# Impact of Foreign Aid on Growth and Trade

## Keshab Bhattarai[1]

## Abstract

Foreign aid from the donors may or may not raise growth rates in receiving countries. In general, they may increase investment but if the amount of aid is associated with conditionality of exports, that will have negative impacts on growth rates. Simulation of the analytical model shows that if TFP grows faster in the recipient countries more than in the donors then developing countries (DCs) can converge in the capital output ratios and investment saving ratios with similar growth patterns as their advanced country (AC) donors over the long horizon. If the resource flows out of the developing countries in return to aid inflows this will have harmful effects in growth of developing economies. Econometric estimates show that investment rather than aid was factors contributing to growth in DCs. Exports tied to aid have been harmful for growth of recipient countries. Panel data analyses shows British aid has contributed to growth in recipient countries as British exports to Asian DCs were positively related to by their level of per capita income irrespective of the amounts of British aid to those economies.

**Key words:** Aid, trade, growth

**JEL Classification:** F35, O19

## I. Introduction

Developing countries (DCs) desire to grow fast but are constrained by capital, technology, economic infrastructure and skilled manpower. They look toward advanced countries for developpment assistance to help themselves to raise the level of investment in order to create the stock of physical and human capital required for economic growth. Advanced countries (ACs) in the OECD have been providing development aid to developing economies around the world. These aids are motived either by humanitarian goals such as alleviation of global poverty and upliftment of living standards of millions of individuals in Asia, Africa and Latin America or by economic motives to promote trade with recipient economies. World Council of Churches in August 1960 and the General Assembly of the UN in the following month had asked advanced economies to provide aid up to 1 percent of their GNP. This was subsequently taken to be the aid target by the Development Assistance Committee of the OECD. However, flows of aid, that stood around £180 billion dollars in 2014 (see Figure 1), have remained below 40 percent of these promises and are even declining in practice (se Figure 2). This amount is less than the total amounting of cash and in kind benefits paid to the British households in the UK. Amounts of aid going to individual countries are tiny as these are distributed to more than 150 developing economies around the globe.

[1]This paper was presented at the EEFS 2016 Annual Conference in Amsterdam in June 2016. Corresponding address: Business School, University of Hull, HU6 7RX, Hull, UK; email: K.R.Bhattarai@hull.ac.uk. University of Hull Business School.

**Figure 1: Total aid flows from advanced to developing economies**



Total aid from DAC and G7 countries ($million, 2013 prices)
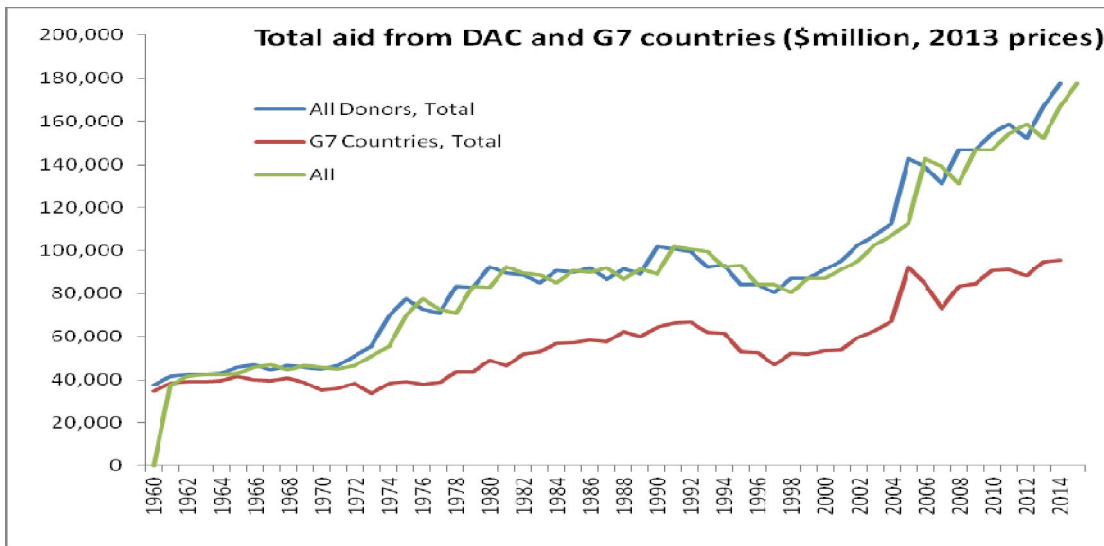
G7 countries have been the major providers of this aid (Figure 1). Literature on aid and trade started growing massively after the successful implementation of Marshall Plan that followed the reconstruction works in the Western Europe after the World War II. This literature grew further after the development decades of 1960 (Chenery and Hollis (1966)). Major advanced countries set up bilateral development aid agency such as the USAID, DFID, JICA, SNV, SATA, DANIDA FINNIDA, ADA, EU and OPEC funds and multilateral agencies including IBRD, regional development banks and IDA coordinated these aid activities across the globe. In the initiative of the IMF the Paris club is playing significant roles in restructuring debt and channelling aid to most promising activities. Campaign for making poverty history and the millennium development goals has redirected development assistance and international resources with fruitful effect of reducing the number of absolute poor to 1 billion (OECD 2015, Morrissey (1993), Rajan and Subramanian (2008)). Many authors however tend to agree that development aids can complement growth but these are neither the necessary nor the sufficient conditions for growth.   Major transformations in the East Asia including those in China, South Korea, Malaysia, Indonesia and Vietnam came from better policy decisions for mobilisation of internal resources.

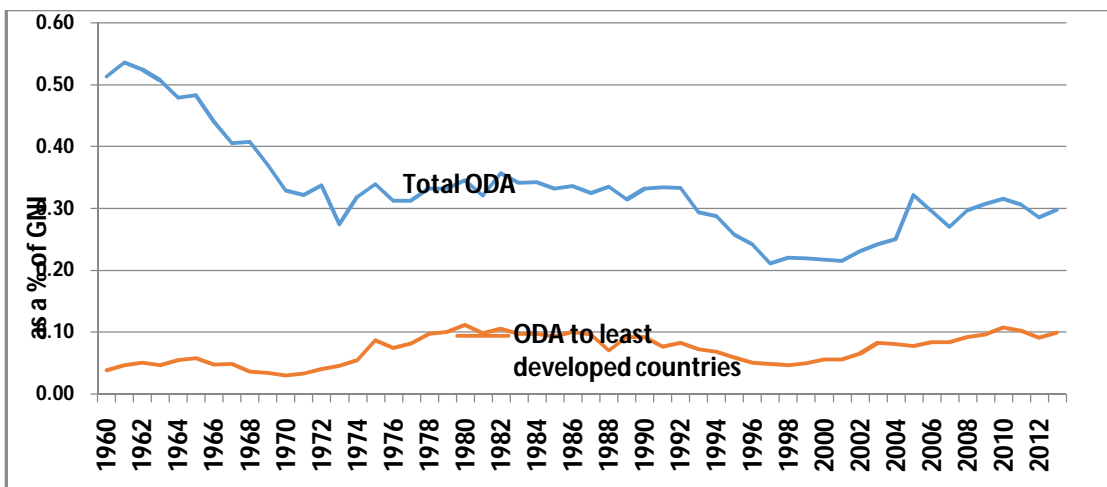**Figure 2: Aid flows to developing countries (as a % of GNI)**
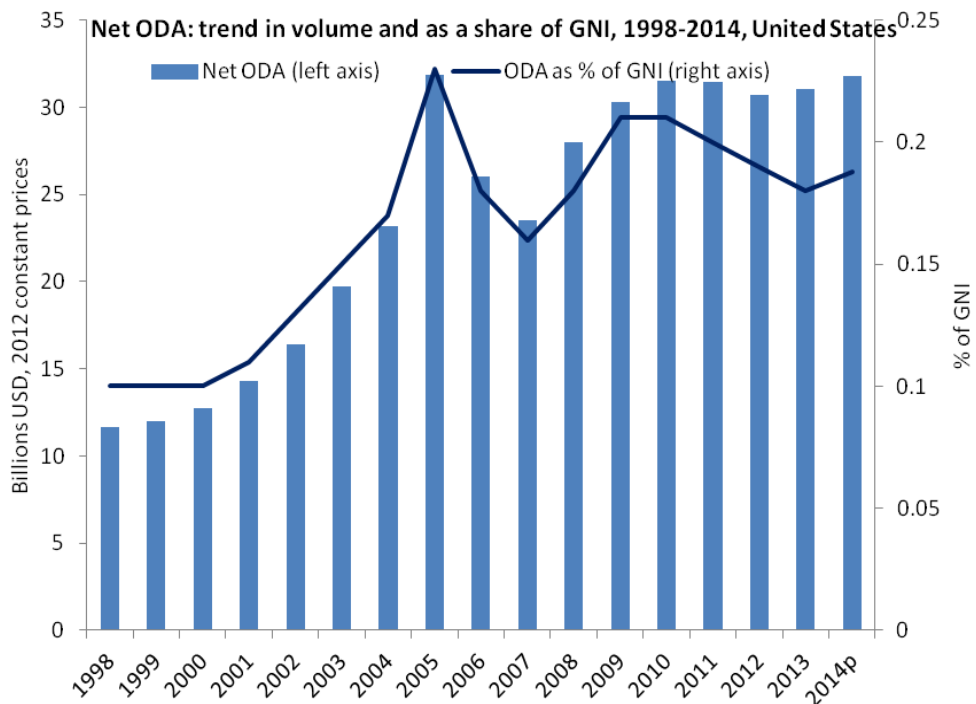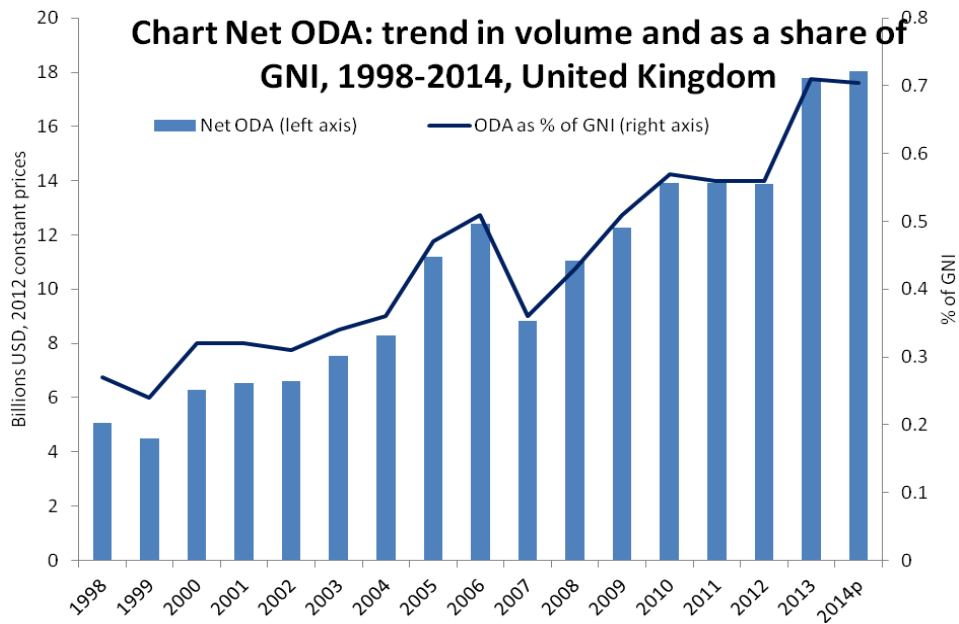
**Figure 3: Aid flows in developing countries**



Net ODA: trend in volume and as a share of GNI, 1998-2014, United States

**Figure 4: Aid flows to developing countries from the UK**



Chart Net ODA: trend in volume and as a share of GNI, 1998-2014, United Kingdom

While some authors show that channel of aid to growth is not only solid, significant, robust and quantitatively relevant (Limodio (2012)) but also beneficial to both the recipients and donors (Morrissey (1993 and 2006)), others argue that aid is fungible and adjustments and reforms are more important in achieving growth than the amount of aid itself (Cass (2000) and Sach (2000)).

Alvi and Senbeta (2012) further argue that aid boost investments but adversely affects TFP. It reduces efficiency of financial institutions in supporting productivity. While some argue that aids are conditional and advanced countries tie aid to their exports (de Janvry and Sadoulet (1988), Wagner (2003), Vijil and Wagner (2012), Stiglitz and Charlton (2006), Busse, Hoekstra and Königer (2012), Vijil and Wagner (2012), Gamberoni and Newfarmer (2014)), others argue that amount of aid are insignificant and not going to countries that need it (Gounder (1995, 1994), Akram (2003), Bandyopadhyay and Vermann (2012)). Cadot, Fernandes, Gourdon, Mattoo and de Melo (2014) provide a good survey on how aids are linked to trade. Aid versus trade issues are analysed elaborately in Karras (2004), Hoekman (2011), Cali, Razzaque, and teVelde (2011), Deardorff and Stern (2009), Helble, Mann, Wilson (2012), Lundsgaarde, Breunig and Prakash (2010), Nitsch (2000), Stiglitz and Charlton (2013). Geography of international trade system in Weidmann, Kuse & Gleditsch (2010) is used to formulate the gravity model of welfare from aid and trade as discussed in Wang (2011), Naito (2012), Takin (2012), Silva and Nelson (2012), Hallett (2013), Peterson and Johansson (2013) and Vijil (2014).

This study aims to illustrate a simple general equilibrium model for analysing conditions by which aid promotes or retards growth in developing countries. These also show how reverse resource-flows may occur if the technical development in developing countries is higher than in advanced countries. Numerical simulations establish that whether aid benefits a developing country depends on a set of behavioural and productivity parameters including the rate of saving, technical progress and capital output ratios. We found no such analysis clearly stated in the literature on aid and trade. Then econometric evidence is provided on how aid influences trade and how trade influences growth in 48 developing economies using a gravity panel model of trade aid from the UK (analysis of the US and Germany and the OECD as a whole is in progress). This study finds that aid has been more effective in promoting exports of advanced countries than promoting economic growth in developing economies. Simulation model of aid and growth is presented in section II followed by numerical solution of this model in section III. Empirical evidence on growth impacts following from the British aid is in section IV followed by conclusions in section V.

## II. Model of aid and growth

Here I develop a small model of 12 equations to analyse how a development aid can contribute to growth in developing countries. The whole world is divided into advanced (a) and developing (d) economies. Most of the literature on aid and growth focuses on empirical aspect of the analysis. Clear specification of the analytical model on how aids may have positive, negative or no effect on the growth of a recipient country is hard to find in the literature. This and next section contains some contribution to this aspect of the literature.

Consider a typical global economy consisting of an advanced and a developing economy. Let the advanced country (AC) grow by rate $g_a$ then starting from the initial income, $Y_{a,0}$ the level of income in this country at time $t$ will be $Y_{a,t}$.

$$Y_{a,t} = Y_{a,0}e^{g_a t}$$

(1)

Let the developing country (DC) grow by $g_d$ and its income, $Y_{d,t}$ at time $t$ will be:

$$Y_{d,t} = Y_{d,0}e^{g_d t}$$

(2)

Generally, growth in the neoclassical model is determined by the rate of saving, growth rate of the population, growth of technology and productivity of capital. In this spirit let the growth rates in two countries is function of capital output ratios (COR)

$$g_{a,t} = g\left(\frac{K_{a,t}}{Y_{a,t}}\right)$$

(3)

Let the COR in the developing country, similarly influence the growth rate in developing countries $g_{d,t}$ be:

$$g_{d,t} = g\left(\frac{K_{d,t}}{Y_{d,t}}\right)$$

(4)

Let the saving rates ( $s_a$ ) be a constant function of output in the advance country:

$$S_{a,t} = s_a Y_{a,t}$$

(5)

Foreign aid ( $\theta_a Y_{a,t}$ ) complements to domestic saving $\left(s_d Y_{d,t}\right)$ in developing country

$$S_{d,t} = s_d Y_{d,t} + \theta_a Y_{a,t}$$

(6)

The process of capital accumulation in two countries are given by:

$$K_{a,t} = (1-\delta_a)K_{a,t-1} + I_{a,t}$$

(7)

$$K_{d,t} = (1-\delta_d)K_{d,t-1} + I_{d,t}$$

(8)

Then the net investment in advanced countries ( $I_{a,t}$ ) equals saving less depreciation and aid given to developing countries

$$I_{a,t} = S_{a,t} - \delta_a K_{a,t-1} - \theta_a Y_{a,t}$$

(9)

Similarly the net investment in developing countries equals saving less depreciation plus aid received ( $\theta_a Y_{a,t}$ ) from the advanced countries:

$$I_{d,t} = S_{d,t} - \delta_d K_{d,t-1} + \theta_a Y_{a,t}$$

(10)

Let $\theta_d Y_{d,t}$ represents the reverse flow from aid. In this case negative net investment is possible in the developing countries and it would be

$$I_{d,t} = S_{d,t} - \delta_d K_{d,t-1} + \theta Y_{a,t} - \theta_d Y_{d,t}$$

(11)

Here term, $\theta Y_{a,t} - \theta_d Y_{d,t}$ , represents the net gain from the aid process. Then the net investment in advanced country will be modified to

$$I_{a,t} = S_{a,t} - \delta_a K_{a,t-1} - \theta_a Y_{a,t} + \theta_d Y_{d,t}$$

(12)

- Thus whether the foreign aid adds more to the investment in advanced or developing countries depends on whether

$$\theta_d Y_{d,t} \geq \theta_a Y_{a,t} \quad \text{or} \quad \theta_d Y_{d,t} \leq \theta_a Y_{a,t} \tag{13}$$

- The DC will gain more if the reverse flow is less than the inward flows $\theta_d Y_{d,t} < \theta_a Y_{a,t}$ ;

- AC will gain more if $\theta_d Y_{d,t} > \theta_a Y_{a,t}$ and net effect of aid is zero when $_d Y_{d,t} = \theta_a Y_{a,t}$.

Many of the empirical studies on impacts of development aid are attempts to measure which one of these three effects are more important. How aid can help a developing economy to reach to its steady state can be illustrated using standard convergence results for countries lower in their per capita income should grow faster in the neoclassical model with: $y = k^{1-\alpha}$

$$\dot{k} = s k^{1-\alpha} - (n+x+\delta)k \Rightarrow \frac{\dot{k}}{k} = \frac{s k^{1-\alpha}}{k} - (n+x+\delta) \tag{14}$$

$$\frac{\dot{y}}{y} = (1-\alpha)(n+x+\delta)\left[k^{*\alpha}k^{-\alpha} - 1\right] = (1-\alpha)(n+x+\delta)\left[\left(\frac{y^*}{y}\right)^{\frac{\alpha}{1-\alpha}} - 1\right] \tag{15}$$

Check $y^{*\frac{\alpha}{1-\alpha}} = k^{*(1-\alpha)\frac{\alpha}{1-\alpha}} = k^{*\alpha}$ and $y^{\frac{\alpha}{1-\alpha}} = k^{(1-\alpha)\frac{\alpha}{1-\alpha}} = k^{\alpha}$.

If the economy is below its steady state, $y^* > y$ then growth is positive, $\frac{\dot{y}}{y} > 0$. Farther below an economy is from the steady state it should grow faster (see Acemoglu (2009), Aghion and Howitt (1998)). This is the reason why aid providing an initial investment should help a developing economy to converge to its steady state. This is how the foreign aid can help countries to reach to their steady states. Then the technological progress can make their growth sustainable. This reduces income gaps between advanced and developing economies. We compute scenarios for these in this model.

## III. Numerical example for impact of aid on growth

Let us start with a case where the advanced economy has 10 times more per capita income than that in a developing economy; $Y_{a,0} = 10000$ versus $Y_{d,0} = 1000$. Advanced country has capital output ratio of 1.5, $g_{a,t} = \frac{K_{a,t}}{Y_{a,t}} = 1.5$ and the developing country has less efficiency in use of capital with this ratio at 4. While advanced country has a lower rate of saving at 15 percent compared 25 percent in a developing economy. Depreciation of capital is higher in developing than in advanced country, $\delta_d = 0.04$ versus $\delta_d = 0.03$. Let us further assume that advanced country meets the international call for development of aid of 1 percent of its GDP.

We compute above model for plausible values of parameters in Table 1 using NLP and MCP solvers for optimisation in GAMS for advanced and developing countries with a time horizon of 50 years:

### Table 1: Parameters of AID model

|        | $K_{a,0}$ | $K_{d,0}$ | $s_a$ | $s_d$ | $x_a$ | $x_d$ | $\delta_a$ | $\delta_d$ | $Y_{a,0}$ | $Y_{d,0}$ |
|--------|-----------|-----------|-------|-------|-------|-------|------------|------------|-----------|-----------|
| Values | 15000     | 4000      | 0.15  | 0.30  | 0.03  | 0.04  | 0.01       | 0          | 10000     | 1000      |

It is assumed the advanced countries like to maximise their level of output subject all constraints in the above model. Results from these computations are presented in Figures 5 to 10.
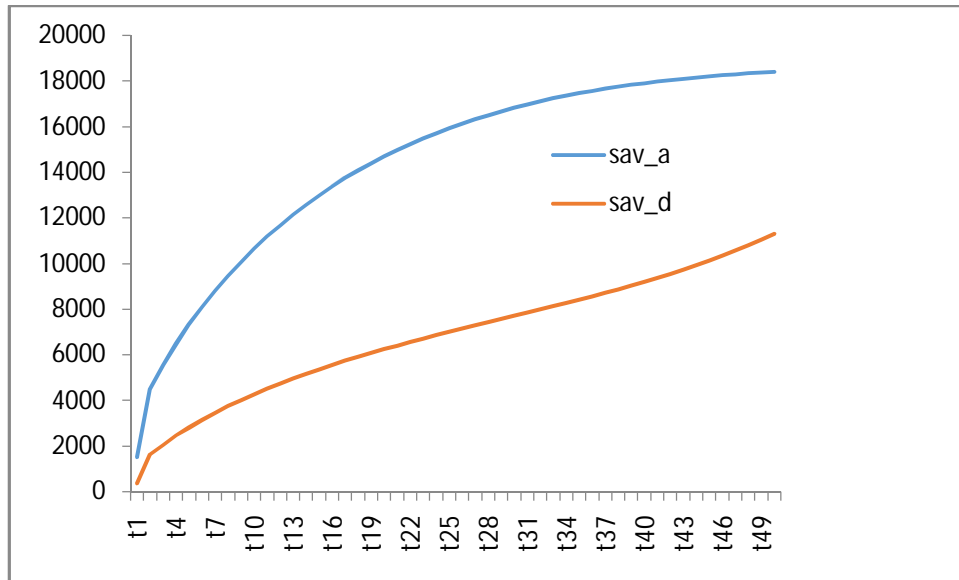


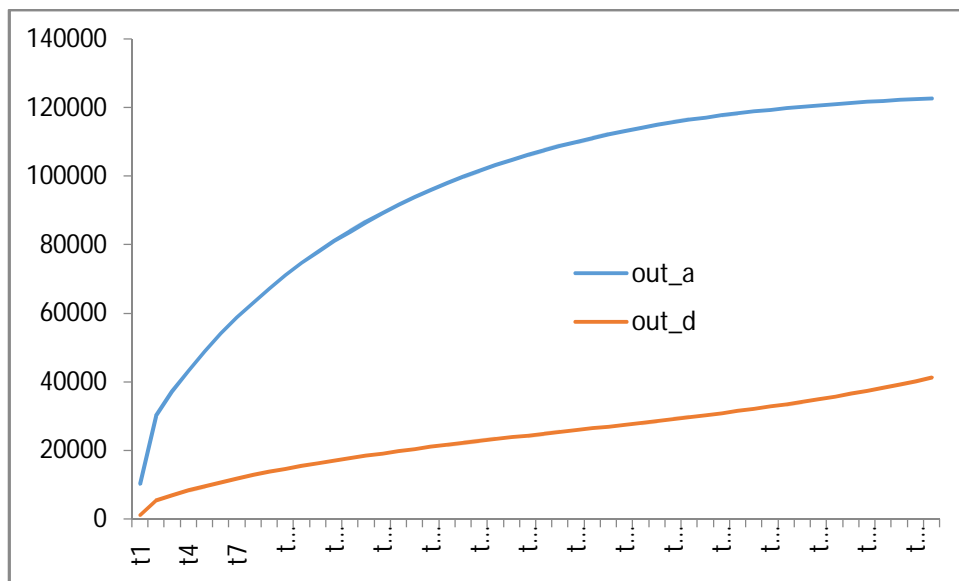**Figure 5: Savings in advanced and developing economies**



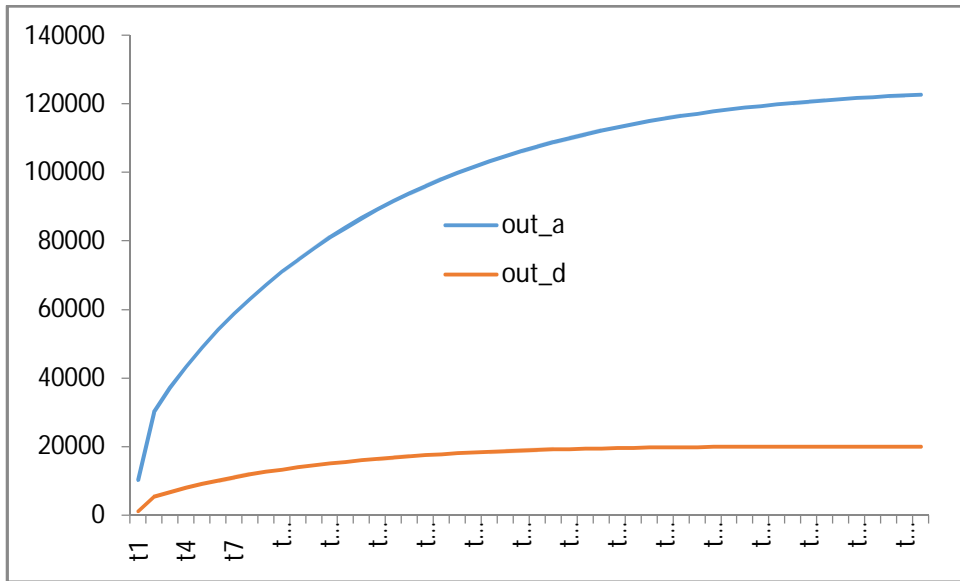**Figure 6: Output in advanced and developing economies**

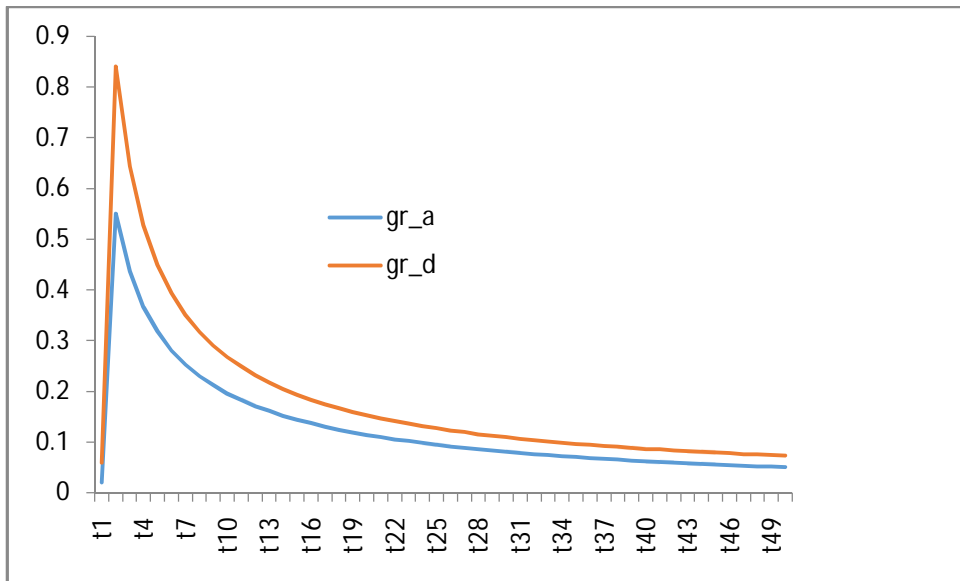**Figure 7: Output in ACs and DCs in the base case**



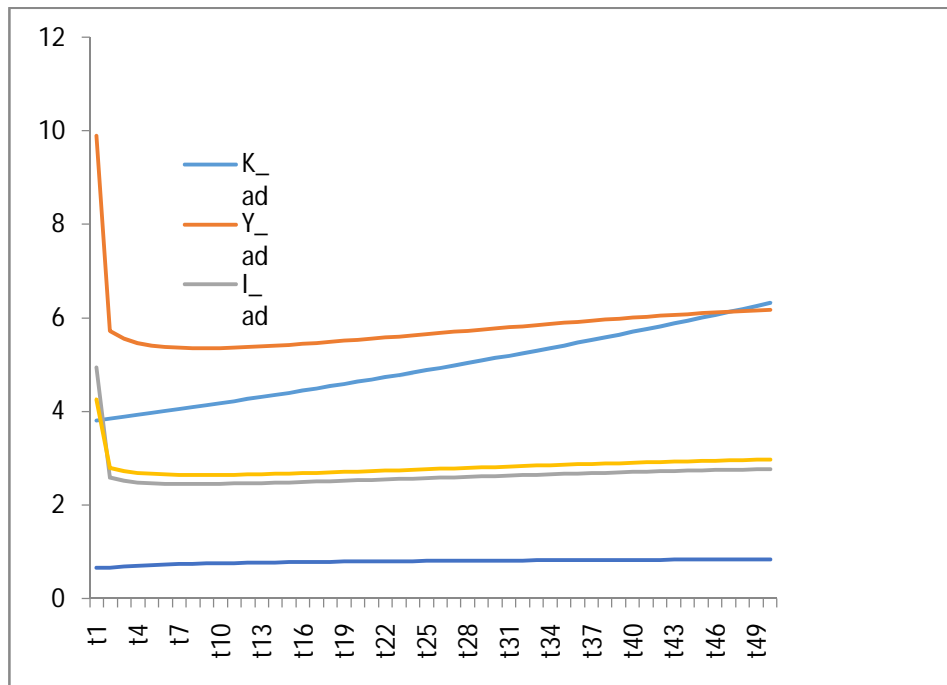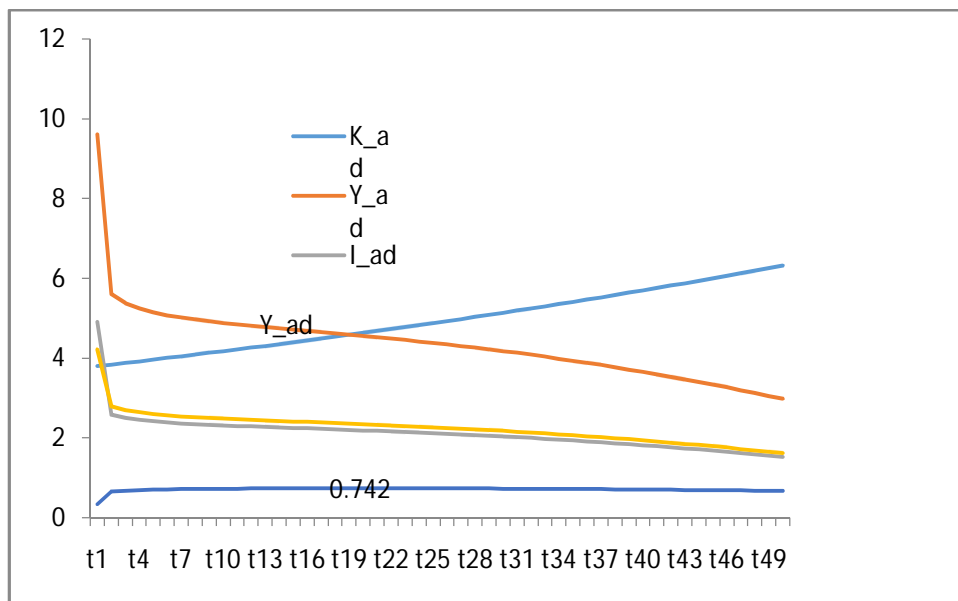**Figure 8: Growth in advanced and developing economies**

**Figure 9: Macro ratios AC to DC without TFP and Aid**



Aid should be considered as a seed corn investment that can trigger the process of capital accumulation and growth. (Marshall Plan; disaster relief such as Nepal Earthquake disaster 2015, floods, tsunami in Thailand in 2006, fires, control of epidemic such as Ebola virus in Sierra Leon in 2014/15). Development aid can complement in creating education, health, environment; mechanism efficient regulation and markets and thus have long run supply and demand side effects. From this simulation one is tempted to conclude that development aids seem to impact on output, investment, saving and growth enhances welfare of individuals, though it is also an empirical issue which requires analysis of time series on growth in recipient countries in contrast to aid flows from donors.

Econometric analysis is undertaken in the next section in order to assess the impact of aid on trade and growth in Asian countries from the UK using the panel data for Bahrain, Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Iran, Japan, Jordan, Korea, Kuwait, Lebanon, Malaysia, Maldives, Mongolia, Nepal, Oman, Pakistan, Philippines, Quarter, Saudi Arabia, Singapore, Sri Lanka, Thailand, UAE, Vietnam, Yemen from year 2003 to 2014. A general hypothesis to be tested is that growth depends on trade, investment and aids.

$$gr_{i,t} = \gamma_0 + \gamma_1 trd_{i,t} + \gamma_2 Inv_{i,t} + \gamma_3 Aid_{i,t} + \varepsilon_{gr,i,t}$$

(16)

Objective of this analysis is to find out how the growth in a country $\left(gr_{i,t}\right)$ at time $t$ depends on investment ratio ( $Inv_{i,t}$ ), aid flows ( $Aid_{i,t}$ ) and on exports to that country from the UK ( $trd_{i,t}$ ). In theory investment ratio along with aid flows should contribute positively on growth rate. Whether imports from the donor country would raise or lower growth should depend on the nature of such exports. If exports are to purchase raw material or technical knowhow, it should promote growth. It should not have much impact if it is spent on consumption.

We also apply the Gravity model of aid to assess the impact of aid on trade (British exports) following the popular method developed by Wagner (2003) and used in such analysis of trade in many studies as follows:

$$\ln(T_{dr}) = \beta_1 \ln\left(\frac{Y_d Y_r}{Y_W}\right) + \beta_2 \ln\left(\frac{Y_d}{P_d}\right) + \beta_3 \ln\left(\frac{Y_r}{P_r}\right) + \beta_4 \ln(D_{dr})$$
$$+ \beta_5 \ln(REM_d) + \beta_6 \ln(REM_r) + \beta_7 \ln(LAN_{dr}) + \varepsilon_{dr}$$

(17)

$$\ln(A_{dr}) = \beta_1 \ln(Y_d) + \beta_1 \ln(Y_r) + \beta_3 \ln(D_{dr}) + \beta_4 \ln\left(\frac{Y_d}{P_d}\right)$$
$$+ \beta_5 \ln\left(\frac{Y_r}{P_r}\right) + \beta_6 \ln(LAN_{dr}) + \beta_7 \ln(MILSR_{dr}) + C + \varepsilon_{dr}$$

(18)

$$\ln(T_{dr}) = \ln \Gamma_{dr} + \beta_8 \ln(\max\{1, A_{dr}\}) + \beta_9 \ln(NAD_{dr}) + \varepsilon_{dr}$$

(19)

$$REM_r = \frac{1}{\sum_d \left(\frac{\left(\frac{Y_d}{Y_W}\right)}{D_{dr}}\right)}$$

Here $\frac{Y_d Y_r}{Y_W}$ measure the gravity factor between donor and recipient relative to the global GDP, $\frac{Y_d}{P_d}$ is the per capita income in donor country and $\frac{Y_r}{P_r}$ that in the recipient country, $D_{dr}$ measure the distance between donor and recipient, $LAN_{dr}$ is the measure of common language, $REM_d$ and $REM_r$ are the remoteness index of donor and recipient, $A_{dr}$ is aid flow from donors to recipients, $T_{dr}$ measures the exports from donor to the recipient. the term $\ln(\max\{1, A_{dr}\})$ is used to handle non-negative aspects of aid and $NAD_{dr}$ is a dummy to capture no-aid.

## IV. Analysis of Data

A data set is constructed on growth rate, investment, aid flows, population, GDP per capita and distance from the UK in order to assess the impact of aid from the UK in growth and trade of several Asian countries from 2003 to 2014 for 28 countries as mentioned above. Aid flows are collected from the OECD database. GDP, investment, population, per capita GDP and export from UK are constructed from the World Bank Data Indicators. Bilateral distances from UK are taken from the Goggle map[2].

### Growth on aid Regression

Results of panel data regression analysis on how aid and trade variables impact on economic growth are presented in Tables 2 and 3. While these are still preliminary results and need to take very carefully, some significant results emerge from the fixed or random effect or dynamic panel data estimates from the STATA routines. First the flow of UK aid to developing Asia has expected positive sign on economic growth but this coefficient is not significant. This may be because the amount of aid is negligible compared to the need for investment or it may have been misused. This is an issue for further investigation. Secondly, investment is driving growth in these economies. It has expected positive sign and is statistically significant in all of these three estimates. Finally, the conditionality of exports to these countries have been harmful for growth of these aid recipient economies as reflected by negative and significant relations between such exports from the UK as a donor country. The Hausman test recommends the random effect over the fixed effect panel model.

**Table 2: Impact on growth of investment, conditioned imports and aid: static panel regression estimates of the UK aid flows to Asian countries**

| Dep Variable: growth | Fixed Effect | Random Effect |
|---|---|---|
| log AID | 1.40e-06 | 2.91e-06 |
| Investment | 0.002*** | 0.001*** |
| Imports (cond.) | -4.02e-09*** | -6.49e-09 |
| Constant | -0.01047 | 0.032*** |
| Tests | $F(3,173) = 5.92(0.000)$ | Wald: $\chi^2$ = 10.8 (0.013) |
| Sample | $N$ =22; NT= 198 | $N$ =22; NT= 198 |
| Within | 0.093 | 0.066 |
| Between | 0.000 | 0.031 |
| Overall | 0.0411 | 0.010 |
| Hausman Test for random effect model $\chi^2$ = 8.19 (0.017) | | |

**Table 3: Impact on growth of investment, conditioned imports and aid: Arellano-Bover/Blundell-Bond Estimation**

| Dep Variable: Growth | Coefficient | Z-value | $p > |z|$ |
|---|---|---|---|
| Growth, lag 1 | 0.019 | 0.27 | 0.78 |
| log Aid | -5.84e-07*** | -0.17 | 0.86 |
| Inv ratio | 0.002 | 4.19 | 0.00 |
| log UK exports | -0.011*** | -3.05 | 0.00 |
| Constant | 0.124 | 2.57 | 0.010 |
| Wald $\chi^2$ = 28.79(0.000); Sample size $N$ =22; NT= 176 | | | |

[2]See also at http://www.distancefromto.net/countries.php; http://www.cepii.fr/CEPII/en/bdd_modele/models.asp.

**Trade on aid regression**

The second set of regression analysis is on how aid flows from the UK impact on export from the UK to the recipient counties in developing Asia. First the random and fixed effect panel data models show that aid had not had a significant impact on British exports to these countries but the dynamic panel data results indicate that aid flows lower British exports to these countries. Secondly, Higher the per capita income of the recipient country more is the amount exported from the UK. This relation is positive and highly significant. Thirdly per capita income growth in the UK was important for trade flows to Asian developing economies as shown by the results of the dynamic panel data model. Fourth the distance factor was not significant determinant of UK exports to those countries. The British aid were lower to countries it had more exports. Then that seems to imply that UK had emphasized on increasing its own trade than giving aid to recipient countries. Given the focus on humanitarian issues on international development this issue is slightly counter intuitive and needs further investigation.

**Table 4: Impact on Trade of Aid: Static Panel Regression Estimates for OECD countries**

| Dep Variable: Exports | Fixed Effect | Random Effect |
|---|---|---|
| log YYUKYA | -0.423 | 1.006*** |
| log per cap y | 1.700*** | 0.681*** |
| log per cap UK | 1.31 | 0.850 |
| DIST | 0 | -0.592 |
| log AID | 0.002* | 0.009 |
| Constant | -4.105* | -19.671* |
| Tests | $F(4,167) = 46.2(0.000)$ | Wald: $\chi^2$ = 424.8 (0.000) |
| Sample | $N$ =22; NT= 193 | $N$ =22; NT= 193 |
| Within | 0.525 | 0.506 |
| Between | 0.0055 | 0.929 |
| Overall | 0.0030 | 0.917 |
| Hausman Test for random effect model $\chi^2$ = 11.75 (0.019) | | |

**Table 5: Dynamic Panel Data Estimation for Impacts on trade of Aid on Trade: Arellano-Bover/Blundell-Bond Estimation**

| Dep Variable: Exports | Coefficient | Z-value | $p > |z|$ |
|---|---|---|---|
| Exp, lag 1 | 1.005*** | 4412.5 | 0.00 |
| YYUKYA | -1.76e-0.6*** | -178.5 | 0.00 |
| YPUK | 2.0892*** | 64.37 | 0.002 |
| YP | 0 | 0 | 0.00 |
| DIST | 0 | 4.95 | 0.00 |
| AID | 1.9852 | 52.22 | 0.00 |
| Constant | 0 | 0 | 0 |
| Wald $\chi^2$ = 6.55+08(0.000); Sample size $N$ =22; NT= 216 | | | |

**Table 6: Dynamic panel data model for impact on trade of income, trade and aid (elasticity form): Arellano-Bover/Blundell-Bond Estimation**

| Dep Variable: Growth | Coefficient | Z-value | $p > ^{\lvert z \rvert}$ |
|---|---|---|---|
| log export, lag 1 | -0.179*** | -4.63 | 0.000 |
| log YYUKYA | -1.562*** | -1.87 | 0.061 |
| log per cap y | 2.764*** | 7.97 | 0.000 |
| log per cap UK | -1.766*** | 2.59 | 0.000 |
| DIST | 1.309*** | 1.04 | 0.297 |
| log AID | -0.0252*** | -7.65 | 0.000 |
| Constant | 0 | 0 | 0 |
| Wald $\mathcal{m}\Omega$ = 155168.16(0.000); Sample size $N$ =21; NT= 133 | | | |

Issue of distribution of income is more complicated. How does commitment of the UK, the US or the any other advanced country in the OECD to 1 percent GDP target of aid impact on income inequality is an interesting topic for a larger scale research project. This may be an issue we will explore in future.

Econometric estimates presented in this section generally support the analytical results in the previous section that whether flows of aid can raise or lower the growth rate in the recipient country depends not only on the size of these aids relative to investment needs in the recipient countries but also on the mechanism whether these aid flows are tied to trade or how much they affect the technical progress in the recipient countries. Multilateral global interaction model is required in order to truly assess the impacts of development cooperation. We aim to expand the scope of this study covering aid flows from G7 countries separately and the OECD as whole for not only countries in Asia but also in Africa, Latin America and Oceania.

## V. Conclusion

Foreign aid from the donors may or may not raise growth rates in receiving countries. In general, they may increase investment but if the amount of aid is associated with conditionality of exports, that will have negative impacts on growth rates. Simulation of the analytical model shows that if TFP grows faster in the recipient countries than the donors they can converge in the capital output ratios and investment saving ratios with similar growth patterns over the long horizon. If the resource flows out of the developing countries in return to aid flows this may have harmful effects in growth of developing economies. Econometric estimates show that investment rather than aid was a factor contributing to growth. Exports tied to aid are always harmful for growth of recipient countries. British exports to developing Asia have promoted investment, and raised growth rates in per capita income irrespective of the amount of aid flowing to those Asian developing economies.

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