

Foreign aid, macroeconomic policies and economic growth nexus in India: An ARDL bounds testing approach

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Abstract. *The purpose of this paper is to examine the effectiveness of foreign aid on economic growth in Indian economy using annual data from 1970 to 2014. The co-integration test confirms a long run relationship between real GDP per capita and foreign aid for India. The study finds a positive and significant impact of foreign aid on economic growth in India both in long run and in short run. Our results provide strong evidence that effectiveness of foreign aid on economic growth is contingent on macroeconomic policy environment in India. The VECM results confirm short-run and long run unidirectional causality running from foreign aid, government expenditure and trade openness to economic growth in India. Further, the results of the variance decomposition approach indicate that economic growth in India mostly explained by foreign aid. Further, the impulse response function result indicates that there is positive response in economic growth due to shock stemming in foreign aid. The findings and the results are useful guidelines for major stakeholders, including donors and the government of recipient countries for designing framework for aid effectiveness.*

Keywords: Foreign Aid, Economic growth, India, ARDL, VECM.

JEL Classification: C01, C51, E13, F03, F35.

1. Introduction

Developing countries are no doubt characterized as capital resource constraint economies. This much needed capital to boost economic growth and welfare is largely inadequate domestically, which consequently deserves the need for external capital. Foreign aid is a significant source of external income to developing countries. Foreign aid has a potential to play a key role in promoting developing countries' economic growth. It has emerged as a dominant strategy for alleviating poverty in developing nations. Yet it seems that the developing countries of the world continue to suffer from economic hardship, raising questions of whether foreign aid is a worthwhile and effective approach to boost growth and development in recipient economies. This question has attracted the attention of many scholars over several decades.

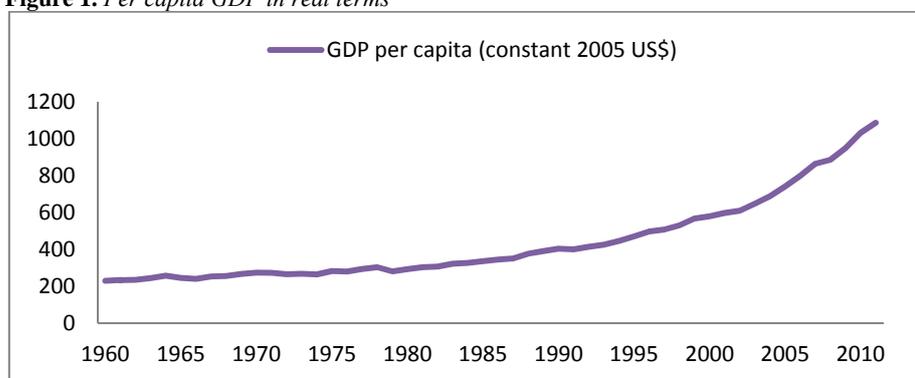
As Morrissey (2001) points out (a) aid increases investment, in physical and human capital; (b) aid increases the capacity to import capital goods or technology; (c) aid does not have indirect effects that reduce investment or savings rates; and aid is associated with technology transfer that increases the productivity of capital and promotes endogenous technical change. According to McGillivray et al. (2006), four main alternative views on the effectiveness of aid, namely; (a) aid has decreasing returns, (b) aid effectiveness is influenced by external and climatic conditions, (c) aid effectiveness is influenced by political conditions, and (d) aid effectiveness depends on institutional quality.

The empirical evidence on the role of foreign aid in the growth process of developing countries obtained from extensive studies has been mixed. For example (Papanek, 1973; Levy, 1988; Islam, 1992; Hansen and Tarp, 2000; Burnside and Dollar, 2000; Gomanee et al., 2003; Dalgaard et al., 2004; Karras, 2006) find evidence for positive impact of foreign aid on growth, (Easterly, 1999; Burnside and Dollar, 2000; Brautigam and Knack, 2004) find evidence for negative impact of foreign aid and growth, while (Mosley, 1980; Mosley et al., 1987; Boone, 1996; Jensen and Paldam, 2003; Rajan and Subramaniam, 2005; Williamson, 2008) find evidence to suggest that aid has no impact on growth. It should be noted that, although Burnside and Dollar (2000) concluded that foreign aid has positive effects, this conclusion applies only to economies in which it is combined with good fiscal, monetary, and trade policies. A study by Doucouliagos and Paldam (2009), using the meta-analysis covering 68 papers containing a total of 543 direct estimates, it is found that the effect of aid on growth estimates scatter considerably and add up to a small positive, but insignificant, effect on growth. By and large, the relation between aid and economic growth remains inconclusive.

Foreign aid takes many forms. The most important in terms of its size and influence is Official development assistance (ODA) provided by the Development Assistance Committee (DAC) of the Organization for Economic Cooperation and Development (OECD). ODA is calculated as the sum of grants and loans to aid recipients' countries that; (a) are undertaken by the official sector of the donor country; (b) have the main objective of promotion of economic development and welfare in recipient countries; and (c) are on concessional financial terms (i.e., with a grant element equal to at least 25 per cent of the total). In addition to these financial flows, technical co-operation costs are also

included in ODA. The items that are not included in ODA are: grants, loans and credits for military purposes, transfer payments to private individuals, donations from the public, commercial loans and foreign direct investment (FDI). India's widely seen success stories of globalization, has significantly accelerated its economic growth since the inception of economic reforms in 1991 (Basu, 2008; Panagariya, 2010). The country is one of the fastest growing economies in the world and hosts some of the largest foreign investment inflows in recent years (UNCTAD, 2010). Figure 1 shows that per capita GDP has remained almost constant ranging between the periods 1960 to 1980. After that, real per capita GDP shows an upward trend over the rest of the period.

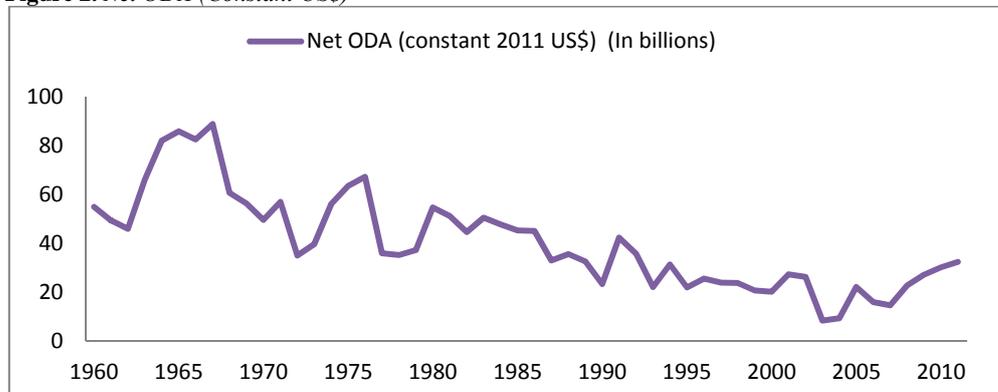
Figure 1. *Per capita GDP in real terms*



Source: World Bank, database.

It is not surprising to note that despite its rapid economic growth in recent years, India still receives development aid. Among developing countries, India continues to be one of the largest recipients of foreign aid. In 2009, the total net ODA, received by India from all donor countries was about US\$ 2.502 billion, of which US\$ 1.578 billion was in the form of net bilateral aid flows from countries organized in the Development Assistance Committee (DAC) (OECD, 2012). At US\$ 630 million, India is still the single largest recipient of development aid from the United Kingdom (OECD, 2012). Moreover, India also receives a substantial amount of aid from international NGOs. For example, in 2010, the Bill & Melinda Gates Foundation committed US\$ 100 million to India (OECD, 2012).

Figure 2 shows that ODA to India has been fairly sporadic with dips in contributions over the period under consideration. The peak from 1965 - 1980 was a response to India's economic problems mostly due to Indo - Pak war and its consequences which resulted in a request to the IMF for a greater ODA. Subsequently, ODA has been relatively constant since the early 1980s. The average annual disbursement of aid to India in the first half of the 1990s was close to 2.9 billion dollars. After the introduction of the economic reforms period spanning from 1992 onwards there has been decrease in ODA till 2003-2004 followed by a rise and then another fall in 2006 and 2007. Again, it has increased due to the financial crisis that has also affected the Indian economy, which required further assistance from the external sector.

Figure 2. Net ODA (Constant US\$)

Source: World Bank, database.

Unsurprisingly the top five government donor's total contributions over the last 11 years have been from UK, Japan, EU, Germany and the United States (US), the five donors with bilateral programmes from 2003. Even before the decision was taken to limit bilateral aid the UK funded a considerable proportion of aid to India, for example 18% in 2002. This proportion rose to 46% and 43% in 2003 and 2004 respectively before settling at figures between 22% and 31% over the next six years. Over the period 2000 to 2010 the UK has given 23% of all aid. In 2010 however, Japan gave the largest amount of aid to India, US\$939.3 million (more than US\$300 million more than the UK) representing 34% of the total for that year.

Table 1. Top three donors of India's official development assistance (ODA), 2000-2010

Top three donors	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
1 UK	265.0	232.3	427.5	365.8	356.7	551.5	318.8	416.0	536.7	630.3	636.7	4737.3
UK %	14	9	18	46	43	27	22	31	26	25	23	23%
2 Japan	383.2	629.2	613.9	381.1	-90.7	81.5	35.9	123.8	658.6	517.0	939.3	4272.7
Japan %	21	25	26	48	-11	4	2	9	32	21	34	21%
3 EU	108.1	152.4	164.0	84.2	172.4	226.2	245.4	93.9	119.2	98.9	98.3	1562.9
EU %	6	6	7	11	21	11	17	7	6	4	4	8%

Source: OECD DAC, constant 2009 prices, excluding debt relief, in US\$ million and as a proportion of ODA from all donors.

There is no significant study regarding the aid effectiveness on economic growth by using modern econometrics technique for India. Specifically, no known study has used the autoregressive distributed lag (ARDL) approach to examine this relationship. There is a need to fill this gap in literature. Hence, the objective of this paper is to shed light on the issue by using ARDL approach to investigate the linkage among foreign aid, macroeconomic policies and economic growth in the context of India. The aim of the paper is to examine the effectiveness of foreign aid (or more explicitly ODA) on economic growth in India. More specifically, an attempt is made to ascertain whether effectiveness of foreign aid on economic growth is contingent on macroeconomic policy environment in India. The outcome of the study will provide useful insights into the role of foreign aid,

macroeconomic policies and will help the policy makers to address the issue of aid effectiveness in developing countries like India.

The remainder of the paper is structured as follows; Section 2 presents the theoretical perspectives and review of empirical literature. Section 3 outlines the model specification, data issues, econometric methodology used in the study. Section 4 analyses the empirical results of the study and Section 5 presents the concluding remarks and policy implications.

2. Literature review on aid-growth relationship

2.1 Theoretical perspective

The earlier work on the relationship between foreign aid and economic growth were persuaded by the early growth theories, which suggested that aid is considered to be the driving force for economic growth through capital accumulation in the recipient country. Conventionally, the most important limitation to the economic growth of developing countries despite having surplus labour, there is lack of savings which is crucial for investment. Additionally, low per capita income limits the capacity to generate saving for developing economies. The original Harrod-Domar model was expanded in the “two-gap” model of Chenery and Strout (1966). This model suggested that the first gap is between the amount of investment necessary to attain a certain rate of economic growth and the available domestic saving, whereas the second gap is between import requirements for a given level of production and foreign exchange earnings (Easterley, 2003). The developing countries cannot overcome the shortage of saving and foreign exchange earnings from their own resources. Thus, foreign aid could be used to promote the growth in developing countries by reducing saving-investment and export-import gap and eradicating the constraints of the original Harrod-Domar model (Papanek 1972, Newlyn 1973).

Bacha (1990) added a third gap (in addition to savings and foreign exchange gaps) – the fiscal gap to this model of aid-growth. The basic argument argued that all aid was used as a net increment to the capital stock. Another group of economists, Rahman (1967), Griffin (1970), Griffin and Enos (1970) and Weisskopf (1972) argued that that if the cost of foreign resources (in the form of concessional loan and grant aid) is lower than the marginal rate of return, then only these resources would be preferred substitutes for domestic resources (savings).

Further, in recent years, literature on aid effectiveness on the stable macroeconomic policies of the recipient countries has been stressed to make aid more effective for economic growth. The World Bank also stressed on supportive macroeconomic framework for successful structural adjustment. It can be viewed that macroeconomic stability and fewer distortions make capital inflow more effective. Distortionary macroeconomic policies reduce the efficiency of capital investment and the rate of economic growth (World Bank, 1990). Hudson and Mosley (2001) mentioned two reasons for the inclusions of policy variables in the original model. Firstly, there is a possibility that countries with good policy environment would grow faster, regardless of

the changes in the factors of production. Secondly, there is a possibility that in the presence of a good policy environment, credit is transmitted into investment. Hence, empirical investigations are required to establish the foreign aid-economic growth nexus taking into account macroeconomic policies in recipient developing countries.

2.2. An overview of empirical literature

There seems to be extensive work examining the direction between aid and growth. As earlier mentioned, the results from these various studies are mixed. On the one side, World Bank research finds that aid effectiveness is contingent on the macroeconomic policy environment of the recipient. Aid is effective at spurring growth in countries with good policies but has little impact in countries with poor policies. This view was supported by: Burnside and Dollar, 2000; Collier and Dollar, 2002; Collier and Dehn, 2001; Collier and Hoeffler, 2002. On the other side of the debate, researchers argue that aid works irrespective of the policy environment (Hansen and Tarp, 2001; Lensink and Morrisse, 2000; Guillaumont and Chauvet, 2001; Dalgaard and Hansen, 2001; Hudson and Mosley, 2001; Lu and Ram, 2001). Implicit, in the debate is the issue of aid selectivity. Advocates of the World Bank research argue for a re-allocation of aid in favor of countries with good policies and a policy of selectivity is currently being embraced by many bilateral and multilateral aid donors. However, a policy of selectivity is unfounded and unnecessary if aid works irrespective of the policy environment. The debate has been driven by the results from cross-country regression analysis.

Hansen and Tarp (2000) reviewed 72 studies that estimated aid-growth relationship. 40 out of those 72 studies showed a positive relationship between foreign aid and economic growth while 31 studies did not find any significant impact. Only one study showed a negative aid-growth nexus. They also claimed that such positive impact of aid came through increased savings. Thus, it can be argued that foreign aid helps to increase economic growth in developing countries by relieving the savings constraint. A study conducted by McGillivray (2005) demonstrates how aid to African countries not only increases growth but also reduces poverty. He points out the important fact that continuously growing poverty, mainly in sub-Saharan African countries, compromises the MDGs (Millennium Development Goals) main target of dropping the percentage of people living in extreme poverty to half the 1990 level by 2015. His research econometrically analyzes empirical, time series data for 1968-1999, concluded that the policy regimes of each country, such as inflation and trade openness, influence the amounts of aid received.

Addison et al. (2005) examine trends in official aid to Africa over the period 1960 to 2002. The authors largely emphasize the tremendous decrease in aid over the last decade, which will have an impact on Africans living in poverty and the African economy as a whole. This paper concludes that aid promotes growth and reduces poverty. It also positively impacts public sector aggregates, contributing to higher public spending and to lower domestic borrowing. Gomanee et al. (2005) address directly the mechanisms via which aid impacts growth. Using a sample of 25 Sub-Saharan African countries over the period 1970 to 1997, the authors determined that foreign aid has a significant positive effect on economic growth. Furthermore, they identified investment as the most

significant transmission mechanism. This paper concludes that on average, each one of percentage point increase in the aid/GNP ratio contributes one-quarter of one percentage point to the growth rate. Karras (2006) investigates the correlation between foreign aid and growth in per capita GDP using annual data from the 1960 to 1997 for a sample of 71 aid-receiving developing countries. This paper concludes that the effect of foreign aid on economic growth is positive, permanent, and statistically significant.

By using a simultaneous-equation model, Burke and Ahmadi-Esfahani (2006) did not find sufficient evidence to conclude that aid had a significant effect on the economic growth in Thailand, Indonesia and the Philippines during 1970 to 2000. A study by Doucouliagos and Paldam (2009), using the meta-analysis covering 68 papers containing a total of 543 direct estimates, found that the effect of aid on growth estimates scatter considerably and add up to a small positive, but insignificant, effect on growth. Mallik (2008) predicted negative effect of aid on economic growth while investigating long run and short run relationship between foreign aid and log of real GDP per capita in 6 Sub-Saharan countries using cointegration technique 5 out of 6 countries had a significant and negative long run effect of aid on economic growth. In the short run, foreign aid seemed to have no significant impact on growth of real GDP per capita in most of these Sub-Saharan economies except Nigeria.

While a large set of literature attempts to identify the aid-growth relationship, very few examine this issue for South Asian countries. Dhakal et al. (1996) examined three South Asian countries: India, Nepal and Pakistan, applying Granger Causality test in these countries for the period 1960 to 1990. Growth effect of aid was found to be positive and significant in India and Pakistan. Otim (1996), however, implicitly observed a positive relationship between aid and growth through government fiscal behavior in three South Asian countries: Pakistan, India and Sri Lanka. The apparent failure for observing any clear link between aid and growth may be attributed to several factors including small set of sample and mis-specified model that limit the effectiveness of these studies. Hence, inconclusive results on aid-growth relationship in South Asia demand for further investigation. A paper by Asteriou (2009) used a panel data set for five South Asian countries to investigate the aid-growth relationship for a period ranging from 1975 to 2002. Using both panel Mean Group (MG) and Pooled Mean Group (PMG) approaches, Asteriou found a positive aid-growth relationship in this region.

The debate so far has been driven by the results from cross-country regression analysis. Surprisingly very few studies have investigated the issue of aid effectiveness for individual aid recipients using time series data. This is surprising since the impact of aid is likely to be recipient country specific.

By using time series data from 1972 to 1988, Islam (1992) suggested a weak positive relationship between aid and growth in Bangladesh. Although grants and food aid were found to be more effective than community and project aid; however, in general, foreign resources seemed to have less impact on growth compared to domestic resources. This conclusion deserves careful consideration for two reasons. First, the period in Islam's study was short for time series analysis and second, Islam himself mentioned that estimated coefficients suffered from collinearity and specification problem. Khan and

Rahim (1993) focused on the effectiveness of aid in increasing GNP growth in Pakistan from 1960 to 1988. Although aid did not have immediate impact on GNP growth; one year lagged value of aid variable produced positive and significant growth impact. These results contradicted with Shabbir and Mohammed (1992) who earlier found a positive aid-growth relationship in Pakistan. According to Mahmood (1993), insignificant results of Khan and Rahim (1993) might be due to mis-specification of their model.

Gounder (2001) investigate the effectiveness of foreign aid for the case of Fiji for the period 1968 to 1996. He used Autoregressive Distributed Lag approach to co-integration to estimate the models. The results show that total aid flows and its various forms i.e., bilateral aid, grant aid and technical cooperation grant aid, has a significant impact on economic growth in Fiji. Lloyd et al. (2001) investigate the effectiveness of foreign aid for the case of Ghana for the period 1970 to 1997. The study finds that aid contributes to long-run growth in private consumption and that policy reform enhanced the effectiveness of aid. Quartey (2005) focuses on innovative ways of making financial aid effective in Ghana. The author concluded that mainly multi-donor budgetary support could be successful, but only if the government of Ghana and its partners plan better and coordinate their efforts.

Mavrotas (2002) focused on the effectiveness of aid on growth for India. He derived a reduced form growth equation for the period 1970 to 1992. He found that policies have an impact on aid effectiveness in India. The study supported the finding that aid contributes to long-run growth in private consumption and that policy reform enhanced the effectiveness of aid. Ouattara (2006) analyzes the effects of aid flows on key fiscal aggregates in Senegal for the period of 1970-2000. The author determined three main outcomes of his study. Firstly, a large portion of aid flows, approximately 41%, was used to finance Senegal's debt and 20% of the government's resources are devoted to debt servicing. Secondly, the impact of aid flows on domestic expenditures is statistically insignificant, and thirdly debt servicing has a significant negative effect on domestic expenditure.

While there is mounting evidence that aid does contribute to growth, there is some dispute as to whether good policy is a necessary condition for aid effectiveness. To enhance our understanding of aid effectiveness, it is desirable to conduct study to assess the impact of aid on growth in a developing country like India by taking into account the policy variables.

3. Methodology and data

3.1 Model specification and data issues

The main focus of the study is the issue of whether aid works better in the presence of good policy environment. In order to capture the effectiveness of aid inflow on growth in the presence of good policy, we incorporate the aid-policy interactive term in the growth model. The model specified for estimating the impact of foreign aid on economic growth

identifies capital and other key determinants of economic growth as commonly suggested in the growth-literature Kargbo (2012).

Following the underlying theory, to examine the role of aid on economic growth, we employ both time series estimation procedure by employing ARDL approach to co-integration.

The empirical model framed for aid-growth linkage is specified as:

$$LPGDP_t = \beta_0 + \beta_1 LODA_t + \beta_2 LPI + \beta_3 LGFCE + \beta_4 INF + \beta_5 LTOP + \varepsilon_t \quad (1)$$

Where, LPGDP represents the economic performance of an economy. It is defined by per capita gross domestic product. LODA is aid denotes foreign aid (ODA) as a share of GDP. LPI constitutes the summation of ratio of gross capital formation to GDP (GCF) and private sector credit to GDP (Kargbo, 2012), it represents the private capital domestic sources which is crucial source of capital in addition to aid to encourage economic growth.

Apart from these the variables the study makes use of three control variables, (1) government final consumption expenditure (GFCE) (Easterly and Rebelo, 1993) to include the effect of the fiscal policy; (2) consumer price index (CPI, base year = 2005); inflation (Fischer 1993) to capture the impact of monetary policy and (3) trade openness, which is (imports + exports)/GDP (Fenny 2005). Openness to trade is often hypothesized to raise growth through several channels, such as access to advanced technology from abroad, greater access to variety of inputs for production, and also broader markets that raise the efficiency of domestic production through increased specialization (Durberry et al., 2006). Edward (1998), for instance, uses a series of openness indicator of trade policy. In the present context, the ratio of total trade to GDP ratio is used as variable named (TOP) to proxy the trade openness in India.

In the present context, the study uses the annual data for the period 1970 to 2014. L implies that the variables have been transformed in natural logs. The data sources are; International Financial Statistics Yearbooks published by the IMF and World Bank Statistical Yearbooks.

3.2. Co-integration with ARDL

To empirically analyze the long run relationship and dynamic interaction, the model has been estimated by Auto regressive distributed lag (ARDL) co-integration procedure developed by Pesaran et al. (2001). The procedure is adopted for following reasons. First, the bound test is simple as opposed to other multivariate co-integration technique such as Johansen and Juselius (1990), it allows co-integrating relationship to be estimated by OLS once the lag order is selected. Second, the bound test procedure does not require the pre testing of the variables included in the model for unit root unlike other techniques, such as Engle and Granger (1987). These approaches require that all the variables to be integrated of the same order (I(1)). Otherwise, the predictive power will be lost (Kim et al., 2004; Perron, 1989, 1997). However, ARDL technique is applicable irrespective of whether regressor in the model is I (0) or I (1). The procedure will however crash in the presence of I (2) series. Third, the test is relatively more efficient in small sample data sizes as is the case of this study. Fourth the error correction method integrates the short

run dynamics with long run equilibrium without losing long run information. The inclusion of dynamics helps in the correction of endogeneity bias (Pesaran and Pesaran, 1997). This methodology is the appropriate one, as foreign aid has been largely argued to be endogenous. The unrestricted error correction model (UECM) of ARDL model is used to examine the long run & short run relationship take the following form.

$$\begin{aligned} \Delta LPGDP_t = & \delta_0 + \delta_1 C + \delta_2 LODA_{t-1} + \delta_3 LPI_{t-1} + \delta_4 LINF_{t-1} + \delta_5 LGFCE_{t-1} + \delta_6 LTOP_{t-1} + \\ & \sum_{i=1}^q \alpha_i \Delta LODA_{t-i} + \sum_{i=1}^q \beta_i \Delta LPI_{t-i} + \sum_{i=1}^q \mu_i \Delta LINF_{t-i} + \sum_{i=1}^q \sigma_i \Delta LGFCE_{t-i} + \\ & \sum_{i=1}^q \omega_i \Delta LTOP_{t-i} + \varepsilon_t \end{aligned} \quad (2)$$

Where the series are as defined earlier and C is constant term and L implies that the variables have been transformed in natural logs. The first part of the equation (2) with $\delta_2, \delta_3, \delta_4, \delta_5$ and δ_6 refer to the long run coefficients and the second part with $\alpha, \beta, \mu, \sigma, \omega$ refers to the short run coefficients. The null hypothesis of no c0-integration $H_0: \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = 0$ and the alternative hypothesis $H_1: \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq \delta_6 \neq 0$ implies co-integration among the series (equation 2).

3.3. ARDL bound test procedure

The first step in the ARDL test is to estimate equation (2) by OLS in order to test for existence of a long run relationship among variables by conducting an F-test for the joint significance of the coefficients of the lagged levels of variables i.e. H_0 (null hypothesis) as against H_1 (alternative hypothesis) as stated earlier. Two asymptotic critical values bound provide a test for co-integration when the independent variables are I(d) where $(0 \leq d \leq 1)$; a lower value assuming the regressors are I(0) and an upper value assuming purely I(1) regressors of the F- statistics is above the upper critical values, the null hypothesis of no long run relationship can be rejected. Conversely, if the test statistics fall between the lower and the upper bound of critical values, the null hypothesis cannot be rejected. Further, if the calculated values lie between lower and upper bounds, the decision about the co-integration is inconclusive (Pesaran et al., 2001). In the second step, once the co-integration is established the conditional ARDL long run model for $LPGDP_t$ can be estimated as:

$$\begin{aligned} \Delta LPGDP_t = & \alpha_0 + \sum_{i=1}^q \delta_1 LPGDP_{t-i} + \sum_{i=1}^q \delta_2 LODA_{t-i} + \sum_{i=1}^q \delta_3 LPI_{t-i} + \\ & \sum_{i=1}^q \delta_4 LINF_{t-i} + \sum_{i=1}^q \delta_5 LGFCE_{t-i} + \sum_{i=1}^q \delta_6 LTOP_{t-i} + \varepsilon_t \end{aligned} \quad (3)$$

This involves selecting the orders of ARDL (q, q_1, q_2, q_3, q_4) models using SIC. The third and final step, we obtain the short run dynamic parameters by estimating an error correction model with the long run estimates. This is specified as below:

$$\begin{aligned} \Delta LPGDP_t = & \mu + \sum_{i=1}^{q_1} \alpha_i \Delta LPGDP_{t-i} + \sum_{i=1}^{q_2} \beta_i \Delta LODA_{t-i} + \sum_{i=1}^{q_3} \mu_i \Delta LPI_{t-i} + \\ & \sum_{i=1}^{q_4} \sigma_i \Delta LINF_{t-i} + \sum_{i=1}^{q_5} \omega_i \Delta LGFCE_{t-i} + \sum_{i=1}^{q_6} \gamma_i \Delta LTOP_{t-i} + \phi ECM_{t-1} + \varepsilon_t \end{aligned} \quad (4)$$

Where $\alpha, \beta, \mu, \sigma, \omega, \gamma$ are short run dynamic coefficient to equilibrium and ϕ is the speed adjustment coefficient.

To ascertain the goodness of fit of the ARDL model, diagnostic and stability tests are conducted. The diagnostic test examines the serial correlation, functional form, normality, and heteroscedasticity associated with the model. The structural stability test is conducted by employing the cumulative residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ).

3.4. Granger causality test

The direction of causality between foreign aid, economic growth, private investment, inflation, trade openness and government final consumption expenditure is investigated by applying the VECM Granger causality approach after confirming the presence of cointegration between the above mentioned variables. On the same line Granger (1969) argued that vector error correction model (VECM) is more appropriate to examine the causality between the series at I(1). The VECM is restricted form of unrestricted VAR and restriction is levied on the presence of long run relationship between the series. The system of error correction model (ECM) uses all the series endogenously. This system allows the predicted variables to explain itself both by its own lags and lags of forcing variables as well as the lags of the error correction term and by residual term. The VECM equations are modeled as follows:

$$\begin{pmatrix} \Delta LPGDP_t \\ \Delta LODA_t \\ \Delta LPI_t \\ \Delta LINF_t \\ \Delta LGFCE_t \\ \Delta LTOP_t \end{pmatrix} = \begin{pmatrix} C1 \\ C2 \\ C3 \\ C4 \\ C5 \\ C6 \end{pmatrix} + \sum_{i=1}^p \begin{bmatrix} \beta_{11i} & \beta_{12i} & \beta_{13i} & \beta_{14i} & \beta_{15i} & \beta_{16i} \\ \beta_{21i} & \beta_{22i} & \beta_{23i} & \beta_{24i} & \beta_{25i} & \beta_{26i} \\ \beta_{31i} & \beta_{32i} & \beta_{33i} & \beta_{34i} & \beta_{35i} & \beta_{36i} \\ \beta_{41i} & \beta_{42i} & \beta_{43i} & \beta_{44i} & \beta_{45i} & \beta_{46i} \\ \beta_{51i} & \beta_{52i} & \beta_{53i} & \beta_{54i} & \beta_{55i} & \beta_{56i} \\ \beta_{61i} & \beta_{62i} & \beta_{63i} & \beta_{64i} & \beta_{65i} & \beta_{66i} \end{bmatrix} X \begin{pmatrix} \Delta LPGDP_{t-i} \\ \Delta LODA_{t-i} \\ \Delta LPI_{t-i} \\ \Delta LINF_{t-i} \\ \Delta LGFCE_{t-i} \\ \Delta LTOP_{t-i} \end{pmatrix} + \begin{pmatrix} \gamma_1 \\ \gamma_2 \\ \gamma_3 \\ \gamma_4 \\ \gamma_5 \\ \gamma_6 \end{pmatrix} ECM_{t-1} + \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \end{pmatrix} \tag{5}$$

Where ε_{it} are random term and supposed to be normally distributed with zero mean and constant variance. The C's, β 's and γ 's are the parameters to be estimated. ECM_{t-1} represents the one period lagged error-term derived from the cointegration vector. From the Equation (5) given the use of a VAR structure, all variables are treated as endogenous variables. The F test is applied here to examine the direction of any causal relationship between the variables. The foreign aid (ODA) does not Granger cause economic growth (PGDP) in the short run, if and only if all the coefficients of β_{12i} 's are not significantly different from zero in Equation (5). Similarly, the economic growth do not Granger cause energy in the short run if and only if all the coefficients β_{21i} 's are not significantly different from zero in the Equation (5). There are referred to as the short-run Granger causality test. The t-statistics of the estimate of lagged term i.e. ECM_{t-1} with negative sign is used to test the long run causal relation. The short-run and long-run Granger causality results are reported below in Table 7.

4. Empirical analysis

4.1. Stationarity test

To determine the order of integration, the study uses two sets of unit root tests; (1) ADF, DF-GLS and KPSS tests and (2) Ng-Perron unit root tests at levels and first differences. The vital statistics are presented in Table 2. The results show that all the variables except LINF and LTOP are non-stationary at levels. Having found that some variables are not stationary at levels, and some variables are stationary at level, the next step is to difference the variables once in order to perform stationarity tests on differenced variables. The results reported in Table 2 show that after differencing the variables once, all the variables expect LINF and LTOP were confirmed to be stationary. It is, therefore, worth concluding that the variable LODA, LPGDP, LPI and LGFCE variables used in this study are integrated of order one $I(1)$ and the variable, LINF and LTOP are integrated of order $I(0)$. Therefore, the study uses autoregressive distributed lag (ARDL) approach to co-integration. In addition, it is also important to ascertain that the optimal lag order of the model is chosen appropriately so that the error terms of the equations are not serially correlated. Consequently, the lag order should be high enough so that the conditional ECM is not subject to over parameterization problems (Narayan, 2005; Pesaran, 2001). The results of these tests are presented in Table 3.

Table 2. Stationarity Test of Variables

	Classical Unit Root Tests			Ng-Perron Unit Root Tests			
	ADF	DF-GLS	KPSS	MZa	MZt	MSB	MPT
LPGDP	3.8783	-0.4475	0.2135	0.22111	0.1108	0.5015	61.5671
LODA	-2.3546	-1.7010	0.2211	-6.82040	-1.7493	0.2564	13.4422
LPI	-1.2194	-1.2429	0.1064	-4.46842	-1.4778	0.3307	20.2527
LINF	-4.9281	-4.0056	0.1019	-14.6215	-2.6995	0.1846	6.25752
LGFCE	-1.5596	-1.6561	0.1394	-4.30412	-1.4042	0.3262	20.5841
LTOP	-3.5139	-3.2009	0.0535	-77.7963	-6.1818	0.0794	1.39930
Δ LPGDP	-5.6488	-5.6652	0.0770	-18.8942	-3.0591	0.1619	4.91037
Δ LODA	-6.522	-3.2697	0.1775	-10.4374	-2.2589	0.2164	8.85069
Δ LPI	4.0905	-3.7904	0.1245	-4.13432	-1.4237	0.3443	21.8879
Δ LINF	-5.6064	-5.5036	0.3648	-6.69517	-1.8038	0.2694	13.6248
Δ LGFCE	-3.6167	-3.6029	0.0972	-19.7304	-3.1280	0.1585	4.69647
Δ LTOP	-3.3851	-3.3220	0.0797	-17.3970	-2.9399	0.1689	5.29472

Note: the lag length of ADF test is determined by the Akaike information criterion (AIC) and Schwartz Bayesian Criterion (SBC) values.

Table 3. Lag Length Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	157.6116	NA	2.02e-10	-10.9722	-10.7819	-10.9140
1	267.6116	180.714	2.49e-13	-18.6865*	-16.7349*	-17.3956
2	275.6525	10.9126	4.75e-13	-17.1180	-15.4052	-16.5944
3	311.9226	38.8608*	1.38e-13	-17.5659	-16.0918	-17.8095*

* indicates lag order selected by the criterion.

LR: sequential modified LR test statistic (each test at 5% level).

FPE: final prediction error.

AIC: Akaike information criterion.

SIC: Schwarz information criterion.

HQ: Hannan-Quinn information criterion.

4.2. ARDL estimation results

After determining the order of integration, the study employs ARDL approach to co-integration in order to determine the long run relationship among the variables. The result of bound testing approach is presented in Table 4. The bound test evidence confirms the long run relationship because the calculated F-statistics is greater than critical values of upper level of the bound at 5% level of significance.

Table 4. ARDL Bounds test

Panel 1: Bound testing to co-integration:

Estimated Equation : $LPGDP = F(LODA, LPI, LINF, LGFCE, LTOP)$
 Optimal lag : 1
 F – Statistics : 4.6263

Panel 2: Diagnostic Tests:

Normality J-B value: 2.2955 (0.3173)
 Breusch-Godfrey Serial Correlation LM Test : 0.9418 (0.4083)
 Heteroscedasticity Test (ARCH) : 0.6062 (0.5522)
 Ramsey Reset Test : 0.0290 (0.9714)

Next step is to estimate the long run and short run coefficients of ARDL model. The long estimates of the model specifications are presented in Table 5. The results indicate that LODA is having a positive and significant impact on the economic growth of India. The ODA coefficient is significant at 1%. This implies that foreign aid contribute to economic growth in India. This result is supported by findings obtained by Gounder (2001, 2002), Mohammed (1993), Ouattara (2006) and Feeny (2005). However, the result contradicts the findings of Chowdhury and Das (2011), Islam (1992) and Kahn and Rahim (1993).

Further, the private investment (PI: constitutes of both the ratio of gross capital formation to GDP and the ratio of private sector credit to GDP) is found to have insignificant impact on the economic growth in India. Again, monetary policy variable proxied by inflation comes out with negative and insignificant impact while determining the long run economic growth of the country. However, the coefficient of fiscal policy variable (GFCE) is significant at 1% level. This implies that level of government expenditure is an important factor in determining long run economic growth of the country. This finding is supported by the results of Kargbo (2012). The coefficient of the trade openness variable is found to be positive and significant at 2%. This finding supports the notion that growth in India is determined by output and export of the major sectors. Further, trade openness encourages the skilled labor force to contribute more to the growth with the help of technology and R&D imports. This result supports the findings by Kargbo (2012) and Feeny (2005).

Table 5. Estimated Long Run Coefficients using ARDL Approach (Dependent variable: LPGDP)

Regressors	ARDL(1,0,0,0,1)		
	Coefficient	t-value	Probability
LODA	0.9673	2.7576	[0.009]
LPI	0.33345	0.6705	[0.507]
LINF	-0.0266	-0.3237	[0.507]
LGFCE	1.3028	4.6830	[0.00]
LTOP	0.7578	2.2351	[0.026]
CONS	-9.0958	-3.4341	[0.002]

Robustness Indicators

R ²	0.99708	
Adjusted R ²	0.99646	
F Statistics	1611.0	[0.000]
D.W. Stat	2.1548	
Serial Correlation,	F = 0.3008	[0.588]
Heteroscedasticity,	F=0.79659	[0.378]
Ramsey Test	F=0.6984	[0.410]

Note: (1) The lag order of model is based on Schwarz Bayesian Criterion (SBC).

The short run estimates are also relevant in the estimation of aid-growth relationship. According to De Boef (2000), the short run change is necessary to maintain the long run relationship. The short run estimates (Table 6) are very much in consonance with the long run estimates as the foreign aid is found to have positive and significant coefficient in the short run also. However, the coefficient is significant at 5% level in the short run. Further, in the short run, the private investment variable (PI) also insignificant in influencing economic growth. However, all the macro-economic policy parameters, except GFCE, have not emerged to contribute the economic growth in the short run. This may not be surprising as the usual aim of macroeconomic policy is to influence the long run growth of the economy. Surprisingly government final consumption expenditure comes out with positive and significant coefficient in the short run as well. This may imply that public expenditure increase creates incentives in the process of short run economic growth in the country.

The ECM mentions the degree to which the equilibrium behavior drives the short run dynamics. Thus, the ECM term is of importance in co-integration analysis. The coefficient of the ECM term (ECM_{t-1}) which signifies the speed of adjustment of the model to equilibrium in the event of external shocks shows 20% of disequilibrium errors are corrected. The ECM term is found to be negative as was expected and also significant further confirming the existence of a long run relationship between foreign aid and economic growth in India.

Table 6. Error Correction representation for the selected ARDL Model (Dependent variable: LPGDP)

Regressors	ARDL(1,0,0,0,0,1)		
	Coefficient	t-value	Probability
$\Delta LODA$	0.4208	1.9507	[0.059]
ΔLPI	0.0682	0.6691	[0.508]
$\Delta LINF$	-0.00523	-0.3133	[0.756]
$\Delta LGFCE$	0.2656	2.3266	[0.026]
$\Delta LTOP$	-0.1257	-0.9316	[0.358]
CONS	-1.8546	-2.2773	[0.029]
ECM_{t-1}	-0.2039	-2.4309	[0.200]
<i>Robustness Indicators</i>			
R ²	0.4888		
Adjusted R ²	0.3804		
D.W. Stat	2.1548		
SE regression	0.0253		
RSS	0.02118		
F-stat.	5.2598	[0.001]	

Note: The lag order of model is based on Schwarz Bayesian Criterion (SBC).

4.3. Granger causality test results

The panel short run and long run Granger causality results are reported below in Table 7. The findings in Table 7 indicate that short-run unidirectional causality running from foreign aid, government expenditure and trade openness to economic growth in India. It has been found that the error correction terms are statistically significant for the specification with LODA as the dependent variables which indicate that there exists a long-run relationship among the variables in the form of Equation (1) which also confirm the results of ARDL bounds test.

Table 7. VECM Based Granger F-Test Results

	<i>Sources of Causation</i>						<i>ECM (t Value)</i>
	Δ LPGDP	Δ LODA	Δ LPI	Δ LINF	Δ LGFCF	Δ LTOP	
Δ LPGDP	--	3.0030*	1.7294	1.3764	2.2653**	2.8207**	-1.8534**
Δ LODA	0.3712	--	0.2706	0.3157	2.3871	1.0992	-0.7188
Δ LPI	3.9829	2.9682	--	2.8475	2.8438	4.1198	2.3834
Δ LINF	7.6047	7.396	7.7448	--	7.5893	7.3175	3.82543
Δ LGFCF	0.1040	1.3332	0.1786	0.8994	--	1.5891	-0.3534
Δ LTOP	1.9227	1.6045	1.2362	1.9227	0.3517	--	0.7823

It is argued in the economic literature that the Granger causality approaches such as the VECM granger causality test has some limitations. The causality test cannot capture relative strength of causal relation between the variables beyond the selected period. This weakens the reliability of causality results by the VECM approach. To solve this issue, the study applied variance decomposition method.

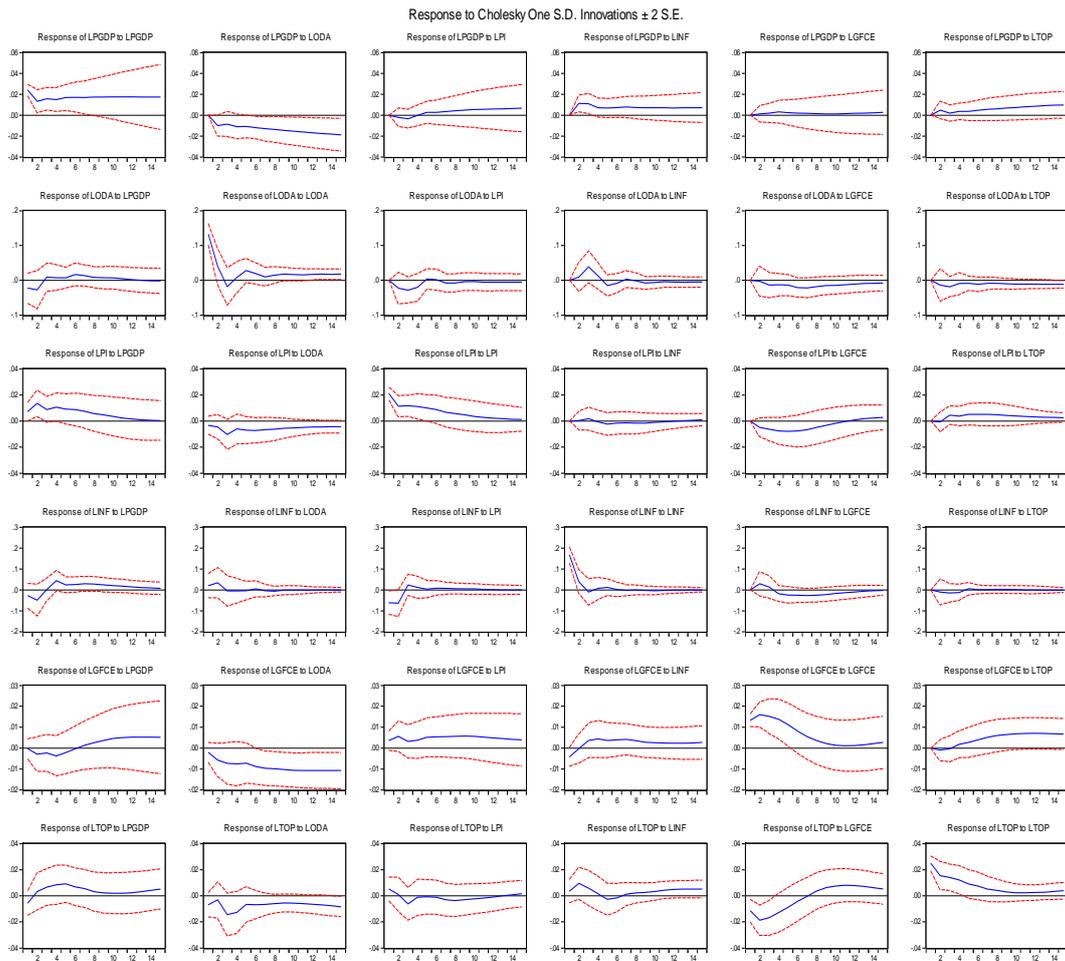
It is pointed out by Pesaran and Shin (2001) that the variance decomposition method shows the contribution in one variable due to innovative shocks stemming in other variables. The main advantage of this approach is that it is insensitive with ordering of the variables because ordering of the variables is uniquely determined by VAR system. The results of the variance decomposition approach are presented in Table 8. The empirical evidence indicates that a 48.61% of economic growth is contributed by its own innovative shocks. Further, Shock in foreign aid explains economic growth by 31.43%. Inflation contributes to economic growth by 9.18% and trade openness contributes 6.94%. The share of other variables in economic growth is very minimal.

Table 8. Variance Decomposition of LPGDP

Period	S.E.	LPGDP	LODA	LPI	LINF	LGFCF	LTOP
1	0.02381	100.0000	0.00000	0.00000	0.00000	0.00000	0.00000
2	0.03160	74.37799	10.1661	0.46066	12.4474	0.12641	2.42137
3	0.03815	67.81587	12.0056	1.12246	16.7612	0.37261	1.92214
4	0.04325	64.55940	15.7408	0.87952	15.7814	0.86296	2.17579
5	0.04841	63.66395	17.5518	1.03079	14.5185	0.95352	2.28133
6	0.05353	62.36604	19.3132	1.08598	13.7338	0.89560	2.60523
7	0.05852	60.48706	21.1577	1.24788	13.2129	0.82301	3.07137
8	0.06340	58.93987	22.7276	1.47413	12.5810	0.75075	3.52651
9	0.06825	57.34294	24.2657	1.76831	11.9121	0.68410	4.02676
10	0.07307	55.82216	25.6465	2.07088	11.3069	0.62546	4.52796
11	0.07781	54.31698	26.9424	2.34992	10.7682	0.58144	5.04090
12	0.08248	52.84010	28.1598	2.61283	10.2894	0.55390	5.54396
13	0.08709	51.40128	29.3089	2.84951	9.86689	0.54377	6.02957
14	0.09165	49.98976	30.3994	3.06087	9.49936	0.55241	6.49813
15	0.09616	48.61366	31.4300	3.24821	9.18112	0.58048	6.94653

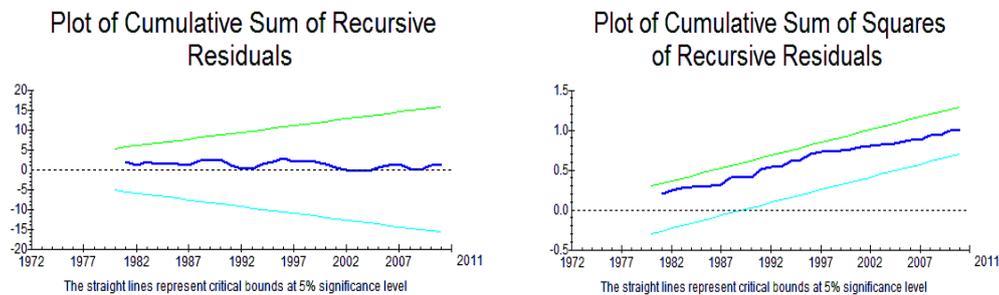
The impulse response function is alternative of variance decomposition approach and shows the reaction in one variable due to shocks stemming in other variables. The output is presented in Figure 3. The results indicate that there is positive response in economic growth due to shock stemming in foreign aid.

Figure 3. Impulse Response Function



4.4. Stability test results

Finally, the CUSUM and CUSUMSQ are estimated and plotted to check the structural stability of the long run parameters together with the short run movements. The test suggests that if the plots of the CUSUM and CUSUMSQ residuals stay within the critical bounds of 5% level of significance, all the coefficients in the given regression are stable. Examination of the plots in Figure 4 shows that CUSUM and CUSUMSQ statistics are well within the 5% critical bounds implying that short run and long run coefficients in the ARDL models are stable.

Figure 4. Plot of CUSUM and CUSUMSQ (Stability Test)

5. Concluding remarks and policy implications

Foreign aid in the form of ODA is an important source of public expenditure in many developing countries in the world. Its impact on economic growth and development has been debated for many multi-country cases over the year. However, the aid effectiveness analyses for single country case are few. Further, in a country like India where aid effectiveness is yet to be examined in recent years, this study will fill this gap by providing the empirical evidence as a basis for policy consideration. To do so, we estimated the foreign aid-economic growth relationship by using ARDL bound test approach and VECM techniques for India over the period 1970 to 2014.

The empirical findings of the study reveal that there exist a long run co-integrating relationship between foreign aid, macroeconomic policy parameters and economic growth in India. The ARDL test result shows significant positive impact on real GDP per capita growth in the country. Further, Trade Openness (measured as total trade/GDP) seems to have positive and long run relationship with real GDP per capita growth in India. The fiscal policy parameter (measured by government final consumption expenditure) is found to have positive and significant impact on the long run growth of the economy. This implies that the level of government expenditure and trade is an important factor in determining long run economic growth of the country. Further, the study found that due to one percent deviation from the long run equilibrium, the growth rate of the real GDP per capita is corrected within the period of 4-5 years in India. The short run estimates are very much in consonance with the long run estimates as the foreign aid is found to have positive and insignificant coefficient in the short run also. The findings of the VECM estimates indicate that short-run unidirectional causality running from foreign aid, government expenditure and trade openness to economic growth in India. Further, the error correction terms are statistically significant for the specification with LODA as the dependent variables which indicate that there exists a long-run relationship among the variables in the model. The results of the variance decomposition approach indicate that economic growth in India mostly explained by foreign aid. Further, the impulse response function result indicates that there is positive response in economic growth due to shock stemming in foreign aid.

Our results provide strong evidence that effectiveness of foreign aid on economic growth is contingent on macroeconomic policy environment supporting the findings of Mavrotas

(2002); Fenny (2005); Karras (2006) and Kargbo (2012). The relationship among foreign aid, macroeconomic policy variables and economic growth indicate that foreign aid and appropriate macroeconomic policy change can be used as an important tool in achieving desired rate of growth in India in par with the findings of Mavrotas (2002). We also found that private investment is not a significant determinant in boosting economic growth in India. However, we found that government expenditure, and trade openness augments the economic growth of the country in the short run as well as in the long run. Our findings suggest that sound economic management policy in terms of low inflation, trade openness and supplementing public expenditures is crucial for aid effectiveness. There is need to implement appropriate policy measures, in order to achieve the positive impact of foreign aid on economic growth through lower inflation, higher public expenditures and trade openness in the Indian economy.

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