FOREIGN AID AND SECTORAL GROWTH IN SUB-SAHARAN AFRICA

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ABSTRACT

The effectiveness of foreign aid in promoting growth has been a subject of intense debate among donors, policy makers and researchers. On the one hand, foreign aid can promote growth and investment by filling the savings gap and the foreign exchange gap. On the other hand, foreign aid may have an adverse effect on growth and investment due to disincentives and moral hazard issues associated with the strategic interactions among donors and recipients and its negative effect on the tradable sector and the competitiveness of the economy through the Dutch Disease. In this paper, we examine long-run effects of foreign aid on output and prices of tradable and non-tradable sectors in twenty-two sub-Saharan African (SSA) countries using cointegrated vector autoregressive (CVAR) analysis. The SSA countries have been major recipients of foreign aid. The CVAR methodology has a number of advantages over single equation estimation and panel data estimation method used in current studies. Unlike these methods, it allows for the dynamics of aid and its effect to differ across countries. For each country, we estimate 5X5 CVAR model using annual data. Our variables comprise of foreign aid, tradable output, non-tradable output , price of tradable goods, and price of non-tradable goods. We find that aid has a heterogeneous effect on sectoral output and prices. It has a significant negative effect on tradable output in fifteen countries, but has a significant positive effect on the tradable output in four countries. Similarly, aid has a significant positive effect on non-tradable output in five countries, but a significant negative effect in six countries. Only in four countries foreign aid has both a negative effect on tradable output and a positive effect on non-tradable output. We also find that aid has an inflationary effect in six countries, while it has a deflationary effect in five countries. We do not find evidence of Dutch disease. Aid does not lead to deterioration in the terms of trade for tradable goods.

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INTRODUCTION

The effectiveness of foreign aid in promoting growth has been a major concern for donors, policy makers and researchers. On the one hand, foreign aid is argued to promote growth and investment by filling the savings gap and the foreign exchange gap (Chenery and Strout 1966, Bacha 1990). On the other hand, foreign aid may have an adverse effect on growth and investment due to disincentives and moral hazard issues associated with the strategic interactions among donors and recipients (Temple 2010, Kumar, 2015) and its negative effect on the tradable sector and the competitiveness of the economy by changing the terms of trade between tradable and non-tradable sectors (see Corden and Neary 1982, Van Wijnbergen 1986, Arellano et al. 2009, Rajan and Subramanian, 2011 on the Dutch Disease).

Building on Corden and Neary (1982), Van Wijnbergen (1986) in a two-good model shows that aid has two effects in the short run, both of which have adverse effect on the tradable sector. Firstly, aid may be allocated more towards the non-tradable sector to meet the pent-up demand for education, health care, physical infrastructure etc… increasing its profitability, raising the relative wages in this sector and overall wages and drawing resources away from the tradable sector (the resource movement effect). Secondly, higher wages will lead to greater demand for non-traded goods increasing the relative price of non-traded goods (spending effect).

While theoretically, the short-run effects of aid on the sectoral composition of GDP and relative prices are clear, its impact over long run is less clear. Torvik (2001) in a model where there is learning-by-doing and learning spill-overs across sectors shows that depending on the degree of learning-by-doing in each sector, the production and productivity in both sectors may go up or down in the long run. Similarly depending on the relative shift in the productivity, the real exchange rate may depreciate or appreciate. Adam and Bevan (2004) in a model in which aid is used to finance public investment show that aid may have a positive effect on tradable sector and lead to depreciation of the real exchange rate.

The response of prices to aid also depends on the policies of government and the central bank (Gupta et al. 2005 and Hussain et al. 2009). If aid widens the fiscal deficit which is financed by increased money supply, it will lead to inflationary pressure in the economy. However, aid inflow may not have inflationary effect if it is used to build international reserve or the central bank sterilizes the inflow through open market operations. Overall, these studies show that one cannot predict a priori the long-run effects of aid on tradable and non-tradable output and prices. It is ultimately an empirical question, which is the focus of this paper.

In this paper, we empirically analyze the long-run effects of aid on output and prices of tradable and non-tradable sectors in twenty-two sub-Saharan African (SSA) countries. These countries were chosen because reliable data is available for a relatively long-span of time. Moreover, these countries are major recipients of aid. The ratio of Official Development Assistance (ODA) to GDP in these countries has averaged 12% between 1970 and 2014. In this paper, the tradable output is defined as value-addition in agricultural and allied activities, mining and quarrying, manufacturing and other industries. The non-tradable output is defined as the GDP minus the tradable output.

In order to analyze the long run effects of aid on tradable and non-tradable sectors and their prices, we use cointegrated vector autoregressive (CVAR) methodology of Juselius et al. (2014). We estimate the model separately for each country, which allows us to control for a rich set of country-specific characteristics and events.

As discussed by Juselius et al. (2014), the CVAR methodology has a number of advantages over single equation estimation and/or panel data estimation method used in current studies (see literature review below). Firstly, the use of a single equation to estimate the effect of foreign aid usually suffers from endogeneity bias. It is very difficult to find commonly accepted instrumental variables. As discussed below, existing literature shows that results are very sensitive to instruments used in the estimation (e.g. Rajan and Subramaniam 2011, Arndt et al. 2015). Secondly, the use of cross-country data analysis does not capture the dynamic effects of aid and its short-run and long-run effects on the macro-economy. Thirdly, as discussed above the long run response of an economy to aid will depend on its effects on sectoral productivity. This in turn will depend on the amount of aid received by an economy and its allocation and government policies. It is extremely important to adequately control for country-specific characteristics. The panel data models used in this literature capture dynamics and control for time-invariant country-characteristics. However, these models are estimated under the assumption of common dynamics and effects of aid across countries. But the dynamics of aid and its effect can differ across countries. In contrast to these approaches, our approach allows for heterogeneous dynamics and effects of aid.

The main results of our analysis are as follows. Firstly, the effect of aid on output and prices of tradable and non-tradable sectors are heterogeneous and varies a great deal across countries. Aid has a significant negative effect on the tradable output in fifteen countries, but has a significant positive effect on the tradable output in four countries. Similarly, aid has a significant positive effect on the non-tradable output in five countries, but a significant negative effect in six countries. Only in four countries (Burundi, Central Africa, Mali, and Sudan) aid has both a negative effect on tradable output and a positive effect on non-tradable output. In other four countries (Cameroon, Kenya, Togo, and Uganda), it has a significant negative effect on output of both sectors. In only one country, Rwanda, it has a significant positive effect on the output of both sectors.

Regarding effects of aid on prices, we find that in six countries (Central Africa, Gambia, Lesotho, Malawi, Rwanda, and Uganda) aid has a significant positive impact on both prices, suggesting that it has an inflationary effect in these countries. On the other hand, in five countries (Benin, Cameroon, Ethiopia, Senegal, and Togo) aid has a deflationary effect in the sense that it has a significant negative impact on both prices.

Interestingly, of the four countries (Burundi, Central Africa, Mali, and Sudan) where aid has a significant negative effect on tradable output and a positive effect on non-tradable output, only in Mali we find that the terms of trade moved against the tradable sector. Overall, our results cast doubt on the efficacy of Dutch disease mechanism in SSA countries, which has received considerable attention in aid literature.

Our paper relates to studies which examine the impact of aid on real exchange rate/prices (Gupta et al. 2005, Hussain et al. 2009, Martins 2011, Juselius et al. 2017) and sectoral growth (Arellano et al. 2009, Rajan and Subramanian, 2006, 2011, Arndt et al. 2015, Selaya and Thiele 2010, and Kumi et al. 2017). Gupta et al. (2005) compare eleven studies on the effect of aid on the real exchange rate. They find that six studies confirm the positive

relation between aid and the real exchange rate appreciation, three studies reach opposite conclusion, and two are inconclusive. In a recent study, Juselius et al. (2017) find that aid led to appreciation in the real exchange rate in Tanzania, but has an insignificant effect in Ghana. Regarding the effects of aid on inflation, Hussain et al. (2009) in a study for five sub-Saharan African countries find that it has an inflationary effect in three countries Mozambique, Tanzania, and Uganda, but not in Ethiopia and Ghana. They also find that aid has no significant effect on real exchange rate in these countries. Martins (2011) in a panel study of 53 African countries finds that aid has a significant negative effect on inflation.

Rajan and Subramanian (2006) and (2011) analyze effects of aid on manufacturing growth and real exchange rate using instrument variable approach. Their instrument variables reflect motives of donors for giving aid. They find that aid has a significant negative effect on manufacturing growth and leads to appreciation of real exchange rate. Similarly, Arellano et al. (2009) in a cross-sectional analysis of seventy-three aid-recipient countries find that aid has a negative effect on the manufacturing exports.

Selaya and Thiele (2010) examine the effects of aid on tradable and non-tradable sector growth in 65 countries using panel data method. They find that aid has a positive effect on growth rate of tradable and non-tradable sectors.

Arndt et al. (2015) study effects of aid on economic transformation of 78 countries for the 1970–2007 period. Their instrument variables differ from Rajan and Subramanium (2006, 2011). Their external instrument for aid is generated through a model which determines the supply of aid at the donor-recipient level. They find that aid has a significant positive effect on the share of non-agricultural sector in GDP.

Kumi et al. (2017) examine the impact of aid on agricultural, manufacturing, and services sectors in 37 SSA countries for the period 1980–2014 using panel data method. They find a positive and significant effect of aid on agricultural, manufacturing, and service sectors suggesting that aid has a positive effect on both the tradable and non-tradable output.

The remainder of this paper is organized as follows. Section 2 provides preliminary analysis of data. The econometric approach is discussed in Section 3. Section 4 presents main results. Section 5 concludes.

DATA

Our variables comprise of net Official Development Aid (aid_t), tradable output ($trad_t$), non-tradable output ($ntrad_t$), price of the tradable goods (p_t^T), and price of the non-tradable goods (p_t^{NT}). Data for the tradable output and non-tradable output in current and constant prices are taken from the World Development Indicators (WDI, 2017). Official Development Aid (ODA) data are sourced from the Organisation for Economic Co-operation and Development (OECD).

In the analysis, the tradable output is defined as the sum of value-addition in agriculture, fishing, forestry and hunting, mining and quarrying, manufacturing and other industries. Non-tradable output is defined as GDP minus tradable output. We derive price indices for tradable (non-tradable) output, $p^T (p^{NT})$, by dividing tradable (non-tradable) output at current prices by tradable (non-tradable) output at constant prices for each country. Foreign aid is reported in the US$. We convert it into local currency at current prices by multiplying

it by the nominal exchange rate for each country. Then we divide it by GDP deflator for each country to convert it into constant local prices.

Our data consists of annual observations for 22 (out of 48) SSA countries. Other 26 SSA countries are excluded for reasons such as missing data on the tradable and non-tradable output, negative aid and stationarity of aid and prices.

Table 1 shows the sample size, aid-to-GDP ratio, and the share of tradable sector in GDP for countries included in the analysis. The availability of data constraints the sample size to a minimum of 33 annual observations for Madagascar to a maximum of 51 for Sierra Leone. Data shows that aid-to-GDP ratio ranges from 4% in Cameroon to 25.3% in Cape Verde with an average of 12% for the overall sample. Tradable output-to-GDP ratio ranges from 32.8% in Cape Verde to 61% in Sierra Leone.

TABLE 1. COUNTRIES, SAMPLE PERIOD, AND AID AND TRADABLE SECTORS AS A PERCENTAGE OF GDP

Country	Period	Aid/GDP	Trad/GDP
Benin	1971-2014	9.00%	47.80%
Botswana	1965-2014	7.80%	54.75%
Burkina Faso	1970-2014	12.00%	51.60%
Burundi	1970-2014	18.60%	63.25%
Cameroon	1965-2014	4.00%	48.05%
Cape Verde	1980-2014	25.30%	32.80%
Central Africa	1977-2012	12.25%	61.80%
Ethiopia	1981-2014	9.80%	58.00%
Gambia	1966-2014	14.90%	38.50%
Kenya	1967-2014	5.75%	44.80%
Lesotho	1975-2013	15.40%	39.50%
Madagascar	1982-2014	8.70%	40.00%
Malawi	1975-2014	19.25%	53.50%
Mali	1967-2014	13.50%	57.60%
Mauritania	1973-2014	19.00%	56.50%
Rwanda	1975-2014	18.20%	56.20%
Senegal	1979-2014	10.25%	37.10%
Seychelles	1978-2014	6.15%	22.70%
Sierra Leone	1964-2014	12.30%	61.10%
Sudan	1976-2011	4.85%	51.95%
Togo	1976-2014	9.50%	55.05%
Uganda	1982-2014	12.20%	53.80%

In our analysis, following Juselius et al. (2014), we use logarithmic transformation of variables at levels instead of ratios such as aid-to-GDP and tradable output-to-GDP as these ratios are usually bounded between 0% and 100%. Additionally, in our model we have used tradable and non-tradable goods prices instead of the relative price of non-tradable goods (the real exchange rate) as variables, since the relative price is found to be stationary in most countries. There would be no long-run relationship among the relative price (in case it is stationary) and other non-stationary variables. Throughout the paper, small letters denote logarithmic values.

Unit Root Tests

Time-series data are time dependent and it is crucial to determine whether they are stationary and whether they are subject to structural breaks. First, we use the Augmented Dickey-Fuller (ADF) and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests for the unit root. All the variables under the ADF and the KPSS tests are found to be non-stationary in levels[1].

It is well-known that ADF and KPSS tests have low power if the series exhibits a "permanent" regime shift during the period under consideration or if there exist outliers in the residuals of regression. In the presence of structural break, these tests are biased towards non-rejection of the null hypothesis and the rejection frequency is inversely related to the magnitude of the break (Perron, 1990).

There are usually two types of structural breaks: exogenous and endogenous and it is difficult to distinguish between them. For this reason, we have applied the Perron test that deals with exogenous structural break as well as the Zivot-Andrews test which deals with endogenous structural break. Moreover, some series are subject to more than one structural break. We apply the Lumsdaine-Papell (LP) test with multiple endogenous structural breaks for such series[2]. All variables subject to structural breaks are found to be non-stationary and depict the same order of integration (i.e. I(1)) behavior.

ECONOMETRIC APPROACH

The Cointegrated VAR (CVAR) Model

When variables are non-stationary, there is a possibility of cointegration among them which represents the long-run economic relationships. The CVAR approach enables us to distinguish between the short-run dynamic adjustments and the long-run equilibria. It also identifies common trends which push variables out of equilibrium and determines the long-run impact of shocks on these variables.

Consider a reduced form p-dimensional vector autoregressive (VAR(k)) model:

$$y_t = \Phi_1 y_{t-1} + \Phi_2 y_{t-2} + \ldots. + \Phi_k y_{t-k} + \Theta D_t + \upsilon_t \quad (1)$$

Here, y_t is a (p x 1) vector of endogenous variables, in the present case p = 5 and $y_t' = [aid_t, trad_t, ntrad_t, p_t^T, p_t^{NT}]$; Φ_i (i = 1,2,… k) is a (p x p) matrix of parameters; D_t is a (m x 1) vector of m deterministic terms (such as a constant, linear trend, mean-shift dummy, permanent, and transitory intervention dummies); Θ is a (p x m) matrix of coefficients; and k is the lag length. The error terms are identically and independently distributed and serially uncorrelated (i.e. $E(\upsilon_t \upsilon_{t-k}') = 0$, for $k \neq 0$), have a zero-mean ($E(\upsilon_t) = 0$), and a positive definite covariance matrix, Σ, that capture all the possible contemporaneous effects. Hence, the error terms follow a white noise process such that $\upsilon_t \sim NIID(0,\Omega)$.

The CVAR model in the error correction form can be written as:

$$\Delta y_t = \alpha\beta' y_{t-1} + \Gamma_1 \Delta y_{t-1} + \ldots + \Gamma_{k-1} \Delta y_{t-k-1} + \Psi D_t + \varepsilon_t \quad (2)$$

where $\beta' y_{t-1}$ are r long-run relations representing the stationary process with a linear combination and $\varepsilon_t' = [\varepsilon_{aid}, \varepsilon_{trad}, \varepsilon_{ntrad}, \varepsilon_{p^T}, \varepsilon_{p^{NT}}]$ are residuals. α is (p x r) matrix of adjustment coefficients, β are the cointegration parameters that form the linear stationary relations with the non-stationary data series in y_t, and k corresponds to the lag length.

The Common Trends Representation

The CVAR model in (2) can be represented in a form of moving average or "Granger representation" model. This means that the data generating process, y_t, is written as a function of previous innovations of the system. This representation allows us to investigate the role of common stochastic trends that are responsible for the non-stationarity of the process. The moving average form of the CVAR model can be obtained from equation (2) with initial values as follows:

$$y_t = C\sum_{i=1}^{t}(\varepsilon_i + \Psi D_i) + C^*(L)(\varepsilon_t + \Psi D_i) + P_0 \quad (3)$$

where $C = \beta_\perp(\alpha_\perp'\Gamma\beta_\perp)^{-1}\alpha_\perp'$ is a (p x p) long-run impact matrix with a reduced rank, (p - r), which is related to the stochastic part of the process (i.e. cumulation of error), and Γ = -(I - Γ_1 - Γ_1 - … - Γ_{k-1}). For an I(1) process, the number of unit roots defined as the common stochastic trends are (p - r). $\alpha_\perp$ and $\beta_\perp$ are p x (p - r) orthogonal complements of α and β, respectively; $C^*(L) = \sum_{i=0}^{\infty} C_i^* L^i$ is a stationary lag polynomial matrix; and P_0 contains the initial values.

The (p - r) common stochastic trends or the "pushing forces" are measured by $\alpha_\perp' \sum_{i=1}^{t} \varepsilon_i$ which push the system away from the long-run equilibrium (i.e. steady state) and have permanent effects. These pushing forces affect the variables by the loadings $\widetilde{\beta_\perp} = \beta_\perp(\alpha_\perp'\Gamma\beta_\perp)^{-1}$.

The CVAR model in (3) can be written as follows:

$$\begin{bmatrix} aid_t \\ trad_t \\ ntrad_t \\ p_t^T \\ p_t^{NT} \end{bmatrix} = \begin{bmatrix} c_{11} & c_{12} & c_{13} & c_{14} & c_{15} \\ c_{21} & c_{22} & c_{23} & c_{24} & c_{25} \\ c_{31} & c_{32} & c_{33} & c_{34} & c_{35} \\ c_{41} & c_{42} & c_{43} & c_{44} & c_{45} \\ c_{51} & c_{52} & c_{53} & c_{54} & c_{55} \end{bmatrix} \begin{bmatrix} \sum_{i=1}^{t} \varepsilon_{1i} \\ \sum_{i=1}^{t} \varepsilon_{2i} \\ \sum_{i=1}^{t} \varepsilon_{3i} \\ \sum_{i=1}^{t} \varepsilon_{4i} \\ \sum_{i=1}^{t} \varepsilon_{5i} \end{bmatrix} + C\,\Psi \sum D_i + C^*(L)(\varepsilon_t + \Psi D_i) + P_0 \quad (4)$$

In the analysis, we estimate (4) rather than (2) due to following reasons. Firstly, although the cointegration relation, $\beta_i' y_{t-1}$ *in* (2), is defined as a deviation from the long-run equilibrium (equilibrium error) and describes the co-movement of variables overtime, it does not say anything about the causality among them. Additionally, a cointegration of three or more variables creates a problem in the interpretation of sign effects among them. For instance, a long-run relationship represented by: ($ntrad_t$ - $\beta_1\, aid_t - \beta_2\, trad_t$) ~ I(0) suggests that non-tradable output is positively associated with both aid and tradable output. It can also be interpreted as aid is positively associated with non-tradable output but is negatively associated with the tradable output. In contrast to the regression coefficients, the cointegration coefficients are invariant to the choice of normalizing variable. The problem escalates when the number of long-run cointegration relations exceeds one.

Secondly, the long run equilibrium relationships differ from one country to another and this makes it difficult to compare co-movement of variables across countries. The long-run

impact matrix uncovers the causal links between aid and other variables and makes it is easier to compare cross-country results.

Finally, by focusing on the individual coefficients of the long-run impact matrix in (4), we can get a clear picture of which shocks have been significant in pushing the economy out of equilibrium. The causal link hypothesis about aid endogeneity, exogeneity, excludability, and purely adjustability could be tested as nested hypotheses. The long-run matrix *C* in equation (4) can be partitioned as follows:

$C = \begin{bmatrix} c_{11} & C_{12} \\ C_{21} & C_{22} \end{bmatrix}$

where $C_{21}' \equiv (c_{21}, c_{31}, c_{41}, c_{51})$ captures the long-run effects of aid on other variables, $C_{12} \equiv (c_{12}, c_{13}, c_{14}, c_{15})$ captures if aid is being influenced by other variables or not (i.e. exogenous or not), and the submatrix C_{22} contains the coefficients that describe the long-run impulse-responses among variables themselves.

Following Juselius et al. (2014), we can classify SSA countries into 4 Cases:

Case I: Aid and other variables are unrelated; i.e. $C_{21} = 0$ ($c_{21} = c_{31} = c_{41} = c_{51} = 0$) and $C_{12} = 0$ ($c_{12} = c_{13} = c_{14} = c_{15} = 0$). Case I is the most restrictive hypothesis; that is, if not rejected it implies a rejection of the other three remaining cases (II, III, and IV).

Case II: Aid has no long-run impact on other variables; i.e. $c_{11} = 0$, $C_{21} = 0$ ($c_{21} = c_{31} = c_{41} = c_{51} = 0$) and $C_{12} \neq 0$ (c_{12}, c_{13}, c_{14} and $c_{15} \neq 0$). If case II is not rejected, it means that aid is purely adjusting or completely endogenous; and implies a rejection of the other two remaining Cases (III and IV).

Case III: Aid is (weakly) exogenous; i.e. $C_{21} \neq 0$ (c_{21}, c_{31}, c_{41} and $c_{51} \neq 0$) and $C_{12} = 0$ ($c_{12} = c_{13} = c_{14} = c_{15} = 0$). If Case III cannot be rejected, it implies that case IV is rejected. This test is performed by imposing a set of restrictions on the error vector adjustment coefficient α.

Case IV: Both aid and other variables have long-run effects on each other; i.e. $C_{21} \neq 0$ (c_{21}, c_{31}, c_{41} and $c_{51} \neq 0$) and $C_{12} \neq 0$ (c_{12}, c_{13}, c_{14} and $c_{15} \neq 0$). This is the general case where aid is neither exogenous nor completely endogenous; i.e. any shock to aid will push other variables and shocks to other variables will have impact on aid.

Model Specification

The SSA countries are subject to extraordinary shocks such as wars, military coups, institutional reforms, social unrest, famine, and drought. These events affect the stability of parameters of model and may lead to violation of normality assumption (Hendry and Juselius, 2001). It is customary in the literature to control for such extraordinary events and shocks using dummy variables.

Rank Determination

After specifying our model, we use the Johansen trace test to determine the cointegration rank and test for the presence of unit roots in the multivariate framework. The characteristic of the cointegration rank is to divide the data into *r* linearly independent long-run cointegration relations and (p - r) common driving trends. The cointegration relations (stationary part) are interpreted as long-run equilibria (steady states) to which the process is adjusting after a shock hits the system; whereas the common trend (non-stationary part)

are the pushing forces of the process. The choice of *r* is of particular importance since all the econometric analysis are based on the choice of rank and this affects the statistical inference procedures.

TABLE 2. RANKING TEST

Country	Rank
Benin	1
Botswana	2
Burkina Faso	1
Burundi	2
Cameroon	4
Cape Verde	2
Central Africa	1
Ethiopia	3
The Gambia	2
Kenya	1
Lesotho	2
Madagascar	3
Malawi	1
Mali	1
Mauritania	1
Rwanda	1
Senegal	2
Seychelles	2
Sierra Leone	2
Sudan	1

The trace test does not give the exact number of the unit roots. Thus, to determine the cointegration rank (*r*), we follow Juselius (2006) "top-to-bottom" sequential procedure which is asymptotically better than the "bottom-to-top" alternative. In particular, in this model, there are up to five null hypotheses that can be tested. In the trace test, the null hypothesis tests for $r = r^* < p$ versus the alternative hypothesis for $r = p$. For example, the null hypothesis (rank (Π) = *r*) is rejected if one of the estimated ($p - r$) is greater than zero. We start to test the most restricted model, the null hypothesis ($r = 0$) against the alternative hypothesis ($p - r = 5$). If the test statistic is larger than the critical value, the null hypothesis is rejected which means that ($p - r$) unit roots exist. Then the next step is to test the null hypothesis ($r = 1$) against the alternative one ($p - r = 4$), and we stop when the test cannot be rejected. Table 2 provides an overview of the trace test[3]. The test is based on 5% p-value.

MAIN RESULTS

Causal Links between Foreign Aid and Other Variables

The causal interpretation of the four cases discussed above is built on the residuals of aid equation which measure the "true shocks" to aid over time. For this reason, aid residuals

should not be strongly correlated with the residuals of other variables. The residual correlations between aid and other variables are small and not statistically significant for all the countries. Under the assumptions of no cross residual correlations between aid and other variables we can proceed with our analysis.

The sequence of causal testing starts with Case I, the most restrictive one, and ends up with the least restrictive, Case IV. Table 3 presents the results. Based on our analysis, SSA countries can be classified as follows:

I) - Aid and other variables are completely unrelated (Case I): No country belongs to Case I.

II) - Aid is purely adjusting to other variables (Case II): Results show that only in case of Madagascar, aid is purely adjusting. It has no permanent impact on other variables, only transitory effects.

III) - Aid is (weakly) exogenous (Case III): In seven countries, Benin, Burundi, Central Africa, Ethiopia, Lesotho, Mali, and Sudan, we find that aid has an impact on other variables, but is not affected by them.

IV) - Aid is neither completely endogenous or exogenous (Case IV): The remaining countries (Botswana, Burkina Faso, Cameroon, Cape Verde, Gambia, Kenya, Malawi, Mauritania, Rwanda, Senegal, Seychelles, Sierra Leone, Togo, and Uganda) belong to this group. In these countries, aid has a long-run impact on other variables and vice versa.

The Long-Run Impact of Aid

The signs and significance of elements of C_{21} describe the long-run impact of aid shocks on other variables (*trad*, *ntrad*, p^T, and p^{NT}). Table 3 reports the estimated C_{21} coefficients with the significant coefficients highlighted in bold (t-statistics above |1.96|).

Results show that the long-run impact of shocks to aid on tradable output has been negative and significant in majority of SSA countries (15 out of 22)[4]. However, it has a positive and significant effect in four countries, Malawi, Rwanda, Seychelles, and Sierra Leone. The latter result coincides with Demekas et al. (2002) who argue that post-conflict reconstruction aid does not necessarily lead to a shrinkage in the tradable sector. Both Rwanda and Sierra Leone received reconstruction aid after the end of their civil wars in 1994 and 2002, respectively.

We find that aid shocks have a persistent negative impact on the non-tradable output in six countries (Cameroon, Cape Verde, Gambia, Kenya, Togo, and Uganda), a persistent positive impact in five countries (Burundi, Central Africa, Mali, Sudan, and Rwanda), and no effect in the rest. Overall, these results show that the sectoral effects of aid are highly heterogeneous. In four countries (Cameroon, Kenya, Togo, and Uganda) aid has a significant negative effect on both tradable and non-tradable output suggesting that aid has adverse effect on growth in these countries. On the other hand, in Rwanda aid has a significant positive effect on output of both sectors. In four countries (Burundi, Central Africa, Mali, and Sudan), we find that aid has a significant negative effect on tradable output and a positive effect on non-tradable output.

The analysis shows that the effect of aid shocks on prices are also highly heterogeneous. Aid shocks have a positive and significant impact on tradable goods price in seven

countries (Burundi, Central Africa, Gambia, Lesotho, Malawi, Rwanda, and Uganda) and on non-tradable goods price in ten countries[5]. On the other hand, aid shocks have a negative

TABLE 3. LONG-RUN IMPACT OF AID

Country	*trad*	*ntrad*	p^T	p^{NT}	case
Madagascar	0.014 (1.390)	0.052 (1.319)	-0.095 (-1.920)	-0.120 (-1.638)	II
Benin	**-0.069 (-2.273)**	-0.001 (-0.019)	**-0.214 (-3.871)**	**-0.226 (-4.932)**	III
Burundi	**-0.279 (-4.190)**	**0.408 (5.650)**	**0.227 (2.770)**	**-0.303 (-2.909)**	III
Central Africa	**-0.053 (-2.830)**	**0.082 (1.995)**	**0.256 (3.608)**	**0.251 (3.174)**	III
Ethiopia	**-0.277 (-2.222)**	-0.230 (-1.667)	**-0.500 (-2.345)**	**-0.428 (-2.354)**	III
Lesotho	**-0.072 (-3.197)**	0.049 (1.784)	**0.098 (3.228)**	**0.091 (4.221)**	III
Mali	**-0.049 (-2.551)**	**0.038 (2.300)**	0.011 (0.391)	**0.071 (2.960)**	III
Sudan	**-0.036 (-4.494)**	**0.035 (2.034)**	-0.183 (-1.845)	**-0.163 (-2.052)**	III
Botswana	**-0.372 (-3.057)**	-0.061 (-0.765)	0.127 (1.491)	-0.063 (-1.841)	IV
Burkina Faso	**-0.048 (-3.446)**	0.046 (1.841)	0.043 (1.682)	**0.082 (3.758)**	IV
Cameroon	**-0.073 (-3.324)**	**-0.072 (-3.324)**	**-0.207 (-3.324)**	**-0.204 (-3.324)**	IV
Cape Verde	-0.067 (-1.411)	**-0.163 (-2.098)**	-0.007 (-0.218)	**0.162 (3.941)**	IV
Gambia	0.022 (1.459)	**-0.037 (-2.759)**	**0.120 (12.813)**	**0.211 (10.627)**	IV
Kenya	**-0.120 (-2.133)**	**-0.193 (-1.975)**	-0.004 (-0.036)	0.200 (1.688)	IV
Malawi	**0.183 (3.614)**	-0.023 (-0.630)	**0.392 (3.840)**	**0.422 (2.579)**	IV
Mauritania	**-0.066 (-5.221)**	-0.037 (-1.571)	-0.013 (-0.482)	-0.016 (-0.800)	IV
Rwanda	**0.468 (3.580)**	**0.376 (3.388)**	**0.328 (2.484)**	**0.624 (3.453)**	IV
Senegal	**-0.093 (-2.653)**	0.012 (0.647)	**-0.167 (-2.201)**	**-0.135 (-2.297)**	IV
Seychelles	**0.079 (2.143)**	0.048 (1.548)	-0.014 (-0.553)	-0.012 (-0.399)	IV
Sierra Leone	**0.101 (3.977)**	-0.060 (-1.324)	0.103 (0.817)	**0.314 (2.368)**	IV
Togo	**-0.014 (-2.469)**	**-0.025 (-2.886)**	**-0.040 (-5.815)**	**-0.060 (-5.172)**	IV
Uganda	**-0.050 (-4.887)**	**-0.101 (-6.264)**	**0.597 (3.238)**	**0.537 (3.882)**	IV

Note: t-ratios are in parenthesis. Bold figures are significant.

and significant impact on tradable goods price in five countries (Benin, Cameroon, Ethiopia, Senegal, and Togo) and on non-tradable goods price in seven countries (Benin, Burundi, Cameroon, Ethiopia, Senegal, Sudan, and Togo).

Overall, we find that in six countries (Central Africa, Gambia, Lesotho, Malawi, Rwanda, and Uganda) aid has a significant positive impact on both prices, suggesting that it has an inflationary effect in these countries. On the other hand, in five countries (Benin, Cameroon, Ethiopia, Senegal, and Togo) aid has a deflationary effect in the sense that it

has a negative impact on both prices. Finally, there are five countries (Botswana, Kenya, Madagascar, Mauritania, and Seychelles) where aid has no long-run impact on prices. Interestingly, out of four countries (Burundi, Central Africa, Sudan, and Mali) where aid has a significant negative effect on tradable output and a positive effect on non-tradable output, only in Mali there is evidence of relative decline in prices of tradable goods. In Burundi, aid shocks have a significant negative effect on non-tradable prices and a significant positive effect on tradable price, suggesting improvement in terms of trade for tradable sector. In Sudan, aid shocks have a significant positive effect on non-tradable prices and an insignificant effect on the tradable prices suggesting relative improvement in prices of tradable goods. In Central Africa, the effects of aid shocks on both prices are positive and of same magnitude, suggesting that aid shocks have insignificant effect on the terms of trade. Overall, our results cast doubt on the efficacy of Dutch disease mechanism in SSA countries, which has received considerable attention in aid literature.

CONCLUSION

This paper analyzed the long-run impact of aid on output and prices of tradable and non-tradable sectors in twenty-two SSA countries. Results show that aid has a heterogeneous effect on both sectoral output and prices. It has a significant negative effect on tradable output in majority of countries. Aid has a significant positive effect on non-tradable output in five countries, but a significant negative effect in six countries. We also find that aid has an inflationary effect in six countries, while it has a deflationary effect in five countries. Though aid has a negative effect on tradable output in majority of countries, we do not find evidence of Dutch disease. Aid does not lead to deterioration of terms of trade for tradable goods.

ENDNOTES

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[1] Test results can be obtained upon request.
[2] Test results can be obtained upon request.
[3] The tests based on the adjustment α-coefficients t-ratios and the characteristic roots of the model can be obtained upon request.
[4] Benin, Burundi, Botswana, Burkina Faso, Cameroon, Central Africa, Ethiopia, Lesotho, Kenya, Mali, Mauritania, Senegal, Sudan, Togo, and Uganda.
[5] Burkina Faso, Cape Verde, Central Africa, Gambia, Lesotho, Mali, Malawi, Rwanda, Sierra Leone, and Uganda.

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