Research article

Is too much foreign aid a curse or blessing to developing countries?

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ABSTRACT

The aim of the study was to examine the relationship between amount of aid received and economic growth of developing nations and the role of quality of institutions and economic freedom in shaping the relationship between the two. To this effect, a panel data from 2006 – 2019 was gathered from 48 developing countries and an innovative dynamic panel threshold regression was used for estimation. Accordingly, it is found in this study that the relationship between aid and economic growth is nonlinear and U shaped, which shows the presence of threshold value of aid amounting 7.03% of GNI. The results further reveal that aid stimulates economic growth when the sampled developing countries attain a minimum institutional quality threshold of -0.320. As regards to the role of economic freedom, it is found that the overall economic freedom index of 53.481 should be attained to avoid undesirable effect of aid on economic growth. Therefore, the author recommends that donors should advance sufficient amount of aid to developing countries if they are really committed to support their economy. Recipient developing countries should improve up on the existing institutional setup and improve economic freedom indicators in order to get the best out of aid.

1. Introduction

The economic growth theory by Harrod (1939) and Domar (1946) is among the notable neoclassical growth theories. The theory contends that national saving fuels economic growth via bolstering accumulation of capital and, thus, developing countries should save so as to grow economically. Nonetheless, it is true that a number of factors hinder significant mobilization of saving domestically and, therefore, meager investments which eventually slowdown economic growth rate. In addition, developing nations are confronted with foreign exchange shortfall, which creates problem of financing international trade (Chenery and Strout, 1966).

The implication of these theoretical arguments is that capital obtained overseas through stimulates economic growth of developing nations via filling the two gaps (Yiew and Lau, 2018). On contrary to this, however, there are also theoretical arguments that are pessimistic regarding the role of aid in economic growth of developing nations. According to Burnside and Dollar (2000), foreign aid contributes to economic growth only under good institutional environment. Foreign aid could also turn out to be harmful than beneficial to the economy as it erodes balance of payment (Liew et al., 2012). Instead of stimulating investment, Gong and Zou (2001) argue that foreign aid would increase consumption of leisure hours, reducing labor supply.

The aid-growth nexus is debatable not only theoretically, but also empirically. Even though some studies have established positive effect of aid on economic growth (Aboubacar et al., 2015; Lee and Alemu, 2015; Moolio and Kong, 2016; Kitsa, 2018), others find negative (Appiah--Konadu et al., 2013; Aghoutane and Karim, 2017; Sothan, 2018; Edward and Tumwebaze, 2020; Yahyaoui and Bouchoucha, 2020), and some others find insignificant (Tang and Bundhoo, 2017; Kirikkaleli et al., 2021) aid-growth relationship. The empirical inconclusive findings concerning the relationship between foreign aid and economic growth created skepticism among researchers across the globe. Based on the idea that linear models are incapable of capturing the true relationship between the variables, some studies employed nonlinear specification to examine the tipping point of aid (Gyimah-brempong et al., 2012; Fashina et al., 2018; Yiew and Lau, 2018). On the other hand, some other studies investigated the role of economic and political environment of the recipient countries in influencing the foreign aid economic growth relationship (Hussen and Lee, 2012; Tang and Bundhoo, 2017; Adusei, 2020).

Even so, the controversy has not been resolved yet. Among those studies with nonlinear specification, even though the hypothesized nonlinear relationship between the variables is confirmed in some studies, the results obtained are conflicting. As regards to the role of absorptive capacity in terms of quality of institutions and macroeconomic...
policies, some studies concluded that it matters in foreign aid – growth relationship (Yahyaoui and Bouchouca, 2020) while some other failed to confirm this (Adusei, 2020). Therefore, the nature of the relationship between foreign aid and economic growth on the one hand and the role of conditions in the recipient countries for effectiveness of aid on the other is still a living debate.

This article seeks to (i) examine the nature of relationship (test of nonlinearity) between foreign aid and economic growth. (ii) Examine whether or not quality of institutions and economic freedom shape the relationship between aid and economic growth. (iii) If they do so, whether certain threshold does exist below and above which the impact of foreign aid on economic growth varies. By studying the nature of relationship between foreign aid and economic growth and the role of institutional quality, there is no way for the current study to be unique, for similar studies have been conducted so far though with inconclusive results. However, contribution of the current study to the body of literature on aid lies in its attempt to examine the role of economic freedom in the aid – growth relationship. And, employment of recently developed panel threshold regression model developed by Seo and Shin (2016) to identify the threshold values of quality of institutions and economic freedom. The remainder of the article proceeds as follows. Review of empirical literature is given in section 2. Section 3 provides methodology adopted by the study. Section 4 presents results obtained by the study with their discussion. Concluding remarks and recommendations are given section 5.

2. Literature review

The link between foreign aid and economic growth has been studied from different theoretical, empirical, and methodological approaches. However, consensus is yet to be reached regarding the direction of the relationship (positive versus negative) and the nature of relationship (linear versus nonlinear). Since theoretical foundation of the nexus between aid and economic growth is mentioned in the introduction section, the review of available empirical literatures on the subject is given in Table 1.

3. Methodology

3.1. Data

This article examines the nexus of aid and economic growth; and, the role of institutional quality and economic freedom in the relationship between them. For this purpose, 48 developing countries given in Table 2 were selected and the necessary data was collected from available databases like World Development Indicators (WDI), World Economic Outlook (WOE), Worldwide Governance Indicators (WGI), Heritage Foundation, and United Nations development program (UNDP) over the period covering 2006–2019. The sample of countries considered in this study is made up of low income and lower middle-income countries according to the World Bank (WB) country classification. Obviously, these countries are not the only developing countries of the world. Developing countries not included in this study are excluded purely because of unavailability of data. The study period (2006–2019) is decided in an attempt to obtain strongly balanced panel data set as panel threshold regression cannot be implemented with unbalanced. Variables of the study were selected on the basis of theory of economic growth. These are: real GDP per capita (the dependent variable), institutional quality index, economic freedom index, aid, population growth, inflation, government expenditure, investment, financial development and schooling.

### Table 1. Literature review

| Author(s) | Country(s) | Period | Methodology | Effect |
|-----------|------------|--------|-------------|--------|
| **Linier studies** | | | | |
| Adimu (2013) | ECOWAS countries | 1990–2009 | Simultaneous equation model | + |
| Fasanya and Onakoya (2012) | Nigeria | 1970–2010 | Error correction model | + |
| Tadesse (2011) | Ethiopia | 1970–2009 | Multivariate co-integration | + |
| Asteriou (2009) | 5 SSA countries | 1975–2002 | PARDL | + |
| Juselius et al. (2014) | 36 African countries | 1960–2007 | VAR | + |
| Armah (2010) | 31 SSA countries | 1984–2007 | Difference GMM | + |
| Ferreira and Simões (2013) | 75 countries | 1972–2007 | GMM | - |
| Kirikaleli et al. (2021) | Chad | 1982–2018 | ARDL, FMOLS & DOLS | + |
| Aghoustane and Karim (2017) | Morocco | 1981–2014 | VECM | - |
| Edward and Karamurriro (2020) | Uganda | 1970–2017 | ARDL | - |
| Sahlan (2018) | Cambodia | 1980–2014 | ARDL | - |
| Moolio and Kong (2016) | Four Asian countries | 1997–2014 | FMOL & DOLS | + |
| Hussen and Lee (2012) | Ethiopia | 1974–2017 | ARDL | - |
| Lee and Almeida (2015) | 58 countries | 1995–2010 | GMM | + |
| **Non-linier studies: aid threshold/tipping point estimates** | | | | |
| Fashina et al. (2018) | Nigeria | 1984–2016 | Inverted U | |
| Gyimah-Brempong et al. (2012) | 77 countries | - | U shaped | |
| Xie and Lau (2018) | 98 developing countries | 2005–2013 | U shaped | |
| Tiwari (2017) | 28 Asian countries | 1998–2007 | GMM | Inverted U |
| Harb and Halil (2019) | 25 developing countries | 1984–2008 | PSTR | Positive above 12.24% |
| **Non-linier studies: The role of absorptive capacities** | | | | |
| Armah (2010) | 31 SSA | 1984–2007 | Difference GMM | Conditional on PS |
| Tang and Bundhoo (2017) | 10 African countries | 1990–2012 | OLS, 2SLS, FD, FE,RE | Conditional on policy |
| Burmide and Dolor (2000) | 56 developing countries | 1970–1993 | OLS, 2SLS | Conditional on policy |
| Adusei (2020) | 42 African countries | 1983–2018 | System GMM | Ins doesn’t matter |
| Yahyaoui and Bouchouca (2020) | 48 countries | 1996–2014 | OLS, FMOLS & GMM | Conditional on Ins |
| Noba et al. (2016) | Egypt | 1960–2010 | ARDL | Conditional on policy |

Note: PS is political stability, Ins is institutional quality, SSA is sub Saharan Africa, “−” & “+” indicate negative and positive effect respectively.
the level of institutional quality, the study relies on the six variables 
schooling is used to proxy human capital (Law and Singh, 2014; Chata-
(2020) used the same proxy variable in their study. Mean years of 
Topadhyay et al., 2021), which is obtained from UNDP. While the annual 
threshold level (L

Table 2. List of sampled nations.

| N.  | Country          | N.  | Country          | N.  | Country          |
|-----|------------------|-----|------------------|-----|------------------|
| 1   | Malawi           | 17  | Belize           | 33  | Tanzania         |
| 2   | Cote d’ivoire    | 18  | Bolivia          | 34  | Senegal          |
| 3   | Gabon            | 19  | El Salvador      | 35  | Nepal            |
| 4   | Ghana            | 20  | Haiti            | 36  | Mauritania       |
| 5   | Kenya            | 21  | Honduras         | 37  | Myanmar          |
| 6   | Madagascar       | 22  | Egypt            | 38  | Cape Verde       |
| 7   | Mali             | 23  | Vietnam          | 39  | Lesotho          |
| 8   | Mozambique       | 24  | Ukraine          | 40  | Congo, Rep.      |
| 9   | Nigeria          | 25  | Sri Lanka        | 41  | Cameroon         |
| 10  | Rwanda           | 26  | Philippines      | 42  | Benin            |
| 11  | Uganda           | 27  | Pakistan         | 43  | Guinea           |
| 12  | Nicaragua        | 28  | Mongolia         | 44  | Guinea-Bissau    |
| 13  | Tunisia          | 29  | Gambia, The      | 45  | Niger            |
| 14  | Morocco          | 30  | India            | 46  | Chad             |
| 15  | Algeria          | 31  | Indonesia        | 47  | Togo             |
| 16  | Zambia           | 32  | Bangladesh       | 48  | Burkina Faso     |

Table 3 provides description of the variables adopted by the study. In 
this study, aid is represented by official development assistance and 
expressed in its share of GNI and sourced from WDI. Consumer price 
index has been adopted by various contemporary empirical growth 
studies to measure cost of living (see Asongu et al., 2018; Bekere and 
Bersisa, 2018; Ruiz, 2018; Hayat, 2019; Osei and Kim, 2020; Krasniqi and 
Demukaj, 2021). However, GDP deflator is preferred in this study due to 
its ability to capture prices of wider goods and services. While some 
recent studies show inflation is harmful to the economy only after some 
threshold level (López-Villavicencio and Mignon, 2011; Kremer et al., 
2013), there is consensus among different schools of economic thought 
that high growth rate of inflation is unfavorable at all (Thanh, 2015). The 
data is obtained from WDI. Government expenditure is expressed in 
percent of GDP and collected from WOE. The same proxy for the variable 
was used by Hayat (2019); Jain et al. (2021). Government expenditure is 
an important economic variable to stimulate the economy during de 

deficiency of demand in Keynesian economics. Government expenditure 
directed towards development enhances growth (Wahab, 2011). Total 
investment as percentage of GDP is considered in this study as another 
important control variable and sourced from WOE. Investment plays a 
pivotal role in the neoclassical growth theories and often considered as 
an indispensable source of growth. Feeny (2005) and Alshammary et al. 
(2020) used the same proxy variable in their study. Mean years of 
schooling is used to proxy human capital (Law and Singh, 2014; Chat-
topadhyay et al., 2021), which is obtained from UNDP. While the annual 
population growth rate is collected from WDI, financial development is 
provided by global financial development database. 

In order to examine if the effect of aid on economic growth hinges on 
the level of institutional quality, the study relies on the six variables 
designed by world governance indicators (WGI) of the World Bank. The 
six variables are namely control of corruption, political stability and 
absence of violence, regulatory quality, and government effectiveness, 
rule of law and voice and accountability. The variables are scaled from –
2.5 (indicates weak quality of institutions) to +2.5 (indicates strong 
quality of institutions). For the purpose of the current study, the average 
of the six indicators is used because there is no variation in relative 
importance attached to each indicator. In the study by Yahyaoui and 
Bouchoucha (2020), it is found that aid performs better under better 
institutional quality while institutional quality does not play significant 
role in shaping the link between aid and economic growth in the paper by 
Aduoei (2020).

In the same vein, economic freedom is represented in this study by 
index of different indicators and gathered from the heritage foundation. 
It measures the extent of governments’ control over domestic economy 
and graded on scale of 0–100. The higher the scale the more liberal the 
economy and vise versa. According to Burmide ($) and Dollar (2000), aid 
promotes economy if given to countries with good economic policy 
environments. However, the study by Vasquez (1999) and Powell and Ryan 
(2011) fails to confirm this as improvement in economic freedom index is 
not rewarded with more aid. Some western donors like World Bank and 
the International Monetary Fund (IMF) prefers to support more free 
economies. If huge amount of aid stimulates recipient’s economy and if 
huge amount of aid is more likely to flow to ward countries with better 
economic freedom, it can be said economic freedom do matter in the 
relationship between aid and economic growth.

3.2. Empirical model

This study relies on panel threshold regression developed by Seo and 
Shin (2016) to achieve its objectives. Panel threshold regression (PTR for 
short) was first proposed by Hansen (1999). It is a great innovation in 
the field as linear models are becoming incapable of detecting the relation-
ship between various economic variables accurately. PTR is a widely 
used method in research areas like inflation (Kremer et al., 2013; Thanh, 
2015; Khan and Hanif, 2020), financial development (Law et al., 2018), 
foreign direct investment (Osei and Kim, 2020), public debt (Alsham-
mary et al., 2020), mobile penetration (Asongu et al., 2018), etc.

The method of Hansen (1999), though notable contribution in the 
field, is static in nature and cannot capture dynamics. Some scholars have 
tried to extend the method of Hansen (1999) by introducing its dynamic 
version (Caner and Hansen, 2004; Dang et al., 2012; Ramirez-Rodn-
d, 2015; Kremer et al., 2013). Even though all of these models move 
one-step beyond Hansen's model, they are still defective since they 
impose too restrictive requirement of exogeneity of either the predictors 
or the threshold variable or even both (Seo and Shin, 2016). Seo and Shin 
(2016) developed a model that relaxes the restriction imposed on prop-
erties of predictors and threshold variables and allow them to be 
endogenous. The proposed estimator is implemented by the method of 
Arellano and Bond (1991). Therefore, the current study employs
modified versions of the original equation developed by Seo and Shin (2016) as given in Eqs. 1a, 1b, and 1c. According to this panel threshold model, the threshold effect is identified using the nonparametric i. i. d. bootstrapping proposed by Seo and Shin (2016). The null hypothesis of no threshold will be rejected if the bootstrap probability value is less than the conventional critical values (1%, 5%, and 10%).

\[ y_t = (1 \cdot X_{it}) \phi_1 \{ \text{aid}_i \leq \delta \} + (1 \cdot X_{it}) \phi_2 \{ \text{aid}_i > \delta \} + \mu_i + \epsilon_t \]  
\[ y_t = (1 \cdot X_{it}) \phi_1 \{ \text{ins}_i \leq \delta \} + (1 \cdot X_{it}) \phi_2 \{ \text{ins}_i > \delta \} + \mu_i + \epsilon_t \]  
\[ y_t = (1 \cdot X_{it}) \phi_1 \{ \text{freed}_i \leq \delta \} + (1 \cdot X_{it}) \phi_2 \{ \text{freed}_i > \delta \} + \mu_i + \epsilon_t \]  

Where \( y_t \) is the logarithm of per capita real GDP, \( X_{it} \) is a \( K \times 1 \) vector of covariates that vary with time and it includes lag of aid, aid represents amount of aid received; \( \text{ins}_i \) is institutional quality, \( \text{freed}_i \) is economic freedom, \( \phi_1 \) is an indicator function, \( \phi_2 \) is the threshold variable, \( \delta \) is the threshold parameter, \( \phi_1 \) and \( \phi_2 \) are respectively coefficients of the lower and upper regime, \( \mu_i \) is country fixed effect and \( \epsilon_t \) is random error, \( t = 1, \ldots, T \) indexes time and \( i = 1, \ldots, N \) indexes country.

4. Result and discussion

4.1. Descriptive statistics and correlation analysis

The result of descriptive analysis is exhibited in Table 3. As depicted in the table, the log of GDP per capita is 7.275 on average with standard deviation of 0.61, which is an indication of low variability in the data series. Over the study period, the net aid inflow to the sampled developing countries amounts to 4.97 percent of GNI on average. Since there is a big gap between the minimum and maximum values of the series, the data points constituting the series have high variability. The highest value of 24.734 is observed for Haiti in 2010 while the lowest value of 0.399, indicating poor institutional quality. Among the sampled countries, the lowest institutional quality (−1.75) is recorded in Myanmar in 2009 while the highest (0.572) is in Cape Verde in 2010 while the mean value for the whole of the sampled countries is 55.284, which, according to the heritage foundation’s country classification, would classify the sample countries as “mostly unfree”.

The result of correlation analysis is reported in Table 4. It is indicated in the table that the independent variables other than inflation, population growth, aid, and square of aid have positive correlation with economic growth. Coefficient of correlation between economic growth and aid (−0.61) shows strong and negative correlation between the variables, indicating that they move in opposite direction. However, though still negative, the correlation between aid and economic growth becomes moderate as shown by coefficient of correlation of -0.47 between square of aid and economic growth.

4.2. The relationship between aid and economic growth

The current study has examined the relationship between aid and economic growth using the method of Seo and Shin (2016). As indicated in Table 5, the result reveals that the relationship between aid and economic growth is nonlinear because the bootstrap p-value based on 1000 replication is significant at 1% critical value indicating that there is a threshold effect of aid. As reported in the upper part of the table, the threshold level of aid is 7.03, such that about 74% of the observations fall below the threshold level.

In the middle part of the table, the impact of aid on economic growth is given. Accordingly, \( \phi_1 \) and \( \phi_2 \) represents the coefficient of aid below and above the threshold level respectively. Below the threshold level, the impact of aid on economic growth is negative while it turns out positive above it. Specifically, a 1-percentage point increase in aid to GNI ratio decreases economic growth by 1.4% for any amount of aid no more than 7.03 percent of GNI and increases economic growth by 1.3% for aid to GNI ratio exceeding 7.03. Thus, aid is nonlinearly related to growth taking U-shape, which means that the impact of aid on economic growth is favorable if and only if it is above certain threshold level. In other words, too much aid to developing nations benefits, not harm their economy. Similar result was obtained by Gyimah-Brempong et al. (2012) and Yiew and Lau (2018). Furthermore, the threshold estimate recorded in this study is closer to the minimum 6.6 percent documented by

Table 4. Matrix of correlations.

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|
| Loggdp    | 1.00|     |     |     |     |     |     |     |     |      |     |
| Aid       | -0.61| 1.00|     |     |     |     |     |     |     |      |     |
| Pop       | -0.39| 0.39| 1.00|     |     |     |     |     |     |      |     |
| Inf       | -0.08| 0.002| -0.09| 1.00|     |     |     |     |     |      |     |
| Ed        | 0.33| -0.27| -0.44| -0.04| 1.00|     |     |     |     |      |     |
| School    | 0.71| -0.55| -0.52| 0.10| 0.29| 1.00|     |     |     |      |     |
| Inv       | 0.20| -0.07| -0.07| -0.05| 0.24| 0.15| 1.00|     |     |      |     |
| Gov       | 0.32| -0.01| -0.32| -0.06| 0.27| 0.33| 0.27| 1.00|     |      |     |
| Ins       | 0.28| 0.12| -0.17| -0.04| 0.30| 0.27| 0.24| 0.27| 1.00|      |     |
| Freed     | 0.18| 0.02| 0.04| -0.04| 0.11| 0.13| -0.01| -0.16| 0.60| 1.00|     |
| Aid sq    | -0.47| 0.93| 0.27| 0.01| -0.22| -0.40| -0.10| 0.02| 0.12| 0.00| 1.00|
Gyimah-Brempong et al. (2012). On the other hand, the result obtained in this study is in stark contrast with what was found by Ali and Isse (2005); Fiodendji and Evlo (2013). These authors found inverted U shape relationship between aid and economic growth. The finding also differs from what was recorded by the study conducted by Khan and Ahmed (2007). The authors concluded that foreign aid is not blessing both at aggregated and disaggregated level from their linear model specification.

Certain amounts of aid received by recipient countries will be added to their capital stock, and hence, bolster investment activities. When viewed from this angle, aid will stimulate economic growth (Yiew and Lau, 2018; Ovaska, 2003). This provides theoretical base for the observed positive effect of aid on economic growth above the threshold level. However, it is also possible that aid requires good policy to be effective (Burnside and Dollar, 2000; Niyonkuru, 2016) and deteriorate balance of payment by causing national currency of the recipient country to appreciate (Liew et al., 2012). According to Borjas (2015), an increase in non-labor income reduces the number of hours people choose to work, which reduces the total labor supply in the economy. Since foreign aid tends to increase non-labor income, therefore, it reduces labor supply and this harms the productive capacity of the country (Gyimah-Brempong et al., 2012). Thus, the claim of the existence of some conditions for effectiveness of aid and the tipping point is not unfounded.

Generally, as the results of this article reveal, the impact of foreign aid received by developing countries on their economic growth is contingent on the amount received. Since it is established that the impact of aid on economic growth is negative (positive) when amount of aid received is below (above) the threshold level respectively, it implies that foreign aid received by the developing countries inevitably entails both favorable and unfavorable effects. Therefore, below the threshold level (7.03% of GNI), the positive effect of aid on economic growth cannot completely swamp the negative effect and foreign aid remains detrimental to the economy. When it is sufficiently above the threshold level, however, it starts to stimulate economic growth. Significance and sign of the control variables are expected except financial development in this study.

The role of institutional quality in the relationship between aid and economic growth.

The role of institutional quality and economic freedom can also be examined using panel threshold regression by designating quality of institutions and economic freedom as threshold variables. This time, however, the threshold variables are institutional quality and economic freedom. In order for institutional quality and economic freedom to matter, the threshold estimate of institutional quality and economic freedom should be statistically different from zero. As shown in Table 6, quality of institutions and economic freedom matter in the nexus of aid and economic growth as confirmed by the bootstrap p-value of less than 1%.

As indicated in Table 6, the institutional quality threshold is -0.320, such that about 72% of the total observations fall below this. Below the threshold level, the effect of aid on economic growth is positive but insignificant. Above the threshold level, however, aid contributes to the economic growth positively and significantly. Accordingly, it is found in this study that a 1% increase in aid to GNI ratio is associated with 0.9% increase in economic growth in countries with average institutional quality greater than -0.320. Similar results concerning the positive role of good quality institutions in the impact of aid on economic growth is obtained by prior studies (Burnside and Dollar, 2000; Tang and Bundhoo, 2017). However, the argument that aid undermines growth under poor institutional quality is not established in this study since the coefficient of aid below the threshold level, though insignificant, is positive.

As regards to the role of economic freedom, the threshold level is 53.481 and it is significant at 1% significance level. As shown in Table 6, the effect of aid on economic growth varies below and above this threshold level. Below the threshold level, the impact of aid on economic growth is negative, but it becomes insignificant when economic freedom index exceeds the threshold level. Specifically, a 1-percentage point increase in economic freedom below the threshold level costs 0.3% in economic growth. The observed negative effect of aid on economic growth when economic freedom is below the threshold level of 53.481 might be for two reasons.

Firstly, the low level of economic freedom index is an indicative of huge involvement of government in the overall economy than private sectors. In situations where government officials are opportunistic and/or corrupt, however, there is little chance for funds obtained through aid to be directed toward productive activities, and thereby promote growth.

Secondly, as found in this study a low level of aid received (below 7.03% of GNI), by developing countries is detrimental to their economy. Some western donors like IMF and WB requires the aid receiving economies to reform their institutions in line of neo liberalism. Countries that show improvement in economic freedom measures will be rewarded with more aid from these donors. Thus, countries with low economic freedom faces difficulties in attracting more aid and thus forced to experience the negative impact of low level of aid received. Out of the 48 sampled countries in this study, 32 have the overall economic freedom index above the threshold level on average. Aid flows to these countries amounts to 5.18% on average while the remaining 16 countries with economic freedom index below the threshold level managed to attract 4.5% of GNI as aid. Therefore, it implies that countries with better economic freedom are rewarded with more aid than those with poor economic freedom.

5. Robustness check

The nonlinear relationship between aid and economic growth on one hand, and the significant role that institutional quality and economic freedom play in the relationship between the variables on the other, has been established by the panel threshold regression. In order to check if the result obtained is robust to different model specification, the current study employed system generalized method of moment with quadratic and interaction models. The quadratic model was used to determine the tipping point while the interaction models were used to ascertain the conditionality of the relationship between vid and economic growth on institutional quality and economic freedom.

The robustness of the mediating role of quality of institutions and economic is checked by including the interaction term between aid and quality of institutions and between aid and economic freedom in the GMM estimation. As indicated in Table 7, the estimated coefficients of

| Table 6. Threshold estimates of institutional quality and economic freedom. |
|---|
| Institutional Quality Economic Freedom |
| \( \phi \) | -0.320*** | 53.481*** |
| \( \phi_1 \) | 0.0004 (0.40) | -0.003 (3.23)*** |
| \( \phi_2 \) | 0.009 (2.66)*** | -0.002 (0.74) |
| Impact of covariates |
| Log(GDP) | 0.825 (36.21)*** | 0.824 (54.12)*** |
| Financial development | -0.0006 (-2.66)*** | 0.00007 (1.61) |
| Investment | 0.002 (4.24)*** | 0.002 (4.56)*** |
| Inflation | 0.0001 (1.48) | 0.0001 (0.28) |
| Population growth | -0.017 (-0.45) | 0.091 (2.55)*** |
| Government expenditure | 0.001 (1.67)* | 0.003 (2.96)*** |
| The 95% confidence interval of the threshold level | [-0.509, -0.131] | [49.675, 57.287] |
| Bootstrap p-value test of linearity | (0.000) | (0.000) |
| Lower regime (%) | 72 | 32 |
| Number of IVs | 162 | 162 |

Note: *, **, *** indicates significance of the estimated coefficients at 10%, 5%, and 1%. Figures in the parenthesis are t-values. The reported coefficients of covariates are those in the lower regime.
aid and square of aid are statistically significant at 5% and 10% significance level respectively with opposite sign. Since the sign of coefficient of aid is negative and that of square of aid is positive, we conclude that the relationship between aid and economic growth is nonlinear taking U shape. The tipping point of 15.5% of GNI is, however, more than twice the threshold level established by the dynamic panel threshold regression. Similar to this result, quadratic specification has overstated the tipping point than the panel threshold regression in the study conducted based on standard error computation explained in Brambor et al. (2005) and Wooldridge (2012).

The interaction models also confirm the result established in dynamic threshold regression regarding the role of quality of institutions and economic freedom. As it is vividly shown in Table 7, standing alone, the impact of aid on economic growth is negative. However, it turns out positive when it interacts with institutional quality. For this interaction model, the marginal effect is not significant when evaluated at mean, minimum, and maximum values of institutional quality. Concerning the role of economic freedom, the negative impact of aid on economic growth becomes positive when interacted with economic freedom, indicating that economic freedom matters. As shown in Table 7, the marginal effect of the interaction term between aid and economic freedom is significant at all values (mean, minimum, and maximum) of economic freedom index.

### 6. Conclusion and recommendation

Even though aid is meant to support the economy of developing countries, there are cases against these both at theoretical and empirical level. To this base, the link between aid and economic growth has been extensively researched with linear models so far. Though limited in number, few studies has tested the nonlinearity in relationship between aid and economic growth with quadratic and interaction models. As far as the relationship between aid and economic growth is concerned, however, results from previous studies are mixed. With this background, the current study is motivated to investigate the link between aid and economic growth using a different approach from the previous studies on the subject. This study contributed to literature on aid in three ways. Firstly, the study has tested non-linearity of the relationship between aid and economic growth using an innovative dynamic panel threshold regression. Secondly, the study has estimated threshold level of institutional quality, which developing countries should attain to be benefited from foreign aid. Thirdly, the study has investigated whether economic freedom matters in the relationship between aid and economic growth.

The study findings show that the effect of aid received by sample developing countries on their economic growth depends on amount of aid received, quality of institution, and economic freedom. Specifically, it is found in this particular study that aid received by developing countries should amount to greater than 7.03% of their GNI to promote economic growth, below which it is detrimental than beneficial. Hence, the result provides empirical support for the famous big push theory that advocates developing countries should mobilize huge amount of resources (including aid) to get their economy transformed for the better. The study also found that institutional quality matters in the relationship between aid and economic growth. In order to be benefited from foreign aid, developing countries should have minimum institutional quality index of -0.320. Below this threshold estimate, the impact of aid on economic growth is not negative, but insignificant. As regards to the role of economic freedom, it is found that aid does not perform well under poor economic freedom index. Below the threshold estimate of economic freedom of 53.481, aid harms the economy of the recipient country. Above the threshold level, however, the impact of aid on economic growth becomes insignificant.
The implication is that developing nations should attract sufficiently large amount of aid (above 7.03% of their GNI); and increase quality of institutions and economic freedom to be benefited from foreign aid. The findings obtained in this study should be considered with caveats. First, the threshold estimates established in this study are based on the panel of countries considered and, therefore, might not be appropriate for individual country. Threshold estimates for individual countries needs to country level studies. Second, the current study examined the impact of aggregated aid inflow on economic growth. Since the impact of aid on economic growth might differ according to the type of aid received, future similar researches can extend the analysis to the disaggregated aid inflows. Thirdly, owing to small sample of nations selected by this article (only 48), it is inappropriate to further divide the sample in to regions or continents to check robustness of the results by controlling for the regions or/and continents.

Declarations

Author contribution statement

Chala Amante Abate: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interest’s statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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