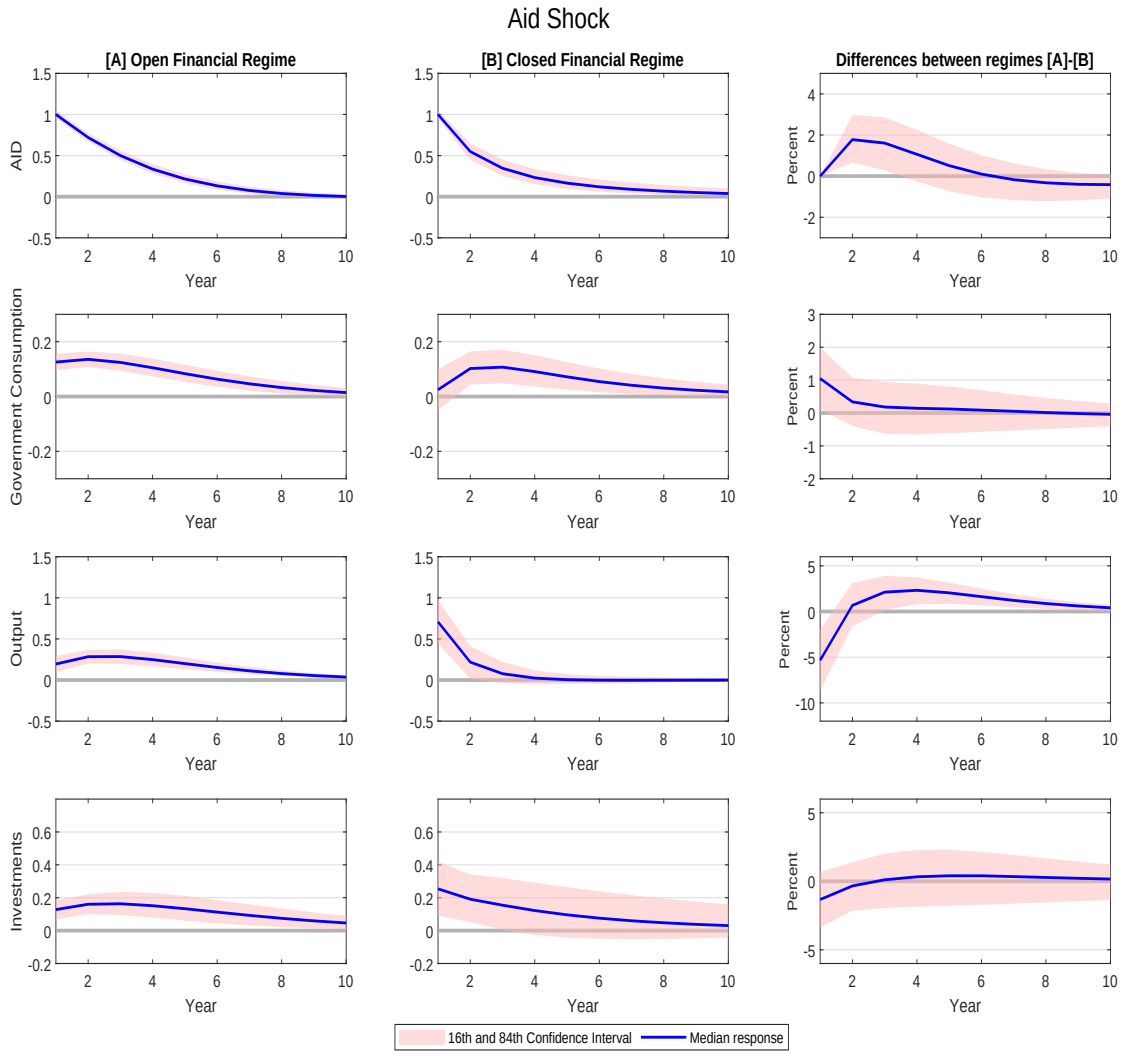


Figure 3.1: **IRFs to a one-unit aid shock for the baseline specification, IPVAR. The solid blue lines represent the median response. The Shadowed area represents the 16th and 84th confidence intervals of the IRFs**

However, the difference between the two sets of multipliers is not statistically significantly different from zero for our entire study horizon; this could clearly be seen from Table 3.3.1. Thus, it indicates that the probability of the difference between the two positions is not statistically significant.

Trade openness

Figure 3.2 presents the macroeconomic effects of a one-unit aid shock obtained for our baseline specification interacted with the trade openness. Both output and investment respond positively to an unexpected aid shock, with more persistence in economies with low trade openness. This shock is more prominent for output with a peak of 0.4% in the second year and persists with a downward trend until the eighth year. The shock has a positive effect on government spending regardless of the level of trade openness of the economy. This could be explained by the fact that an aid shock might lead to an appreciation of the exchange rate, which could lead to a decrease in net export. Thus, confirming our results.

Table 3.3.2 reports the cumulative aid multipliers on several time horizons, as in Eq. 3.3. With the exception of the one-year horizon, multipliers are higher in low-trade compared to high-trade economies. At a one-year horizon, the point estimate is 0.25, and 0.33 for low-trade and high-trade economies, respectively. However, on the five-year horizon, the multiplier is about 0.49 in low-trade and about 0.26 in high-trade economies. Thus, indicating that the difference between the two trade stances becomes more significant and persistent over time.

Table 3.3.2: **Trade openness**

	AID			GOV. CONS.		
Year	low_trade	high_trade	prob (low−high)>0	low_trade	high_trade	prob (low−high)>0
Year 1	0.25	0.33	23.92%	1.75	0.82	100.00%
Year 2	0.36	0.31	65.61%	1.32	0.66	100.00%
Year 3	0.42	0.29	86.85%	1.02	0.54	99.85%
Year 4	0.47	0.27	92.93%	0.81	0.45	98.25%
Year 5	0.49	0.26	95.03%	0.67	0.38	93.84%

Note: Cumulative aid and government spending multipliers at several time horizons and probabilities for differences in multipliers for the IPVAR-X model: Both aid and government spending multipliers are higher in low trade economies, however, with very high probabilities of having positive differences between the two sets of multipliers for government spending multipliers for the entire study horizon.

Table 3.3.2 also presents the test for the probability that the difference between low and high trade is greater than zero. In the short-term this test is not statistically different from zero (i.e., in years 1, 2, and 3); however, we observed that more than 90% of the difference is located above zero for years 4 and 5. Thus, indicating that the difference between the two multipliers for these years is positive with high probability.

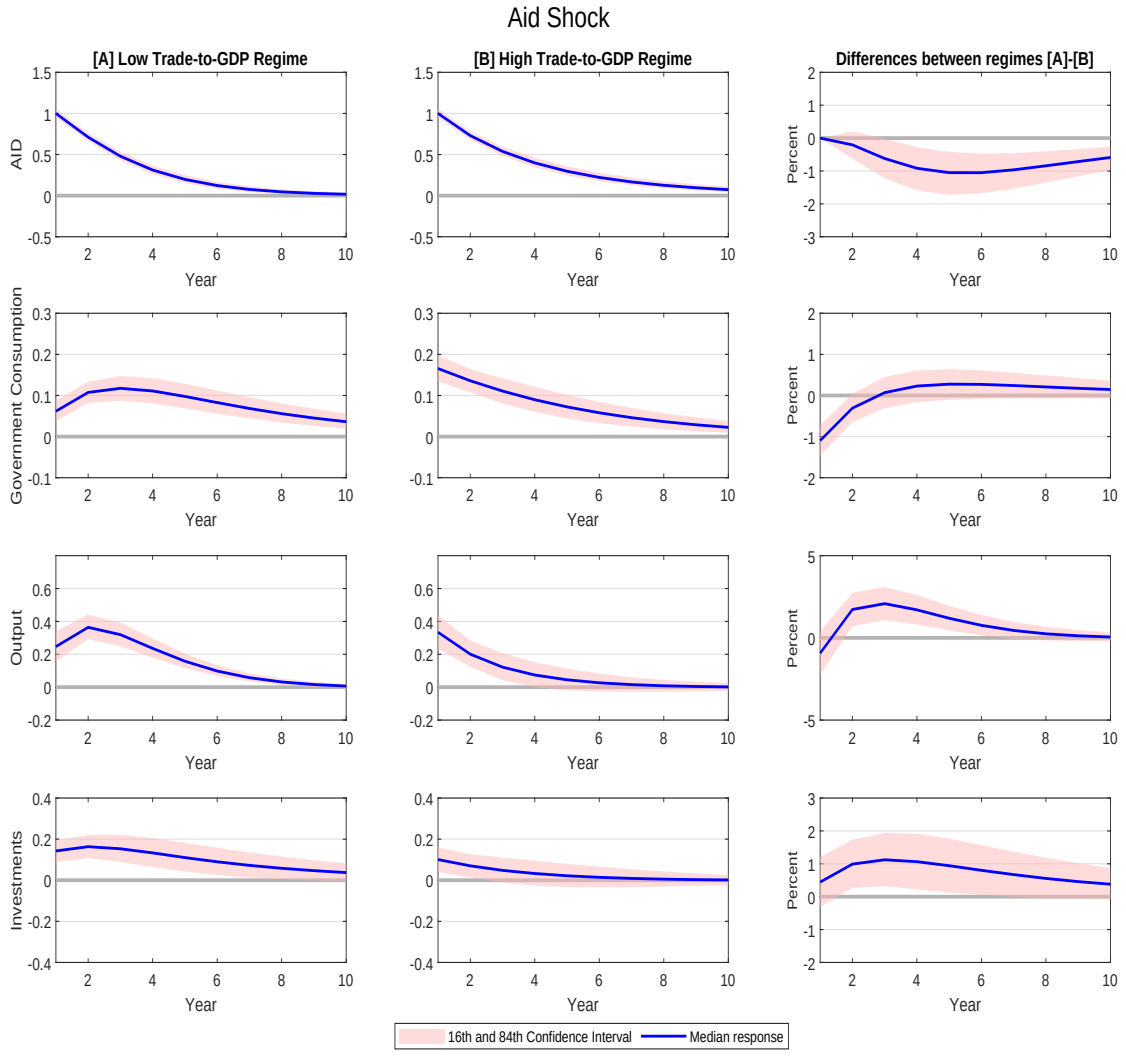


Figure 3.2: **IRFs to a one-unit aid shock for the baseline specification, IPVAR. The solid blue lines represent the median response. The Shadowed area represents the 16th and 84th confidence intervals of the IRFs**

Overall, we found that with respect to the interaction terms we considered (that is, fi-

nancial openness, and trade openness), an unexpected aid shock has a positive impact on government spending, output, and investment in SSA. Our results confirm the predictions of the traditional Mundell-Fleming model and are consistent with those found in the aid fiscal behavior literature. Thus, these results do not support the "Fungibility of Aid" hypothesis and are consistent with the findings of Morrissey (2015), that aid finances government spending in low-income countries.

3.3.2 Government spending Impulse Responses

Financial openness

Figure 3.3 presents the macroeconomic effects of a one-unit government spending shock obtained for our baseline specification interacted with the financial openness. As expected, output, investment, and aid all respond positively to an unexpected government spending shock. This effect is more persistent in financially open economies compared to those in closed economies.

Based on these impulse responses, we computed the cumulative government spending multipliers at several time horizons, as in Eq. 3.3. Results are reported in Table 3.3.1. In both the short- and medium-term, the multiplier is higher if the economy is not financially open, relative to when the economy is financially open. At a one-year horizon, the point estimate is 1.09, and 1.19 for not financially open and financially open economies, respectively. But beyond the one-year horizon, the multiplier is about 0.9 in not financially open and about 0.3 in financially open economies for the medium term.

Thus, we found multipliers to be higher in economies not financially open compared to financially open economies. This is consistent with the predictions of the traditional Mundell-Fleming model, which states that the effectiveness of fiscal policy decreases as the degree of international capital mobility increases. This is because capital mobility can lead to an exchange rate-induced "crowding out" effect, which reduces the effectiveness of fiscal stimuli. However, our findings contradict those of Chian Koh (2017) who found the opposite

relationship.

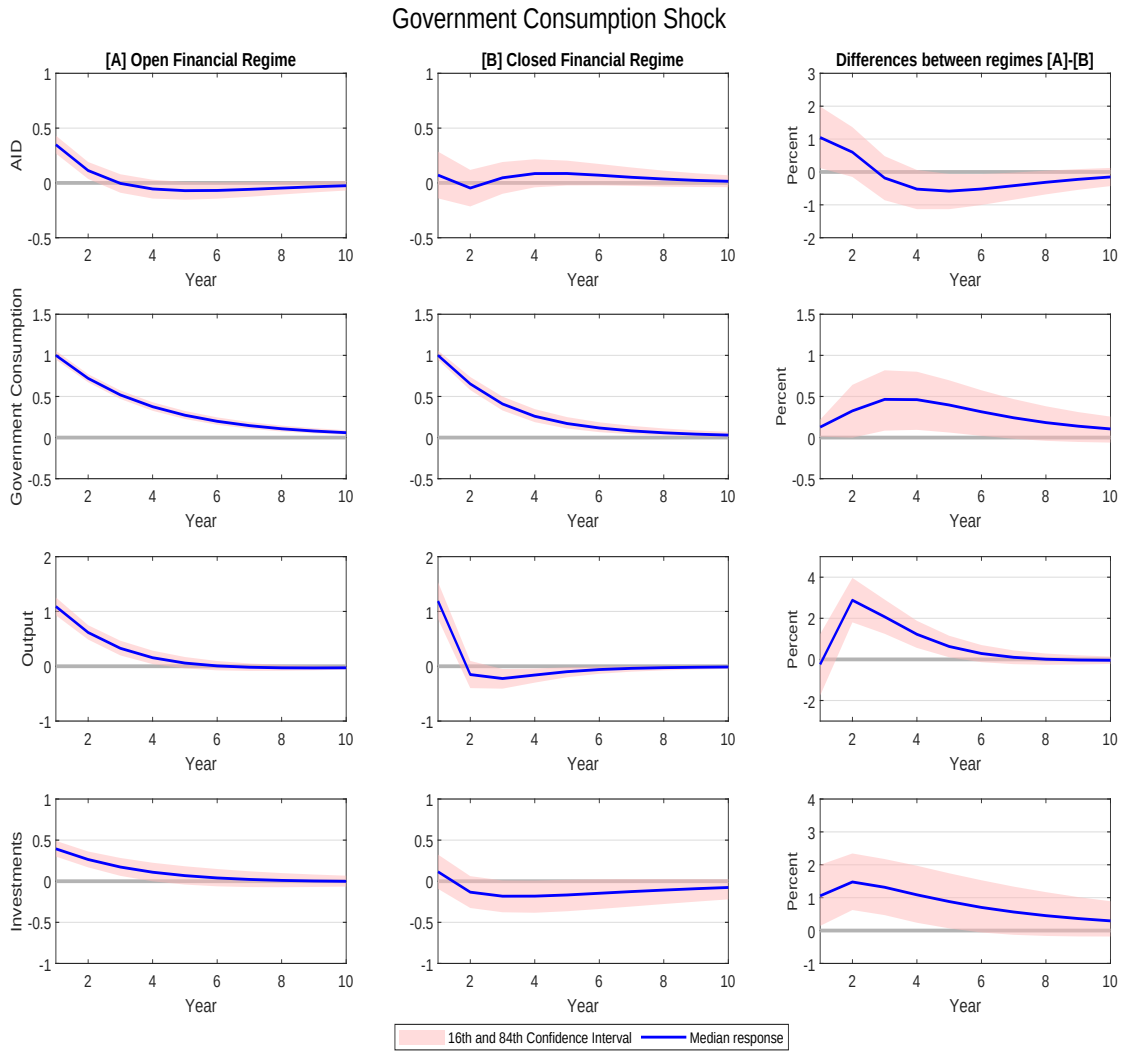


Figure 3.3: **IRFs to a one-unit government spending shock for the baseline specification, IPVAR. The solid blue lines represent the median response. The Shadowed area represents the 16th and 84th confidence intervals of the IRFs**

Table 3.3.1 shows the probability of the difference between the respective cumulative multipliers at various time horizons along with 90 percent credible sets. It turns out that, with the exception of year-1 and year-2, all the other three horizons have more than 90 percent of the probability located above zero, indicating that the difference between the two multipliers is positive with a very high probability.

Trade openness

Figure 3.4 presents the macroeconomic effects of a one-unit government spending shock obtained for our baseline specification interacted with the trade openness. Government spending keeps itself statistically different from zero, while both output and investment respond positively to this shock. Thus, for both output and investment, the effects of this shock are more prominent in low-trade economies. The shock has a positive effect on aid only in high-trade economies.

Table 3.3.2 reports the cumulative government spending multipliers at several time horizons, as in Eq. 3.3. These cumulative multipliers are a replica of the impulse responses discussed above. Overall, multipliers are higher in low-trade compared to high-trade economies. At a one-year horizon, the point estimate is 1.75, and 0.82 for low- and high-trade economies, respectively. However, on the five-year horizon, the multiplier is about 0.67 in low-trade and about 0.38 in high-trade economies. This result is in line with (see Barrell et al. (2013) and Ilzetzki et al. (2013)), who argues that these economies tend to have higher fiscal multipliers because of their fewer demand leakages due to low trade.

The test for the probability of having positive differences between the two sets of multipliers is very high for each time horizon we consider, this could clearly be seen from Table 3.3.2. Table 3.3.2 shows the probability of the difference between the respective cumulative multipliers at various time horizons along with 90 percent credible sets. It turns out that, for all five horizons, more than 90 percent of these probabilities are located above zero, indicating that the difference between the two multipliers is positive with a very high probability.

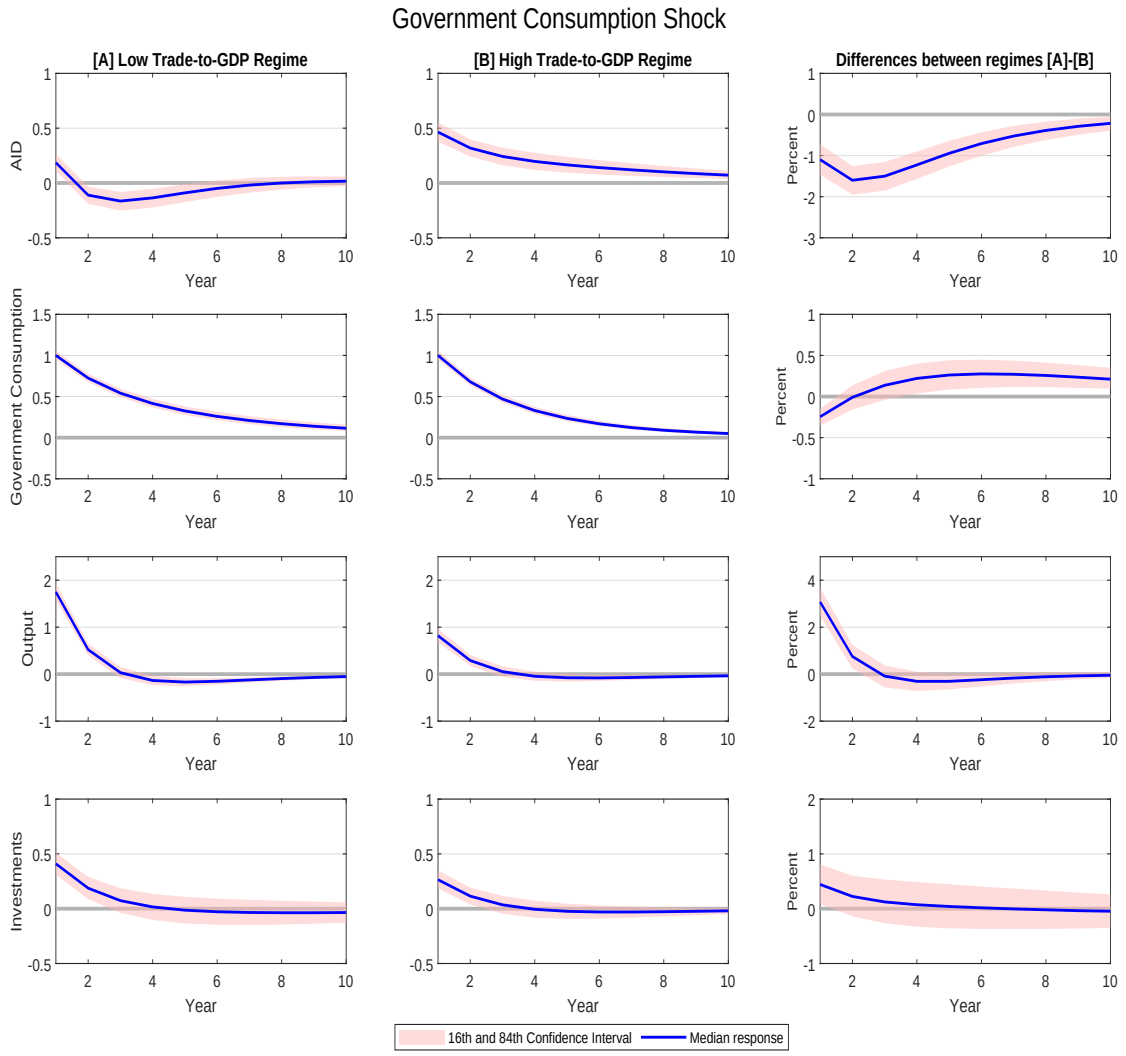


Figure 3.4: **IRFs to a one-unit government spending shock for the baseline specification, IPVAR. The solid blue lines represent the median response. The Shadowed area represents the 16th and 84th confidence intervals of the IRFs**

In general, we found that an unexpected government consumption shock has a positive impact on output, investment, and aid in SSA. However, for both output, and investment we found that the effect of this shock is more persistent in economies that are financially open and have low-trade regimes.

3.4 Robustness

In this section of the paper, we present the results of various tests to ensure the robustness of our findings, which also address some common concerns raised in this literature and may also be relevant to the analysis we have presented.

i. Using a lag structure of two years. Baseline results were produced using a uniform lag structure of one year. This was done to simplify the estimation process of the IPVAR-X model, which requires a large number of parameters. However, we acknowledge that using a longer lag structure would not be feasible due to limited degrees of freedom. Therefore, to test the robustness of our results, we examine the impact of using a two-year lag structure (L=2).

ii. Adding exogenous U.S. variables. Our baseline specification includes variables that are specific only to the SSA countries in our sample. This implies that the SSA is considered a closed economy since it does not explicitly allow for external shocks to affect the endogenous variables of interest. Thus, to account for the potential influence of international factors, we add a set of U.S. variables as exogenous variables, including the U.S. output gap, U.S. inflation, U.S. shadow rate and S&P 500 (see Di Serio et al. (2020), Amendola et al. (2020) and Wu and Xia (2016)).

Table 3.4.1-3.4.4 shows that even after considering different robustness checks (i.e., using a lag structure of two years, and US exogenous variables), this may change the median estimates of the multiplier, but results are qualitatively similar: as in the baseline, aid multipliers are higher in financially open economies in the short term horizon (i.e., years 1 and 2), but with the 2-year lag in year 4 and year 5, aid multipliers are higher in not financially open economies. For trade openness, with the 2-year lag, we observe higher aid multipliers in the short term for high trade economies, while in the medium term (years 4 and 5) aid multipliers are higher in low trade economies, thus, confirming the baseline results.

Table 3.4.1: **Lag structure of two years-Financial openness**

	AID			GOV. CONS.		
Year	not_open	open	prob (not_open−open)>0	not_open	open	prob (not_open−open)>0
Year 1	0.32	0.47	31.77%	1.58	0.81	97.08%
Year 2	0.25	0.64	13.69%	1.30	0.64	94.03%
Year 3	0.32	0.43	36.70%	1.10	0.27	98.52%
Year 4	0.40	0.12	86.78%	0.91	0.01	99.78%
Year 5	0.46	0.03	97.18%	0.77	0.05	99.44%

Note: Cumulative aid and government spending multipliers at several time horizons and probabilities for differences in multipliers for the IPVAR-X model with a lag structure of two years: Aid multipliers are higher in financially open economies with very low probabilities of having a positive difference from years 1, 2, and 3. Government spending multipliers are higher in financially not open economies, with very high probabilities of having a positive difference for the entire study horizon.

Table 3.4.3: **Baseline & U.S. exogenous variables-Financial openness**

	AID			GOV. CONS.		
Year	not_open	open	prob (not_open−open)>0	not_open	open	prob (not_open−open)>0
Year 1	0.24	0.76	4.11%	1.40	1.05	78.46%
Year 2	0.36	0.65	10.33%	1.19	0.58	96.40%
Year 3	0.46	0.59	28.82%	1.00	0.40	96.98%
Year 4	0.53	0.55	47.53%	0.86	0.31	95.30%
Year 5	0.58	0.52	58.90%	0.73	0.26	92.34%

Note: Cumulative aid and government spending multipliers at several time horizons and probabilities for differences in multipliers for the IPVAR-X model with U.S. exogenous variables: Aid multipliers are higher in financially open economies with low probabilities of having a positive difference between the two sets of multipliers. Government spending multipliers are higher in financially not open economies, with very high probabilities for the entire study horizon.

Table 3.4.2: **Lag structure of two years-Trade openness**

	AID			GOV. CONS.		
Year	low_trade	high_trade	prob (low−high)>0	low_trade	high_trade	prob (low−high)>0
Year 1	0.31	0.52	9.04%	1.70	0.90	100.00%
Year 2	0.39	0.40	48.14%	1.34	0.66	99.96%
Year 3	0.42	0.33	73.66%	0.94	0.44	99.37%
Year 4	0.42	0.30	81.05%	0.67	0.29	97.56%
Year 5	0.42	0.29	81.05%	0.53	0.21	94.68%

Note: Cumulative aid and government spending multipliers at several time horizons and probabilities for differences in multipliers for the IPVAR-X model with a lag structure of two years: From the year 3-year 5 aid multipliers are higher in low trade openness economies, whiles government spending multipliers are higher in low trade economies, with very high probabilities for the entire study horizon.

Table 3.4.4: **Baseline & U.S. exogenous variables-Trade openness**

	AID			GOV. CONS.		
Year	low_trade	high_trade	prob (low−high)>0	low_trade	high_trade	prob (low−high)>0
Year 1	0.31	0.31	50.07%	1.67	0.79	100.00%
Year 2	0.44	0.34	81.63%	1.22	0.63	99.96%
Year 3	0.52	0.36	90.41%	0.91	0.51	98.45%
Year 4	0.57	0.37	92.19%	0.70	0.42	92.37%
Year 5	0.59	0.38	92.22%	0.56	0.35	84.70%

Note: Cumulative aid and government spending multipliers at several time horizons and probabilities for differences in multipliers for the IPVAR-X model with U.S. exogenous variables: Both aid and government spending multipliers are higher in low trade economies, with high probabilities of having a positive difference between the sets for almost the entire study horizon.

3.5 Concluding Remarks

Foreign Aid and government spending have always been key policy instruments in stabilizing and stimulating growth in SSA. However, there are few or no studies in the literature that seeks to estimate the size of aid multipliers and their behavior when interacted with some key macroeconomic indicators such as financial openness and trade openness. Due to the high reliance of SSA countries on international trade, the increasing effects of globalization, and from the results found in chapter 2 of this thesis. Thus, the need for policymakers

to understand the relationship between the size of fiscal multipliers and openness in the SSA. Although there exist some studies in the literature that estimate the size of government spending multipliers for a sub-sample of SSA countries (see Ilzetzki et al. (2013), Kraay (2014), and Chian Koh (2017)), this current study is the only one that covers this much panel of SSA countries using the most recent data available.

Thus, using the interacted panel VAR model for 22 SSA countries from 1983 to 2017, with shocks identified using the Cholesky identification strategy, we found that: (i) Consistent with the literature on aid fiscal behavior, and the predictions of the traditional Mundell-fleming model, with respect to the interaction term we considered (that is, financial openness and trade openness), an unexpected aid shock has a positive impact on government spending, output, and investment in SSA. These results also confirm that aid serves as an additional source of finance for government spending in SSA, and as well debunks the "fungibility of aid" hypothesis; (ii) In general, we found that an unexpected government spending shock has a positive impact on output, and investment in SSA.

We computed the cumulative aid and government spending multipliers on several time horizons, as in Eq. 3.3, using the impulse responses that were generated from our baseline specification interacted with financial openness and trade openness. These results are reported in Tables 3.1, 3.2, 3.3, and 3.4.

Therefore, both in the short- and medium-term, the aid multipliers are higher in financially open economies compared to financially closed economies. At a one-year horizon, the point estimate is 0.71, and 0.19 for financially open and financially closed economies, respectively. Whiles, at the five-year horizon we have a point estimate of 0.45, and 0.44 for financially open and financially closed economies, respectively. However, with the exception of the one-year horizon, aid multipliers are higher in low-trade compared to high-trade economies. At a one-year horizon, the point estimate is 0.25, and 0.33 for low-trade and high-trade economies, respectively. But at the five-year horizon, the aid multiplier is about 0.49 in low-trade and about 0.26 in high-trade economies.

Moreover, for government spending multipliers, we found that in both the short and medium term, the multiplier is higher if the economy is not financially open, relative to when the economy is financially open. At a one-year horizon, the point estimate is 1.09, and 1.19 for not financially open and financially open economies, respectively. But beyond the one-year horizon, the multiplier is about 0.9 in not financially open and about 0.3 in financially open economies for the medium term. Whiles for trade openness, the multipliers are higher in low-trade compared to high-trade economies. At a one-year horizon, the point estimate is 1.75, and 0.82 for low- and high-trade economies, respectively. However, on the five-year horizon, the multiplier is about 0.67 in low-trade and about 0.38 in high- trade economies.

As shown in Tables 3.4.1-3.4.4, the above results are robust to changing the lag structure to two years, and also to adding U.S. exogenous variables to the baseline specification.

In conclusion, these results have huge policy implications for the SSA, as it highlights the importance of both aid and government spending in this region. But more importantly, it gives policymakers and donors insight as to when aid and government spending are most effective in enhancing economic growth and when aid is most effective in financing government spending in the SSA.

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