Growth, Sectoral aid and Institutional Quality: *Evidence from Developing Countries*

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Abstract

This paper examines the relationship between sectoral aid and growth, using data from 74 countries between 1980 and 2013. Education aid has higher positive and statistically significant effect on growth compared with health aid and agriculture aid. We find the individual effect of sectoral aid is potentially enhanced when it is interacted with the measure of institutional quality. We also find that South American countries are more efficient in using sectoral aid, and thereby promote growth relative to Africa and Asia. These findings are robust after correcting for potential endogeneity, alternative measures of growth. Overall, our findings provide key insights on policy recommendations for policy-makers and international development agencies.

1. Introduction

One of the most essential questions in economics is to address whether foreign aid enhances economic growth of the recipient countries. The usefulness of foreign aid in enhancing growth in poor countries has been a debatable area since Rosenstein-Rodan in 1943 advocates the provision of aid to Eastern and South-Eastern Europe (Dalgaard et al. 2004)[1]. Successively, several questions related to the inflow of foreign aid to developing countries have emerged. For example, "Why foreign aid is provided?", "How much aid should be provided?" and "Does aid work in all developing countries in a similar way?" These questions serve as a motivation for the substantial literature which documents the effect of foreign aid on economic growth of the developing countries (Meier, 1995). Moreover, the founding of the Millennium Development Goals (MDGs) in 2000, impose more pressure on donors to increase the amount of aid provisions[2]. In recent years, the amount of aid has increased significantly in real terms from US$ 127.3 billion in 2010 to 134.8 billion in 2013 (World Bank, 2014). Consequently, foreign aid, comprising a sizeable proportion of capital inflows, offers potential impressions that it is an important source of long run economic growth in developing countries[3].

However, in the last few years, empirical studies focusing on investigating aid effectiveness have produced "controversial" findings with reference to whether or not aid has really been effective in achieving its anticipated goals. The first strand of literature finds that foreign aid has positive and significant effect on economic growth the recipient countries (Burnside and Dollar 2000; Asteriou 2009; Karras 2006; Collier and Dollar 2003; Basnet 2013; Headey 2008; Feeny 2005; Ekanayake & Dasha 2010; Dalgaard et al. 2004). Conversely, the other strand of studies claim that aid has negative impact on growth. They also argue that aid aggravates corruption, civil conflicts, dependency syndrome and reduces the level of domestic production (Djankov et al. 2008; Busse and Gröning 2009; Easterly 2006; Moyo 2009). Furthermore, other studies show that foreign aid has insignificant effect on growth of the recipient countries (Rajan and Subramanian 2008; Boone 1996).

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[1] Rosenstein-Rodan (1943) suggests that the improvements of various sectors, such as increasing agricultural production in economically depressed areas can be achieved by the delivery of capital from the more developed European countries.

[2] The main objectives of MDGs are to eliminating extreme poverty and hunger, achieve universal primary education, reduce child mortality, ensure environmental sustainability, improve maternal health, and combat HIV/AIDS and other diseases in developing countries.

[3] Foreign aid consists approximately 30% of the total capital inflows in developing countries (OECD, 2009).

Whilst these group of studies show controversial findings, they have essential common characteristics. For example, first, most of them have examined the effect of foreign aid at the macro level by aggregating various types of aid in to a single amount. However, aggregation of aid does not allow inferences about the contribution of specific type of aid. Further, it is impossible to identify the most effective channels of aid inflows to developing countries. Second these studies are silent about how sectoral aid affects growth of the recipient countries when it is interacted institutional quality. Third, most of them consider developing countries as one big region. This procedure impedes identifying the most efficient regions in connection with using foreign aid, and thereby promote growth. Moreover, policy-makers and international development agencies cannot draw policy implications from the efficient regions that may enhance aid utilisations in less efficient regions. These gaps in the literature are our main motivations for conducting this study. More specifically, the main objectives of these study are: (1) to identify the effective channels of aid by examining and comparing the effect of aid provided to different sectors. (2) To examine how aid provided to different sectors affect growth when it is interacted with institutional quality. (3) To identify the efficient regions in terms of using sectoral aid. Thus, our main research questions are: Which sector's foreign aid is "more" effective in stimulating growth of the recipient countries? How does institutional quality moderate this effect? Are there regional variations in using sectoral aid?

These are important question in light of seeking effective channels of foreign aid inflows to developing countries. Recently, major initiatives have been taken by many international aid organisations, such as the United Nations, to increase aid effectiveness, and thereby enhance growth in developing countries. For example, at the recent UNESCO World Education Forum (WEF) held in Republic of Korea in the city of Incheon, many international development agencies committed to address persisting and emerging challenges of education in developing countries. At that occasion, a common objective was established for meeting basic learning needs through providing education aid. Similarly, the Dakar Forum (2000) emphasized that, for many countries, the provision of education was still far from the optimal level. During this Forum, many international development agencies have made new commitments to increase education aid, and ensure its effectiveness through developing a real sectoral approach. Further, the Paris Declaration on Aid Effectiveness held in 2008 developed new modalities of aid (i.e. Sector-Wide-Approach) to examine the effectiveness of aid in sectoral context. Thus, our findings help policy-makers and donors to identify successful channels of aid inflows to developing countries. This also allows to allocate aid to the

productive sectors which potentially play important roles in addressing multifaceted problems, and thereby ensure sustainable economic growth.

Another area of substantial interest is the effect of institutional quality on growth of developing countries, where aid affects their growth rate. The New Institutional Economics (NIE) explains that the quality of institutions has positive and significant effect on economic growth, investment, and financial development (Efendic et al., 2011; Acemoglu and Johnson 2005; Knack and Keefer 1995); Mauro 1995); North, 1990). The roles of institutional quality in developing countries have multitude dimensions. For example, institutional quality improves the macro-economic performances of country by decreasing uncertainty, directing economic activity to productive areas, building trust, and enhancing cooperation. Institutional quality is also important to reduce the level of poverty through supporting productive investments, and then achieve rapid economic growth. Further, stronger institutional quality encourages greater R&D expenditures which in turn promotes technological deepening better than methods that developing countries use to gain access to technology (such as through FDI or capital goods imports). In this context, we look at the interaction effect of sectoral aid and institutional quality on growth of the developing regions. Thus, our findings form this analysis provide important understandings to policy-makers and donors in allocating sector-specific aid based on the level of institutional quality in the recipient countries.

Furthermore, there is a glaring absence of empirical studies focusing on how the joint effect of sectoral aid and institutional quality differed across regions. This is because, as mentioned above, most of the extant empirical works have grouped together all available developing countries in to "one big group", without considering the effect that each sectoral aid may have across different regions. However, in reality, regions vary based on many aspects such as degree of policy environment, institutional quality, types of government and geographical location. These factors in turn may potentially determine the extent of aid effectiveness among regions. Hence, examining sectoral aid effectiveness among regions provides an important *modus operandi* of using foreign aid, and thereby augment growth.

Thus, the central question we investigate in this study is to investigate how sectoral aid and institutional quality individually and jointly affect economic growth of developing countries. Further, this study examines how the individual and joint effects of sectoral aid and institutional quality are varied across regions. This paper uses a comprehensive dataset covering 74 developing countries spanning 1980-2013, and examines the questions by

capturing different dimensions of economic factors. The study contributes to the literature in numerous ways. First, to the best of our knowledge, this is the first study to examine and compare sectoral aid effectiveness in developing nations. Second, this is also the first study to examine the joint effect of sectoral aid and institutional quality. Third, unlike the previous studies, we investigate the joint effect of sectoral aid and institutional quality across three regions: Africa, Asia and South America. Further, we consider a larger sample of developing countries, and use up-to-date aid data.

Our findings suggest that foreign aid provided to education, health and agriculture sectors have positive and significant effect on growth of the recipient countries[4]. We also find that institutional quality augments the individual effect of sectoral aid. Further, our findings show that education aid has the highest positive and significant effect on growth compared with health and agriculture aid. The joint of effect of education aid and institutional quality is significantly higher than the joint effects of both health and agriculture aid with institutional quality. The individual and joint effects of education aid and institutional quality is higher in South America than Africa and Asia. Moreover, our findings support the hypothesis provided by Burnside and Dollar (2000) which suggests that aggregated form of aid promotes growth when it is interacted with "good" policy environments. Our findings are robust with different specifications, such as dropping outliers, and using alternative measures of economic growth.

The remainder of the paper is structured as follows: Section 2 presents the related literature and develops the hypotheses. Section 3 discusses data and methodology. The empirical findings and their implications are provided in Section 4. Finally, Section 5 concludes this discussion.

2. Literature review and hypothesis development

Theoretical models, such as Solow and Swan (1956), demonstrate that foreign aid affects economic growth through investment. For example, when there is aid inflows to a given country, the total annual level of investment will be increased by the amount of aid received. Further, there is much empirical evidence suggesting that foreign aid affects growth through various channels. However, this evidence has produced controversial findings as some of them find positive, some of them find negative and others find insignificant effect of aid. Burnside and Dollar (2000) finds that aid stimulates economic growth when it is interacted with good

[4] We denote aid provided to health, education and agriculture sector as "health aid", "education aid" and "agriculture aid" in the subsequent discussions.

policy environment. Guillaumont and Chauvet (2001) argue that aid effectiveness depends on exogenous (mostly external) environmental factors (such as, terms of trade trend and real value of exports instability and climatic shocks): they posit that the worse the environment, the greater the need for aid and the higher its productivity. Dalgaard et al. (2004) show that aid positively affects long-run productivity. However, the size and direction of the impact depends on policies, and the size of the inflow.

Further, Hansen and Tarp (2001) state that aid enhances, in all conditions, the growth of poor countries. They also conclude that there are decreasing returns to aid; and its effectiveness is sensitive to the set of control variables. Such as, when investment and human capital are controlled, aid has no significant impact on economic growth. Similarly, Chenery and Strout (1966) in their "two-gap" model suggest that the amount of domestic investment in poor countries is potentially important determinant of the impact of aid. This model shows that foreign aid fills the gap when the amount of investment necessary to attain a certain rate of growth deviates from the available domestic saving. It also states that foreign aid fills the gap between import requirements and export earnings so as to attain sustainable growth.

In their seminar research, Collier and Dollar (2003) show that foreign aid significantly reduces the level of poverty in the developing countries. They empirically show that aid lifts around 10 million people annually out of poverty. However, this effect is merely conditional on the quality of policies, such as fiscal policy, trade policy, pro-poor programs and public sector management. Similarly, Svensson (1999) finds that the long-run effect of aid is conditional on the degree of political and civil liberties in the aid-receiving countries. Svensson (1999) further argues that if countries have more democratic government, aid will significantly promotes the growth rate. It is the recipient country's government which intermediates the inflow of aid, thus, aid may be allocated for unproductive and unintended purposes due to its fungibility behaviour[5].

On the other hand, Djankov et at. (2008); Knack (2001); Maren (1997) argue that aid reduces growth and deteriorates the quality of institutions by escalating the perceptions of corruption[6]. They further suggest that aid provides a windfall of resources, and may cause rent

[5] Fungibility of aid is the possibility that aid is used by governments in ways not intended by donors when disbursing the funds (Pack and Pack, 1993)

[6] Tavares (2003) suggests that aid decreases corruption

seeking behaviour as documented in the "curse of natural resources" studies[7]. Moreover, Maren (1997) provides evidence that aid, specifically food aid, is the main cause of civil conflicts through creating different desires to control and possess the aid. In contrast with Burnside and Dollar (2000), studies by Rajan and Subramanian (2008) and Boone (1996) show that there is no robust evidence to claim that aid spurs growth in good policy environment. They also argue that aid is usually channelled to government budget, and this may reduce the need for taxes and causes weak governance.

Despite that the facts that these studies provide mixed findings, most of them paid more attention to examining the impact of aggregated form of aid on growth. However, there is no literature, to the best our knowledge, which aimed at investigating and comparing aid effeteness among sectors. These studies are also silent about the joint effect of sectoral aid and institutional quality on growth. Moreover, as mentioned above, there is no literature which examine the variations of the joint effect of sectoral aid and institutional quality across regions. Due to the glaring absence of literature that systematically compare aid effectiveness across sectors and regions, we build our hypothesis based on the following arguments. First, the findings of the existing studies employing aggregated form of aid do not clearly indicate the effective channels of aid inflows for policy-makers and international aid organisations. Second, sectoral aid effeteness depends on the level of institutional quality. Third, regions are significantly different with regard to sectoral aid utilisations. Investigation of regional disparities in using sectoral aid exhibits imperative policy implications such as, it allows to identify the main determinants that cause these differences and to take corrective actions. Based on these arguments we frame three hypothesises.

H1. There is significant difference among sector-specific aids in stimulating economic growth.

H2. Institutional quality augments the effect of sector-specific aid in developing countries.

H3. The individual and joint effects of sectoral aid & institutional quality differs across regions.

[7] Djankov et al. (2008) state that aid potentially intensifies political instabilities in developing nations than other natural resources, such as petroleum oil, do.

3. Data and Empirical Methodology

3.1.Growth

Based on a cross-country growth regression framework by Barro (1991) and further extended by King and Levine (1993), we use the annual growth rate of real per capita income as the dependent variable[8]. The data for per capita income is obtained from World Development Indicators (WDI) which is measured at constant $USD 2010.

3.2.Sectoral Aid

Data on foreign aid is taken from the current (static) research release of the AidData database (version 2.1; see Tierney et al., 2011) spanning 1980-2013. This database provides a more comprehensive view of aid across all types of sectors for an extended period of time relative to the standard Organisation for Economic Cooperation and Development (OECD), creditor reporting system (CRS). It provides more detailed information about aid to specific sectors, purposes, projects and even activities that do not report to the OECD. Further, this database records both bilateral and multilateral aid for each sector in a consistent format. This recording system highly supportive to examine the effect of specific type of aid on overall economic performance of developing countries. Here, aid is defined as the commitments of Official Development Assistance (ODA) concessional loans and grants from all donors, including multilateral organisations. However, all non-concessional funding, loan guarantees and any equity participations are excluded. We use data on aid commitments because, historically, purpose-related information on aid has only been available for commitments, not actual disbursements (Jones and Tarp, 2016). Further, too much of disbursements data is missing because donors usually "delay" transferring their commitments. Thus, to capture any possible bias from systematic discrepancies between commitments and disbursements, our models incorporate recipient and time fixed effects.

We identified "three" aid-receiving sectors (namely health, agriculture and education sector) to examine sectoral aid effectiveness. One of the main reasons for choosing these sectors is that they are considered as the potential stimulators of economic growth in developing countries as evidenced by numerous studies[9]. Due to this, international aid

[8] Most of the aid-growth nexus studies use the growth of real per capita income as a dependent variable (e.g. Burnside and Dollar, 2000; Guillaumont and Chauvet, 2001; Dalgaard et al. 2004; Hansen and Tarp, 2001; Collier and Dollar, 2003; Svensson, 1999; Djankov et at. 2008; Knack, 2001; Maren, 1997).

[9] Barro (2001) shows that education increases economic growth by facilitating the absorption of superior technologies from leading countries. Similarly, Bloom et al. (2004) suggest that the

organisations are delivering higher amount of aid to these sectors. Rostow (1990) argues that for any developing country, three primary requirements are food, health and basic education. Once these basic requirements are fulfilled then, a country can move into generating sustainable growth through innovation, financial development and trade. Health plays significant roles in the growth process. Healthier workers are physically and mentally more energetic and robust to work in agriculture and manufacturing sectors. They are more productive, and thereby earn higher wages. They are also less likely to be absent from work because of health problems associated with them and their families. Health problems (illness and disability) reduce hourly wages significantly which is very strong particularly in developing countries where a larger proportion of the work force engaged in manual labour. Further, healthier people live longer and save more, which in turn provides higher level of investment, and thereby stimulate long run growth (see Van Zon and Muysken 2001).

Moreover, agriculture sector has substantial contributions in developing countries. It serves as the main source of food for urban and rural dwellers. It provides easily accessible job opportunities for many poor individuals which have lower educational status. It also serves as the source of labour force for the industrial sector; and foreign exchange earnings. Further, usually, international development agencies uses agricultural sector to promote pro-poor growth in developing countries as it comprises a higher proportion of population. Similarly, education sector supports developing countries in different aspects. It helps to develop skills which is important to learn and adopt new technologies from the developed countries. It shows how to achieve efficient resource allocation that significantly increases productivity, and thereby sustainable economic growth. It also reduces the degree of corruption by reforming institutions, and setting technical standards in each sectors of the economy. Thus, it is not surprising that these three sectors, health, agriculture, and education, receive larger amount of aid relative to other sectors over time. In chapter 2, Table 6 shows an evidence that these sectors are receiving larger amount of aid compared with other sectors.

Using the AidData codes, we obtain sectoral aid commitments provided to education, health and agriculture sectors[10]. We "scaled" sectoral aid as share of real GDP which is

development of health indicators including higher life expectancy and lower child mortality have positive and significant effect on economic growth. Moreover, Gollin et al. (2002) conclude that improvements in agricultural productivity can hasten the start of industrialization by releasing labour, and thereby increases growth.

[10] Following Arndt et al. (2010), we treat zero-valued aid observations as zeroes, rather than missing.

measured at constant $USD 2010[11]. Thus, education aid is calculated as the "sum" of aid transferred to primary, secondary, post-secondary and level unspecified education divided by real GDP, and then multiplied by 100. Similarly, health aid is calculated as the "sum" of basic health aid, general health aid and population policies and reproductive health aid divided by real GDP, and then multiplied by 100. Finally, agriculture aid is derived from dividing the total amount of agriculture aid by the real GDP, and then multiplied by 100. Table 1 reports the average values of each sector's aid (as a share of real GDP). Likewise, Table 2 summarises the average values of each sector's aid in Africa, Asia and South America.

3.3. International Country Risk Guide (ICRG) Index

We use ICRG index to measure institutional quality in the recipient countries, and then examine how it moderates the effect of sectoral aid on growth (Bräutigam and Knack 2004; Tavares, 2003). The extant aid-growth nexus literature shows that the effect of aid on growth may considerably depend upon numerous conditions. For example, Burnside and Dollar, 2000; Collier and Dollar, 2003 find that aid has positive and significant impact on growth if the recipient country has good policy environments. Further, Dalgaard et al. (2004) state that aid stimulates growth in countries which are located outside of the tropics and have good policies. Most of the aid-growth studies measure the policy environment by using an index of fiscal, monetary, and trade policies. However, this index has a potential caveat that it only takes "three" policies into account. Thus, to address this limitation we use ICRG index which is a broader and well-accepted measure of country-level risk (Knack and Keefer, 1995; Chong and Gradstein, 2009; Dollar and Kraay, 2002)[12]. It includes more than 22 variables in three subcategories of risk: political, financial and economic. It is calculated as a weighted average of political, financial and economic risk in a country. In ICRG index, the highest overall rating (theoretically 100) shows the lowest risk, and the lowest rating (theoretically zero) shows the highest risk. Thus, it is pragmatic to assume that if an aid- receiving country has stable political, financial and economic environments, sectoral aid will significantly improve the long run economic growth of the recipient countries.

The data on ICRG is obtained from the international country risk guide index calculated by the Political Risk Services (PRS) group. The data for ICRG is available for more than 140 countries starting from 1984. Since our study covers the period 1980-2013, we use each

[11] The standard scaling procedures are aid over real GDP, per capital aid (i.e. aid over population) and aid over government expenditure. However, aid over real GDP scaling procedure is frequently used in the aid-growth nexus literature (Alesina and Weder, 1999).

[12]Fiscal and trade policies are explicitly included in the economic risk ratings, and the monetary policies are included in the financial risk ratings.

country's 1984 figure for the year 1980 to 1983, on the assumption that institutional factors change slowly over time[13].

3.4.Other Control variables

Following the aid-growth literature, we include control variables in our models to investigate the contributions from other aspects in the presence of foreign aid, which are significant determinants of growth. The following controls are included: *log* of initial income, *log* of inflation, trade openness, life expectancy, *log* of broad money (M2) as a percentage of GDP, ethnic fractionalisation, government expenditure (%GDP), interest rate differential, and *log* of population.

It is standard in the empirical growth literature that convergence effect is captured by allowing growth during period *t* to depend on the *log* of real per capita GDP at the beginning of the period. Following Fischer (1993) we include *log* of inflation as a measure of monetary policies. Trade openness facilitates the use of advanced technologies among the trading countries, thereby increases growth (Banerjee and Roy, 2014). It also promotes investments through the use of intermediate goods, new inputs and products (Yanikkaya, 2003). However, other studies, such as Grossman and Helpman (1991); Lucas (1988); Young (1991) argue that trade reduces growth if the trading countries are "asymmetric" in the sense that they have different technological advancements and resource endowments.

We include life expectancy to capture the effect of health on growth. There two strands of literature about the effect of life expectancy on growth. Cervellati and Sunde, 2011; Chakraborty and Das, 2005; Webber, 2002 argue that life expectancy positively contributes to growth. On the other hand, De la and Licandro (1999) finds that life expectancy has positive effect on growth when life expectancy is relatively low; however, the effect is negative in developed countries as the positive effect of a longer life on growth could indeed be offset by an increase in the average age of the workers. Next, financial development contributes to growth through different channels; such as it enables small savers to pool funds, it creates a wider range of instruments which increase savings, it redirects saving from individuals to slow-growing sectors, and it reduces the problem of adverse selection in the credit markets. Thus, to

[13] This assumption is commonly used in the literature (see Burnside and Dollar, 2002). We check our assumption by calculating the annual change of ICRG index in each country; and the result shows that there is a slow annual change of ICRG index in each country. For detailed methodology of the calculation of the ICRG index, please consult the following link: https://www.prsgroup.com/about-us/our-two-methodologies/icrg

capture the effect of financial sector development we include the level of broad money (M2) as a percentage of GDP.

Ethnic fractionalisation is included to control for the long-term characteristics of countries that affect the growth of a country. Easterly and Levine (1997) argue that ethnic fractionalisation correlate with bad policies, and thereby reduces the growth of a country. Fölster and Henrekso, 2001; Burnside and Dollar, 2002 show that government expenditure increases the growth of a country if it is spent for productive purposes. Thus, we include the share of gross government expenditure as a percentage of GDP to capture the effect of government expenditure. We also include interest rate differential to capture the effect of shocks in the international markets[14]. Further, our models also include the size of population of the recipient countries. A detailed description and sources of all variables are presented in Appendix 2.

3.5. Data Description

Our sample contains 2,442 country-year observations from 74 aid-receiving countries from Africa, Asia and South America, and covers the period 1980-2013. The detailed summary statistics of our key variables and list of countries are provided in Table 1 and Appendix 3, respectively. We exclude countries, such as South Sudan, Eritrea, Somalia, Suriname, Guyana and others due to the absence of data for many variables. Table 1 also presents, the descriptive statistics of the following country-level determinants used in our empirical analysis: *log* of initial income, *log* of inflation, trade openness, life expectancy, *log* of broad money (%GDP), ethnic fractionalisation, government expenditure (%GDP), interest rate differential, *log* of population. In Table 1, the mean and median values of education aid are 0.22 and 0.11 respectively. The mean and median values of health aid are 0.90 and 0.40 respectively. The mean and median values of agriculture aid are 0.77 and 0.26 respectively. This indicates that health and education aid comprise the highest and lowest, respectively, share of real GDP in our full sample. The differences in the mean values of sectoral aid imply that there may be a substantial variation among sectors in connection with using aid provided to each sector, and thereby promote growth. We also note that, some countries have zero reported value on education, health and agriculture aid. We decided not to remove the countries with zero sectoral aid for two reasons: (1) to avoid self-selection bias, and (2) zero sectoral aid means a country

[14] We calculate the interest rate differential as the difference between the real interest rate of USA (using as the frontier economy) and the real interest rate of each recipient country.

doesn't receive aid at that particular period of time (i.e. we cannot assume zero value of sectoral aid as a missing data)[15].

Table 1: Summary Statistics

Variables	Mean	Std. Dev.	Median	Min	Max
Growth of per capita income	0.02	0.09	0.02	-2.56	0.72
Education aid	0.22	0.34	0.11	0.00	4.82
Health aid	0.90	1.53	0.40	0.00	24.30
Agriculture aid	0.50	1.01	0.19	0.00	15.21
ICRG index	40.57	8.41	41.19	8.68	74.00
Logarithm of initial income	6.65	1.07	6.49	4.19	10.06
Trade openness	66.33	43.82	56.01	0.02	531.74
Life expectancy	59.35	9.92	59.45	27.08	80.59
Logarithm of inflation	1.53	1.43	1.67	-2.75	9.37
Logarithm of M2/GDP	3.42	0.60	3.36	1.51	5.03
Gov. expenditure (%GDP)	15.50	8.41	13.68	2.05	84.51
Ethnic fractionalization	0.53	0.25	0.60	0.04	0.91
Logarithm of population	16.16	1.61	16.30	11.07	20.91
Interest rate differential	-4.99	39.84	-2.09	-571.77	104.34

Notes: We calculate education, health and agriculture aid by dividing the total amount of aid provided to each sector to real GDP, and multiply by 100. Both aid and real GDP are measured based on the constant $US 2010. We notice three surprising values. (1) The largest deviation of the maximum value of openness from its mean value. This value is observed in Equatorial Guinea in 2007. (2) The largest deviation of the minimum value of life expectancy from its mean value. This value is observed in Rwanda in 1993, and the main causes were civil conflicts and deep-rooted diseases (see Binagwaho et al. 2014). (3) The largest deviation of the minimum value of interest rate differential from its average value. This is observed in Zimbabwe in 2007 mainly due to *hyperinflation* (McIndoe, 2009).

[15] This argument is usually held in the aid-growth literature (see Arndt et al. 2010). We checked our estimation results considering zero sectoral aid as missing data. The result shows that there is a higher difference in the magnitude and significance level of the coefficients of each variable.

In Table 2, we reported the summary statistics of sectoral aid in Africa, Asia and South America. African and South American countries have the highest and lowest share of sectoral aid in real GDP[16]. Further, the share of health aid comprises the highest percentage relative to education and agriculture aid. In summary, we find that the key variables (sectoral aid and ICRG) used in Table 1 fall in the resealable range of variables.

Table 2: Summary Statistics

Variables	Africa				Asia				Latin America			
	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max
Growth	0.01	0.10	-2.6	0.72	0.02	0.09	-1.2	0.43	0.02	0.05	-0.2	0.13
Health aid	1.21	1.79	0.00	24.3	0.57	0.95	0.00	10.4	0.18	0.35	0.02	1.99
Education aid	0.30	0.39	0.00	4.82	0.13	0.19	0.06	1.10	0.06	0.14	0.00	1.48
Agriculture aid	0.65	1.21	0.00	15.2	0.33	0.59	0.00	5.02	0.14	0.33	0.00	3.40
ICRG index	40.0	8.95	8.68	74.0	40.41	7.97	15.1	54.1	43.5	5.73	20.8	54.9
Log of initial income	6.39	1.03	4.19	10.1	6.69	0.91	4.59	9.24	7.82	0.68	6.44	9.35
Trade openness	70.1	47.7	6.32	532	68.33	39.1	0.02	220	45.4	24.1	11.6	123
Life expectancy	54.7	8.78	27.1	74.6	65.01	6.76	27.8	75.2	69.6	5.44	50	80.6
Log of inflation	1.33	1.36	-2.6	8.33	1.50	1.28	-1.6	7.42	2.49	1.61	-2.8	9.37
Log of M2/GDP	3.29	0.55	1.91	5.03	3.71	0.67	1.51	4.95	3.48	0.44	2.41	4.72
Gov. expend. (%GDP)	17.1	9.33	2.05	84.5	12.87	6.13	2.33	43.4	13.3	5.53	2.98	43.4
Ethnic fractionalisation	0.59	0.23	0.67	0.91	0.45	0.25	0.05	0.82	0.44	0.23	0.17	0.82
Log of population	15.7	1.49	11.1	18.9	17.10	1.63	12.9	20.9	16.7	1.09	14.9	19.1
Interest rate differential	-5.8	50.6	-572	101	-0.66	8.49	-52	31.8	-10.	22.8	-91	104

Notes: We calculate health, education and agriculture aid by dividing the total amount of aid provided to each sector to real GDP, and multiply by 100. Both aid and real GDP are measured based on the constant $US 2010. We include 45, 19 and 10 countries from Africa, Asia and South America, respectively, in our sample.

3.6.Empirical Methodology

Following Barro (1991) and further extended by King and Levine (1993), we consider the following empirical model[17]:

$$g_{i,t} = \beta_0 + \beta_1 g_{i,t-1} + \beta_2 SA_{it} + \beta_3 ICRG_{i,t} + \beta_4 (SA_{it} \times ICRG_{i,t}) + \Sigma\gamma' Controls + \lambda_t + a_i + \varepsilon_{it} \quad (1)$$

[16] We conduct t-test for the mean difference of sectoral aid across these regions, and find significant mean difference among the regions. The results are available upon request.

[17] Burnside and Dollar (2000), Collier and Dollar (2003), Guillaumont et al. (2001), Svensson (1999), Asteriou (2009) and Karras (2006) and so many other aid-growth nexus studies use this model.

Where i denotes the country ($i = 1, \dots, 74$) and t denotes the time period ($t = 1980, \dots, 2013$) $g_{i,t}$ is the growth of per capita income of a recipient country. SA_{it} is the amount of sectoral aid provided to education, health or agriculture sector. $ICRG_{i,t}$ indicates a weighted average of political, financial and economic risk of a country that would enhance ($\beta_2 > 0$) or reduce ($\beta_2 < 0$) the effect of sectoral aid (SA_{it}) on growth ($g_{i,t}$). λ_t, a_i and ε_{it} represent fixed time effect, country-specific fixed effect and the idiosyncratic error term respectively. The main coefficients of interest are β_2, β_3 and $\beta_4$with the expectation that each coefficient takes different value as we use different sectoral aid. Finally, as mentioned before, we include a set of control variables, time-specific variables and country-specific control variables to our regression model to explore the contributions of these factors to the growth of aid-receiving countries. Furthermore, we apply this model to examine how the joint effect of sectoral aid and ICRG index on growth is varied among regions (Africa, Asia and South America).

We particularly focus on the parameters β_2 and β_4 to generate the derivative of growth with respect to sectoral aid which is explained as:

$$\frac{\partial g_{i,t}}{\partial SA_{it}} = \beta_2 + \beta_4 * ICRG_{i,t} \quad (2)$$

From Eq. (2), it is possible to measure the effect of sectoral aid on growth at different levels of institutional quality (i.e. ICRG index), holding all other variables constant. Thus, growth is expected to change by ($\beta_2 + \beta_4 * ICRG_{i,t}$) percent when one of the sectoral aid changes by one percentage point. However, the direction of changes in growth depends on the sign of the coefficients. For example, if both β_2 and β_4 are positive (or negative), then SA_{it} has a positive (or negative) effect on growth. On the other hand, if $\beta_2 < 0$ and $\beta_4 > 0$, SA_{it} would reduce growth by β_2. However, this effect can be reduced by maintaining certain level of institutional quality. In this case, it is possible to determine a threshold level above which SA_{it} contributes positively towards growth. Alternatively, if $\beta_2 > 0$ and $\beta_4 < 0$, means that SA_{it} increases growth by β_2. However, this positive effect declines when ICRG index of a given country starts to increase, and this effect becomes insignificant beyond a given threshold level of institutional quality. This indicates that good institutional quality above a certain threshold level may cease the positive effect of sectoral aid (SA_{it}) on growth. The derivative of growth with respect to each sectoral aid is provided in Table 6.

First, we employ pooled OLS to estimate the coefficients in Eq. (1). Next, we use dynamic panel model particularly system-GMM which is proposed by Blundell and Bond

(1998). It is derived from the estimation of a system of two "simultaneous" equations. The first one is level equation which is instrumented by lagged first differences. The second one is the first differenced equation which is instrumented by lagged levels. When there are the issues of heteroscedasticity and serial correlation the two-step system-GMM uses a consistent estimate of the weighting matrix taking the residuals from the one-step estimate (Davidson and MacKinnon, 2004; Roodman, 2006). System-GMM helps to solve endogeneity problem by generating "internal" instrumental variables from the model. Further, system-GMM decreases instrument proliferation by using three important techniques. (1) By limiting the number of instruments to certain lags instead of using all available lags. (2) By using a method called "collapsing" that combines instruments into smaller sets. (3) By using both techniques together (see Roodman, 2009b). We discuss our main findings in the next section.

3.7.Empirical Findings

3.7.1. Baseline Findings

The baseline results generated from pooled OLS estimation are presented in Table 3. Education aid, health aid and agriculture aid are measured as a share of real GDP. Specification 1 captures the relationship between education aid and growth of per capita income, specification 3 and 5 indicate the effect of health and agriculture aid on growth respectively. Our findings show that a one percentage point increase in education aid contributes 0.0682 percentage point increase in growth of per capita income. Similarly, a one percentage point increase in health aid enhances growth by 0.0012 percentage point. Specification 5 shows that a one percentage point increase in agriculture aid enhances growth by 0.0031 percentage point. Specification 2, 4 and 6 show the joint effect of sectoral aid and institutional quality[18]. These specifications indicate that the effect of sectoral aid is augmented when it is interacted with ICRG index[19]. For example, specification 2 implies that a one percentage point increase in education aid contributes 0.0974 percentage point in growth when it is interacted with ICRG index.

Although all specifications in Table 3 show that each sectoral aid has positive and significant effect on growth, there is a substantial difference among the coefficient estimates. Thus, our baseline findings show that aid provided to education sector exerts the "highest"

[18] The individual effect of ICRG is positive and significant in all specifications.
[19] These findings are similar with other aid-growth studies (Burnside and Dollar, 2002; Collier and Dollar, 2003) albeit we use a broader measure of institutional quality.

positive and significant effect on growth of the recipient countries. This effect is further augmented when education aid is interacted with the measure of institutional quality. Agriculture aid is also effective in stimulating growth compared with health aid. Further, we include all sectoral aid and control variables in one pooled OLS regression in the hope of obtaining "efficiency" as it is shown in specification 7 (see Table 3). However, the magnitude and significance level of the coefficients of the aid and control variables are completely different than that of the separated regressions. We suspect that collinearity between the aid variables is the potential source of these differences (see Appendix 1). This situation is also investigated by some studies focusing on the "fungibility behaviour" of foreign aid. For example, Jones, 2005; Pack and Pack, 1990 show that governments of aid-receiving countries, particularly in Africa, usually transfer donor resources to non-targeted expenditures. They also argue that aid is only slightly fungible at the macro level (where funds are diverted to tax relief) but that a greater level of fungibility is observed at the micro level (i.e. funds transferred among sectors). Thus, our discussion solely depends on the results from the separated regressions.

Table 3: Impact of Sectoral Aid and Institutional Quality on Growth: *Pooled OLS Estimations*

Variables	Education aid		Health aid		Agriculture aid		Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Education aid	0.0682**	0.0721**					0.0416**
	(2.471)	(2.011)					(2.051)
(Education aid) x ICRG		0.0974**					0.1217**
		(2.289)					(2.220)
Health aid			0.0012**	0.0002*			0.0023**
			(2.090)	(1.681)			(2.383)
(Health aid) x ICRG				0.0126**			0.0071**
				(2.643)			(2.447)
Agriculture aid					0.0031*	0.0207***	0.0204***
					(1.979)	(3.520)	(2.883)
(Agriculture aid) x ICRG						0.0601***	0.0631***
						(4.06)	(3.540)
ICRG	0.0012***	0.0015***	0.0017***	0.0013**	0.0117***	0.0016***	0.1742***
	(3.908)	(3.865)	(3.905)	(5.344)	(3.895)	(4.846)	(5.376)
Logarithm of initial income	-0.0071**	-0.0068**	-0.0077**	-0.00656**	-0.0086***	-0.0093***	-0.0089***
	(-2.455)	(-2.353)	(-2.615)	(-2.670)	(-2.893)	(-3.135)	(-3.680)
Trade openness	0.0023***	0.0023***	0.0023***	0.00023**	0.0023***	0.0024***	0.0023***
	(3.898)	(3.903)	(3.887)	(4.858)	(3.847)	(3.988)	(4.925)
Life expectancy	0.0039*	0.0004*	0.0038	0.00037	0.0036	0.0034	0.0035
	(1.87)	(1.93)	(1.52)	(1.363)	(1.009)	(0.957)	(1.287)
Logarithm of inflation	-0.0004	-0.0003	-0.0053	-0.00033	-0.0052	-0.0045	-0.0003
	(-0.345)	(-0.298)	(-0.511)	(-0.253)	(-0.501)	(-0.435)	(-0.232)
Logarithm of M2/GDP	-0.0103*	-0.0103*	-0.0109*	-0.0124*	-0.0987*	-0.0107**	-0.0109**
	(-1.94)	(-1.950)	(-1.900)	(-2.553)	(-1.867)	(-2.018)	(-2.716)
Government expenditure (%GDP)	-0.0014	-0.0014	-0.0014	-0.00014	-0.0013	-0.0006	-0.0006
	(-0.570)	(-0.574)	(-0.547)	(-0.554)	(-0.506)	(-0.252)	(-0.246)
Ethnic fractionalisation	-0.0107*	-0.0109*	-0.0101	-0.01163	-0.0096	-0.0106	-0.0106
	(-1.697)	(-1.731)	(-1.590)	(-1.533)	(-1.512)	(-1.585)	(-1.403)
Logarithm of population	0.0043*	0.0044*	0.0047*	0.0042**	0.0036	0.0035	0.0036**
	(1.947)	(1.984)	(1.786)	(2.895)	(1.615)	(1.567)	(2.480)
Interest rate differential	-0.0004	-0.0004	-0.0004	-0.00003	-0.0003	-0.0004	-0.0004
	(-0.550)	(-0.548)	(-0.545)	(-0.672)	(-0.513)	(-0.544)	(-0.818)
Constant	-0.0283	-0.0304	-0.0173	-0.03230	-0.0026	-0.0106	-0.0184
	(-1.015)	(-1.089)	(-0.578)	(-1.046)	(-0.091)	(-0.362)	(-0.586)
Adjusted-R^2	0.439	0.432	0.428	0.435	0.424	0.494	0.382

Notes: The dependent variable is growth of per capita income. Heteroscedasticity and autocorrelation robust t-statistics are in parentheses. ***, **, & * denote significance at 1%, 5% and 10% respectively. The effect of ICRG index positive and significant in all specifications. We include 2,368 observations and 74 countries in all models.

Table 3 above reports that all specifications except specification 7 have reasonable explanatory power as the adjusted R squared is in the range of 42.4% to 49.4%. The coefficients are also robust after the inclusion of various control variables to the specifications. The coefficients of logarithm of initial income, trade openness and logarithm of M2/GDP are significant in all specifications. However, the coefficients of life expectancy, logarithm of population and ethnic fractionalisation have different significance level across all specifications. In all empirical specifications, we include country and time dummy variables to capture country and time-specific effects respectively. Moreover, Table 4 below reports the baseline results of the effect of sectoral aid, and their joint effect with ICRG index on growth in Africa, Asia and South America. The coefficients from specification 1, 7 and 13 demonstrate that education aid has the highest positive and significant effect (0.217 percentage point) on growth in South America than Africa and Asia. Likewise, specifications 2, 8 and 16 show that the joint effect of education aid and ICRG index is highest in South America (0.387 percentage point) than Africa (0.126 percentage point) and Asia (0.265 percentage point).

In Table 4, specification 3, 9 and 15 show the relationship between health aid and growth in Africa, Asia and South America respectively. The coefficients from these specifications indicate that South America countries are more efficient in using health aid, and thereby promote growth than African and Asian countries. This relationship is also maintained when health aid is interacted with ICRG index (see specifications 4, 10 and 16). For example, when health aid is relaxed by one percentage point, it contributes 0.226 percentage point increase in growth which is larger than 0.094 (in Africa) and 0.163 (in Asia). On the other hand, Asian countries are efficient in using agriculture aid as it is shown by specifications 5, 11 and 17. This findings also are maintained when agriculture aid interacted with ICRG index (see specification 6, 12 and 18). The individual effect of ICRG index is positive and significant in all specifications. The findings reported in Table 4 also enable us to identify the effective channels of aid inflows within a region. For example, the coefficients from specification 1, 3 and 5 indicate that education aid is more effective regarding spurring growth in Africa.

Although our findings from the pooled OLS regressions show that education aid is more effective than health and agriculture aid, this conclusion is unreliable because aid and growth are endogenously related (e.g., Rajan and Subramanian 2008; Nunn and Qian 2014). One of the main reasons of the endogeneity of foreign aid is that donors may provide large amount of aid to those countries which have lower economic growth. This indicates that lower economic performance of the recipient countries can be a determinant of aid inflows to developing countries. Further, when a country uses aid effectively, donors will provide more aid to this country as a reward.

Table 4: Impact of Sectoral Aid on Growth in Africa, Asia and South America: *Pooled OLS Estimations*

	Africa						Asia						South America					
Variables	Education aid		Health aid		Agri. aid		Education aid		Health aid		Agri. aid		Education aid		Health aid		Agri. aid	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Education aid	0.067	0.053					0.142	0.127					0.217	0.182				
	(1.98)	(1.71)					(1.77)	(1.89)					(1.91)	(1.76)				
(Edu. aid) x ICRG		0.126						0.265						0.387				
		(2.76)						(2.67)						(2.25)				
Health aid			0.031	0.002					0.107	0.041					0.212	0.311		
			(1.66)	(1.75)					(2.74)	(1.65)					(2.23)	(2.01)		
(Health aid) x ICRG				0.094						0.163						0.226		
				(1.87)						(1.76)						(2.19)		
Agriculture aid					0.023	0.021					0.216	0.148					0.083	0.051
					(1.87)	(3.47)					(2.49)	(1.84)					(1.68)	(1.70)
(Agri. aid) x ICRG						0.065						0.892						0.118
						(4.01)						(2.11)						(2.61)
ICRG	0.0012	0.024	0.042	0.029	0.041	0.024	0.002	0.004	0.002	0.002	0.015	0.012	0.003	0.007	0.027	0.002	0.002	0.002
	(3.139)	(2.19)	(2.09)	(2.43)	(2.02)	(2.19)	(2.30)	(1.73)	(2.33)	(3.24)	(3.30)	(2.47)	(5.30)	(3.28)	(5.48)	(3.39)	(3.63)	(3.12)
Log. initial income	-0.011	-0.008	-0.01	-0.02	-0.01	-0.02	-0.02	-0.02	-0.016	-0.017	-0.018	-0.018	-0.032	0.124	-0.057	-0.006	-0.002	-0.078
	(-2.68)	(-2.45)	(-2.8)	(-5.1)	(-3.3)	(-5.2)	(-2.5)	(-2.4)	(-2.22)	(-2.32)	(-2.51)	(-2.43)	(-1.77)	(0.27)	(-1.68)	(-1.46)	(-0.53)	(-0.42)
Trade openness	0.0033	0.033	0.032	0.033	0.003	0.032	-0.01	-0.03	-0.003	-0.008	-0.003	-0.003	-0.001	-0.016	-0.003	0.004	-0.274	-0.014
	(4.189)	(3.69)	(3.59)	(3.73)	(3.34)	(3.61)	(0.16)	(0.15)	(-0.15)	(-0.37)	(-0.14)	(-0.14)	(-0.06)	(-0.65)	(-0.15)	(0.17)	(-0.28)	(-0.41)
Life expectancy	0.0054	-0.001	-0.01	-0.08	-0.11	-0.01	0.021	0.024	0.025	0.003	0.004	0.024	-0.002	0.161	-0.012	-0.003	0.019	0.022
	(0.934)	(-1.75)	(1.44)	(1.27)	(1.70)	(1.69)	(1.73)	(1.73)	(1.54)	(1.88)	(1.73)	(1.70)	(-1.27)	(1.28)	(-0.95)	(-0.03)	(1.86)	(1.74)
Log of inflation	-0.0007	0.258	0.274	0.290	0.318	-0.32	0.132	0.013	0.013	0.018	0.012	0.083	0.044	-0.001	-0.001	0.047	-0.004	0.024
	(-0.42)	(1.30)	(1.38)	(1.49)	(1.56)	(1.65)	(0.28)	(0.28)	(0.28)	(0.38)	(0.24)	(0.18)	(0.31)	(-0.00)	(-0.07)	(0.32)	(-0.28)	(1.59)
Log of M2/GDP	-0.0774	0.023	0.037	0.044	0.029	0.034	0.002	0.021	0.022	0.026	0.021	0.028	0.018	-0.002	0.022	0.002	-0.015	-0.014
	(-0.78)	(1.00)	(1.61)	(1.94)	(1.26)	(1.53)	(1.85)	(1.59)	(1.65)	(1.75)	(1.60)	(1.77)	(0.80)	(-0.89)	(0.99)	(0.88)	(-0.70)	(-0.61)
Gov.t expenditure	0.0001	0.0041	0.024	0.039	0.017	0.028	-0.06	-0.06	-0.047	-0.18 6	-0.043	-0.051	-0.068	-0.054	-0.081	-0.069	-0.066	-0.056
	(0.255)	(0.99)	(0.58)	(0.96)	(0.41)	(0.68)	(0.46)	(0.46)	(-0.35)	(-1.39)	(-0.33)	(-0.37)	(-1.43)	(-1.12)	(-1.72)	(-1.43)	(-1.38)	(-1.17)
Ethnic fractionalisation	-0.017	-0.015	-0.02	-0.02	-0.02	-0.02	-0.01	-0.03	-0.019	-0.013	-0.011	-0.012	-0.018	-0.015	-0.014	-0.015	-0.013	-0.012
	(-2.15)	(-2.44)	(-2.5)	(-2.2)	(-2.4)	(-2.0)	(-2.0)	(-2.0)	(-2.03)	(-2.04)	(-2.11)	(-2.00)	(-2.10)	(-2.04)	(-2.11)	(-2.00)	(-2.01)	(-2.21)
Log of population	0.0061	0.822	0.922	0.022	0.012	0.027	-0.04	-0.04	-0.041	-0.051	-0.046	-0.049	0.009	-0.044	-0.074	-0.054	-0.046	-0.044
	(1.978)	(0.84)	(0.95)	(2.30)	(1.20)	(-2.7)	(2.35)	(-2.4)	(-2.30)	(-1.66)	(-1.75)	(-1.52)	(0.45)	(-2.13)	(-0.04)	(-0.26)	(-2.26)	(-2.13)
Interest rate differential	-0.0006	-0.012	-0.01	-0.01	-0.01	-0.01	-0.09	-0.08	-0.088	-0.081	-0.081	-0.073	0.007	0.007	0.008	0.002	0.007	0.004
	(-0.88)	(-1.69)	(1.36)	(1.11)	(1.34)	(0.97)	(1.18)	(1.18)	(1.22)	(1.12)	(1.11)	(0.98)	(0.50)	(0.50)	(0.61)	(0.15)	(0.50)	(0.26)
No. of obs.	1,440	1,440	1,440	1,440	1,440	1,440	608	608	608	608	608	608	320	320	320	320	320	320
Adjusted-R^2	0.575	0.443	0.551	0.494	0.478	0.474	0.542	0.542	0.529	0.464	0.445	0.438	0.481	0.512	0.581	0.538	0.562	0.558

Notes: The dependent variable is growth of per capita income. Heteroscedasticity and autocorrelation robust t-statistics are in parentheses. We didn't put asterisk on the top of the significant coefficients due to the paucity of space. Therefore, if t-statistics is greater than 2.63, the coefficient is statistically significant at the 1% level. Similarly, if the t-statistics ranges from 1.97 to 2.63, and from 1.65 to 1.96 the coefficient is significant at the 5% and 10% level respectively.

We, therefore, apply alternative approach, panel GMM regressions, that can potentially solve the endogeneity problem in our model. This approach comes with two important estimation procedures. These are the difference-GMM due to Arellano and Bond (AB, 1991), and the system-GMM estimator due to Blundell and Bond (BB, 1998). In the AB estimator, lagged levels of the endogenous variables are used as instruments for the differenced independent variables. However, in the BB estimator, lagged levels of endogenous independent variables are used as instruments for the differenced independent variables as in the AB estimator, and the level equation is estimated by using lagged differences as instruments (Roodman, 2009**).**

The instruments here depend on the assumptions that whether the variables in the model are endogenous, predetermined or exogenous. Hence, variables including lagged growth, sectoral aid[20], ICRG index, *log* of initial income, trade openness, life expectancy, *log* of inflation, *log* of broad money, government expenditure (%GDP), *log* of population and interest rate differential are assumed to be endogenous variables and use their lagged values based on GMM type instruments. The main reason for treating these variables as endogenous is that each of the variables can be determined by the growth of per capita income. For example, the classical theory of population growth, primarily associated with Malthus, states that an increase in per capita income (particularly among poor individuals) tend to increase birth rates and significantly reduce death rates (Coale and Hoover, 2015). This implies that the growth of population is endogenously associated with economic growth. Similarly, the level of government expenditure and economic growth of a country are endogenously related. Because when economic growth of a country increases, the level of public expenditure will also increase (Devarajan et al. 1996). There is also a wealth of literature arguing that economic growth affects financial sector development. The demand for financial services might increase when the growth of a country rises over time (see Calderón and Liu, 2003). On the other hand, ethnic fractionalisation is considered as exogenous variable. Because the degree of ethnic fractionalisation of a given country doesn't depend on economic performance of the country, rather it is a natural process (see Easterly and Levine, 1990).

We conduct system-GMM estimations using Blundell-Bond procedures[21]. In Table 5 below, we report the results from system-GMM estimation technique. The lags range is set to from one to four in all specifications. We report the results of using the four lags of all the

[20] Sectoral aid indicates education aid, health aid or agriculture aid.

[21] We ran the system-GMM estimations using the xtabond2 command in Stata version 14. This command has an important feature that it increases the *chi*-square value of the Hansen over identification test compared with the previous versions (Roodman, 2009).

endogenous variables as instruments. The results are qualitatively similar when we set the lags to one, two or three[22]. We discuss the results from the system-GMM specifications by comparing them with the findings from pooled OLS regressions. In Table 5, for each model, the estimated coefficient on the lagged growth is positive, highly persistent and statistically significant at the 1% level indicating that growth in current year is heavily influenced by growth in the previous year.

[22] The results from using lag one to three are available upon request.

Table 5: The Impact of Sectoral Aid and Institutional Quality on Growth: *System-GMM (Blundell-Bond procedure)*

Variables	Education aid		Health aid		Agriculture aid		Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Lag 1 growth	0.117***	0.105***	0.097***	0.085***	0.104***	0.096***	0.059***
	(11.52)	(8.54)	(7.75)	(5.95)	(10.16)	(6.46)	(3.18)
Education aid	0.032***	0.122***					0.146***
	(2.46)	(2.01)					(3.28)
(Education aid) x ICRG		0.354***					0.004***
		(2.38)					(3.76)
Health aid			0.007***	0.019***			0.006*
			(4.33)	(4.85)			(1.74)
(Health aid) x ICRG				0.066***			0.039**
				(5.47)			(2.17)
Agriculture aid					0.004**	0.044***	0.015**
					(2.81)	(5.41)	(2.29)
(Agriculture aid) x ICRG						0.089**	0.013**
						(5.33)	(2.51)
ICRG	0.016***	0.012***	0.017***	0.013**	0.019***	0.016***	0.071*
	(3.78)	(3.20)	(5.95)	(2.85)	(6.18)	(6.23)	(1.92)
Logarithm of initial income	-0.009***	-0.012***	-0.012***	-0.016***	-0.008***	-0.014***	-0.016***
	(-3.54)	(-4.38)	(-5.29)	(-4.89)	(-2.83)	(-4.47)	(-3.63)
Trade openness	0.021***	0.023***	0.032***	0.023***	0.019***	0.025***	0.022***
	(3.731)	(3.637)	(5.372)	(3.182)	(2.91)	(3.75)	(3.08)
Life expectancy	0.002***	0.002***	0.002***	0.002***	0.003***	0.014***	0.002***
	(4.88)	(5.02)	(4.87)	(6.37)	(3.58)	(3.76)	(5.79)
Logarithm of inflation	-0.004***	-0.003***	-0.003***	-0.006***	-0.004***	-0.003***	-0.004***
	(-3.49)	(-2.52)	(-2.39)	(-4.74)	(-4.37)	(-2.44)	(-3.09)
Logarithm of M2/GDP	0.023***	0.021***	0.018***	0.012***	0.025***	0.023***	0.018***
	(7.48)	(5.18)	(6.40)	(2.47)	(6.43)	(5.66)	(5.17)
Government expenditure (%GDP)	0.089**	0.074**	0.027*	0.009*	0.001**	0.074*	-0.00011
	(2.25)	(2.31)	(1.94)	(1.80)	(2.32)	(1.76)	(-0.209)
Logarithm of population	-0.009*	-0.008*	-0.015**	-0.007*	0.003	-0.001	-0.006
	(-1.81)	(-1.76)	(-2.88)	(-1.65)	(1.53)	(-0.11)	(-1.04)
Ethnic fractionalisation	-0.003	-0.004	-0.002	-0.001	-0.006	-0.005	-0.001
	(-0.69)	(-0.13)	(-0.58)	(-0.15)	(-1.47)	(-1.10)	(-0.17)
Interest rate differential	-0.002	0.001	0.001	-0.003	0.003	0.002	0.003
	(-1.69	(0.738)	(0.287)	(-1.07)	(1.505)	(0.73)	(0.03)
Constant	-0.056	0.002	-0.036	-0.011	-0.097	-0.053	0.037
	(-0.98)	(0.037)	(-0.82)	(-0.18)	(-1.38)	(-0.77)	(0.86)
Sargan test of over identification	135.25 (0.06)	121.04 (0.26)	101.66 (0.44)	99.587 (0.11)	103.3 (0.19)	100.7 (0.27)	987.4 (0.000)
AR(2) (test for serial correlation)	1.80 (0.072)	1.69 (0.091)	1.49 (0.137)	0.95 (0.44)	1.74 (0.082)	1.60 (0.109)	1.11 (0.266)

Notes: The dependent variable is growth of per capita income. Heteroscedasticity and autocorrelation robust t-statistics are in parentheses. ***, **, and * denote significance at the 1%, 5% and 10% level respectively. GMM type variables are lag 1 growth, sectoral aid, ICRG, initial income, openness, life expectancy, inflation, broad money, gov. expenditure, population, interest rate differential and their lags' range is set to from one to four in all models. Following the suggestions of Roodman (2009b), the standard type instrumental variables are ethnic fractionalisation and time dummies. Time dummies which are not reported in the table are included in our regressions to eliminating cross-sectional dependence following Sarafidis et al. (2009). Sargan test is a test of over identification restrictions, and p-values for this test are shown in parentheses. AR (2) is test for autocorrelation, and p-values are provided in parenthesis. We include 2,172 observations and 74 countries in all models.

Consistent with our findings in Table 3, specification 1 and 2 of Table 5 report that education aid has the highest positive and significant effect on growth than health and agriculture aid. For example, specification 1 of Table 5 shows that a one percentage point increase in education aid contributes 0.032 percentage point in growth. This effect is significantly augmented when education aid is interacted with ICRG index (0.354, *t-stat* 2.38) as shown in specification 2. In all models, the estimated coefficients on sectoral aid are highly improved when sectoral aid is interacted with ICRG index.

In Table 6 below, we report the results from system-GMM estimations to identify the efficient region in connection with using sectoral aid. These findings are consistent with the results provided in Table 4. As depicted in Table 6 below South American countries are more efficient in terms of using education aid (see specifications 1, 7 and13) and agriculture aid (see specifications 5, 11 and17) than African and Asian countries. Likewise, the joint effects of education aid and agriculture aid with ICRG index are higher in South America. On other hand, Asian countries are more efficient in terms of using health aid (0.205, *t-stat* 1.96) than Africa (0.004, *t-stat* 2.29) and South America (0.058, *t-stat* 2.00). The joint effect of health aid and ICRG is also higher in Asia as reported in specification 4, 10, 16.

Overall, our findings show that the effect of sectoral aid on growth is significantly augmented when it is interacted with institutional quality. In South America the joint effect of sectoral aid, particularly education and agriculture aid, with ICRG index is higher compared with Africa and Asia. These effects are mainly attributed to the higher mean value of ICRG index (see Table 2). In South America, in the last decades, many economic, social and political policy reforms have been conducted, which in turn potentially enhance the effectiveness of sectoral aid, and thereby economic growth. Campos and Nugent (1999) find that South American countries show higher rankings in terms of many institutional characteristics, such as rule of law, executive accountability and bureaucratic efficiency relative to East Asian countries. More specifically, in South America, three important policy reforms have performed in education sector: (1) those which attempt to improve student educational outcomes by changing teacher and school characteristics, (2) those that change the incentives for students and parents, and (3) those that enhance financial management in educational sector. Brown and Hunter (2004) show that South American countries have higher degree of democracy, their governments allocate a greater share of resources to primary education which is most important for human capital formation in developing countries[23].

[23] The level of democracy is implicitly included in the ICRG index calculation

Similarly, in South America, various agricultural policy reforms have been carried out since 1990. For example, the concept of agroecology-based agricultural production gain increasing attention. This approach involves the expansion of integrated agro-ecological science and technology among the agrarian societies and public institutions. It also enhances food security while conserving natural resources, and empowering the agrarian societies. In addition, many universities have incorporated agroecology into their programs; and state and federal organizations provide large amount of resources to support research and development activities in the agricultural sector. As a result, this agricultural policy reform has induced agricultural productivity, agro-exports, self-reliance of farmers, conservation and renewal of agricultural resources, production of healthy foods with low costs, and total agricultural production (see Altieri and Toledo, 2011). By and large, substantial institutional reformations in many of the South American countries could potentially encourage them to attain higher level of sectoral aid effectiveness compared with other regions. The success of these policy reforms is manifested by the larger estimated coefficients of the interaction of education aid and agriculture aid with ICRG index.

Moreover, in the last decades, most of the Asian countries paid more attention to health sector through reforming health sector policies and strategies to achieve efficiency, improve the quality of health services and to generate new resources for basic and general health care services (WHO, 2014). In addition, an increasing health expenditure as a percentage of GDP leads to lowest proportion of maternal and child morality compared with Africa and South America (Alkema et al. 2016). Further, the *Declaration of Alma Ata* in 1978 encourages governments of Asian countries to spend large amount of capital on the development and provision of primary health care services for all individuals in which most of the countries are becoming more successful in attaining the stated goals than other regions (Lawn et al. 2008)[24]. These improvements in sector are witnessed by the higher joint effect of health aid and ICRG index in Asia than Africa and South America.

On the other hand, the joint effect of sectoral aid and ICRG index is lowest in Africa compared with Asia and South America. This would be mainly emanated from the lower degree of institutional quality as it is shown in Table 2. In our data set, most of the African countries are trapped by absolute deterioration of institutional quality for many years as it is shown by a

[24] It is a conference that urges the development and implementation of effective national and international policies and strategies to enhance primary health care services throughout the world and particularly in developing countries in a spirit of technical cooperation (WHO, 2003)

very low annual percentage change in the ICRG index[25]. Furthermore, African countries are characterized by poor institutional quality, weak rule of law, an absence of accountability and high levels of corruption and poor governance. However, foreign aid comprises the highest proportion of government budgets of African countries (Knack, 2004). Despite the fact that these countries receive large amount of aid, Thorbecke (2013) shows that Africa is the only region in the developing world where the proportion of poor has not declined between 1981 and 2005 and where the absolute number of poor almost doubled over time. This implies that providing large amount foreign aid by itself is not the best solution to tackle poverty, and thereby increase economic growth. Hence, it is better that international aid organisations set conditions that initiate reforms in economic, financial and political environments before they deliver aid to African countries. We provide suggestive evidence that strengthen this argument that, in all regions, the individual effect of sectoral aid is significantly augmented when it is interacted with the measure of institutional quality (see Table 6).

Thus, our findings reveal that making sectoral aid more systematically conditional on institutional quality would significantly promote its effect on economic growth of the recipient countries. This relationship would be true as long as "conditional sectoral aid" contributes positively to the growth of developing countries in a regular basis. However, this positive effect decreases (even disappears) if the level of institutional quality declines in the recipient countries. For example, in Table 7 below shows that the derivative of growth with respect of each sectoral aid decreases as the level of ICRG index tends to decline.

In Table 7 below, the marginal effect of sectoral aid at different levels of institutional quality. In all regions, the marginal effect is significantly increasing when the level of ICRG rises. These results are consistent with the findings of Burnside and Dollar (2000); Collier and Dollar (2002) which show that aggregated form of foreign aid has positive and significant effect on growth when it is interacted with good policy environments.

[25] We calculate the annual percentage change of ICRG index for all countries in which all of the African countries, except Cape Verde, South Africa and Ghana, have less than 0.05 annual percentage change of ICRG index.

Table 6: Impact of Sectoral Aid and Institutional Quality on Growth in Africa, Asia and South America: *System-GMM (Blundell-Bond procedure)*

	Africa						Asia						South America					
Variables	Education aid		Health aid		Agri. aid		Education aid		Health aid		Agri. aid		Education aid		Health aid		Agri. aid	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Lag 1 growth	0.129	0.063	0.078	0.052	0.122	0.086	0.164	0.109	0.234	0.023	0.147	0.123	0.121	0.122	0.120	0.103	0.113	0.110
	(3.85)	(1.95)	(3.06)	(2.77)	(5.22)	(1.93)	(1.88)	(1.86)	(1.95)	(2.21)	(1.95)	(2.01)	(2.14)	(2.14)	(2.03)	(2.00)	(2.12)	(2.22)
Education aid	0.014	0.078					0.169	0.171					0.519	0.277				
	(2.15)	(2.06)					(1.81)	(2.15)					(2.05)	(1.93)				
(Education aid) x ICRG		0.104						0.390						0.823				
		(2.28)						(2.20)						(2.02)				
Health aid			0.004	0.011					0.205	0.121					0.058	0.049		
			(2.29)	(2.35)					(1.96)	(1.91)					(2.00)	(2.20)		
(Health aid) x ICRG				0.036						0.373						0.088		
				(1.89)						(2.08)						(2.57)		
Agriculture aid					0.009	0.012					0.012	0.023					0.055	0.041
					(2.35)	(1.87)					(2.56)	(1.97)					(2.00)	(2.05)
(Agriculture aid) x ICRG						0.006						0.055						0.072
						(3.76)						(1.83)						(2.8)
ICRG	0.013	0.042	0.033	0.035	0.033(8	0.003	0.119	0.147	0.129	0.111	0.108	0.126	0.212	0.202	0.203	0.212	0.112	0.112
	(5.96)	(5.79)	(7.28)	(4.94)	.45)	(5.32)	(3.19)	(3.15)	(3.44)	(2.04)	(2.23)	(0.43)	(4.78)	(4.41)	(5.01)	(4.33)	(4.80)	(2.89)
Log of initial income	-0.024	-0.021	-0.02	-0.02	-0.03	-0.02	-0.12	-0.08	-0.01	-0.01	-0.07	-0.07	-0.08	-0.06	-0.01	-0.09	-0.09	-0.01
	(-5.81)	(-4.33)	(-6.8)	(-4.1)	(-6.3)	(3.3)	(-1.8)	(-2.4)	(-1.8)	(-1.9)	(-2.4)	(-2.5)	(-1.8)	(-1.9)	(-2.3)	(-1.9)	(-2.1)	(-2.2)
Trade openness	0.004	0.0043	0.005	0.055	0.037	0.039	0.002	0.013	0.001	0.001	0.001	0.003	-0.01	-0.03	-0.04	-0.09	-0.08	-0.05
	(7.21)	(4.94)	(5.69)	(5.26)	(6.84)	(8.9)	(0.03)	(0.51)	(1.90)	(1.55)	(1.50)	(0.26)	(-0.3)	(-0.3)	(-0.3)	(-0.8)	(-0.6)	(-0.4)
Life expectancy	0.0008	0.0006	0.002	0.002	0.064	0.009	-0.01	-0.01	0.004	0.006	0.003	0.002	0.001	0.023	0.005	-0.07	0.001	0.001
	(1.78)	(1.72)	(2.44)	(2.38)	(2.17)	(1.72)	(-1.5)	(-0.2)	(0.94)	(0.82)	(0.60)	(0.28)	(0.60)	(0.37)	(0.24)	(-0.1)	(0.79)	(1.46)
Log of inflation	-0.037	-0.026	-0.03	-0.02	-0.01	-0.01	-0.08	-0.09	-0.03	-0.02	-0.01	0.006	-0.01	-0.01	0.012	0.003	0.004	0.003
	(-2.42)	(2.103)	(-1.7)	(-1.7)	(-1.9)	(-1.8)	(-1.1)	(-0.8)	(-0.4)	(-1.0)	(-0.3)	(0.16)	(-1.7)	(-1.6)	(0.09)	(0.02)	(0.29)	(2.11)
Log of M2/GDP	-0.014	-0.009	-0.04	-0.01	-0.01	-0.01	0.13	0.12	0.01	0.061	0.067	0.001	0.002	0.002	0.006	0.041	0.011	0.001
	(-2.63)	(-1.11)	(-0.7)	(-0.7)	(-1.1)	(-1.9)	(1.1)	(1.4)	(0.6)	(0.39)	(0.53)	(0.44)	(0.83)	(1.71)	(0.36)	(0.01)	(0.64)	(0.03)
Gov. expenditure (%GDP)	0.002	0.001	0.001	0.001	0.001	0.001	0.085	0.003	0.004	0.006	0.001	0.006	0.001	0.001	0.001	0.001	0.001	0.041
	(3.68)	(1.92)	(1.65)	(1.09)	(2.7)	(3.14)	(0.24)	(0.64)	(0.64)	(0.73)	(0.17)	(0.27)	(0.94)	(1.01)	(1.05)	(1.21)	(1.05)	(0.87)
Log of population	-0.013	0.009	0.009	0.008	-0.02	0.009	-5.72	-0.23	-0.05	-0.11	-0.06	0.040	0.001	0.003	-0.08	-0.05	0.067	0.003
	(-1.89)	(1.09)	(1.12)	(0.72)	(-2.9)	(1.06)	(-1.4)	(-2.4)	(-0.4)	(-1.8)	(-0.6)	(0.08)	(0.42)	(1.04)	(-0.1)	(-0.2)	(0.25)	(1.07)
Ethnic fractionalisation	-0.011	0.012	-0.09	0.010	0.002	0.004	0.29	-0.04	1.797	1.743	1.078	1.827	-0.03	-0.08	-0.05	-0.05	-0.04	0.021
	(-2.20)	(1.47)	(-1.8)	(1.38)	(0.58)	(0.87)	(1.42)	(-1.8)	(1.22)	(1.10)	(0.90)	(0.76)	(-2.0)	(-2.1)	(-2.0)	(-1.4)	(-0.3)	(0.18)
Interest rate differential	-0.005	-0.003	-0.03	-0.02	-0.06	-0.09	0.001	-0.01	-0.04	-0.03	-0.03	-0.03	0.003	0.001	0.005	0.001	0.004	-0.05
	(-1.96)	(-0.81)	(-1.6)	(-1.1)	(-2.9)	(-4.3)	(1.56)	(-0.0)	(-2.9)	(-2.9)	(-3.2)	(-1.9)	(0.29)	(0.08)	(0.46)	(0.97)	(0.36)	(-0.5)
Sargan test of over identification	96.3	90.2	90.1	90.5	(93.6)	94.61	59.5	58.5	51.5	58.5	59.5	50.5	(61.1)	(65)	(64.1)	(67.2)	(68.6)	(72.1)
	0.13	(0.19)	(0.31)	(0.11)	0.417	(0.16)	(0.20)	(0.29)	(0.29)	(0.29)	(0.23)	(0.23)	0.161	0.168	0.144	0.126	0.168	0.210
AR(2) (test for autocorrelation)	1.84	1.36	1.46	1.28	2.20	1.91	1.51	1.64	1.80		1.38	1.09	2.10	2.13	2.21	2.41	2.52	2.61
	(0.07)	0.580	(0.15)	(0.21)	(0.28)	(0.06)	(0.13)	(0.10)	(0.42)		(0.17)	(0.28)	(0.41)	(0.51)	(0.36)	(0.35)	(0.22	(0.37)

Notes: The dependent variable is growth of per capita income. Heteroscedasticity and autocorrelation robust t-statistics are in parentheses. We didn't put asterisk on the top of the significant coefficients due to the paucity of space. Therefore, if *t-stat* is greater than 2.63, the coefficient is significant at the 1% level. Similarly, if the *t-stat* ranges from 1.97 to 2.63, and from 1.65 to 1.96 the coefficient is significant at the 5% and 10% level respectively. GMM type variables are lag 1 growth, sectoral aid, ICRG, initial income, openness, life expectancy, inflation, broad money, gov. expenditure, population, interest rate differential and their lags' range is set to from one to four in all models. Following the suggestions of Roodman (2009b), the standard type instrumental variables are ethnic fractionalisation and time dummies. Time dummies which are not reported in the table are included in our regressions to eliminating cross-sectional dependence following Sarafidis et al. (2009). Sargan test is a test of over identification restrictions, and p-values for this test are shown in parentheses. AR (2) is test for autocorrelation, and p-values are provided in parenthesis. We include 1,317observations and 45 countries in Africa, 559 observations and 19 countries in Asia, and 296 observations and 10 countries in our models. We also ran full sample regressions in each region, and the results are available upon request.

Table 7: The Marginal effect of sectoral aid at different level of institutional quality: *System-GMM*

ICRG index		Full sample		
Percentile	Percentile value	Education Aid	Health Aid	Agriculture aid
0.001	8.68	3.195	0.592	0.817
10	29.74	10.651	1.982	2.691
40	39.28	14.029	2.612	3.540
80	46.86	16.711	3.112	4.215
		Africa		
1	19.152	2.070	0.701	0.127
20	33.294	3.541	1.210	0.212
60	41.561	4.401	1.507	0.264
		Asia		
30	36.829	14.534	13.858	2.049
59	44.291	17.444	16.642	2.459
96	51.008	20.064	19.147	2.829
		South America		
45	43.811	36.333	3.904	3.196
75	46.972	38.935	4.183	3.423
90	49.621	41.115	4.416	3.614

Notes: We arbitrarily chose the level of percentile, and obtain the approximated percentile values of ICRG index. We then calculate the derivate of growth with respect to each sectoral aid (or *Equation 2*) for the full sample and each region. Further, we conduct *t*-test to check whether there is a significant difference between the marginal values derived from different levels of ICRG. The t-test shows that the difference is significant at 1% level.

3.7.2. Robustness check

We conduct robustness checks to our findings from system-GMM regressions by using alternative dependent variable. We use the growth of labour productivity as an alternative outcome variable. Because higher labour productivity and economic growth may potentially indicate that a given economy is performing better than others. For example, if labour productivity increases, there will be a continuous improvement in per capita GDP. Hence, economic growth and labour productivity have strong correlation as evidenced by numerous theoretical and empirical studies (e. g., Korkmaz and Korkmaz, 2017, Auzina, 2014, Alani, 2012). Thus, labour productivity is calculated as the ratio of real GDP to employment. The data for this variable is obtained from *The Conference Board Total Economy Database*™[26]. The main reason to replace the growth of per capita income by the growth of labour productivity drawn from the Conference Board is to check whether our results are robust to an alternative measure of overall economic performance[27]. In Table 8 below, we report the individual and joint effect of sectoral aid and ICRG index on growth of labour productivity. Results from specifications 1-7 show that the individual and joint effect of sectoral aid and ICRG index are positive and highly statistically significant. Specifications 1, 3, 5 show that the estimated coefficient on education aid is larger than the estimated coefficients on health and agriculture aid. Similarly, specifications 2, 4 and 6 show that the joint effect of education aid and ICRG index (0.191, *t-stat* 0.023) higher than the joint effect of health aid and ICRG index (0.085, *t-stat* 3.68) and agriculture aid and ICRG index (0.053, *t-stat* 2.88).

In Table 9 below, we present the individual and joint effect sectoral aid and ICRG index on labour productivity in Africa, Asia and South America. Specifications 1-18 show that the estimated coefficients on the individual and interaction of sectoral aid with ICRG index are positive and significant in these regions. However, the individual effect of education aid and agriculture aid and their interaction with ICRG index is higher in South America.

[26] The Conference Board Total Economy Database measures labour productivity in two ways: (1) GDP per person employed, and (2) GDP per hour worked. We use the growth of GDP per person employed due to the fact that it has data for an extended period of time. Further information about the data is online at:https://www.conference-board.org/data/economydatabase/index.cfm?id=27762

[27] Well (2007) and Arora (2001) examine the effect of health on labour productivity as a measure of economic performance.

Table 8: Impact of Sectoral Aid and Institutional Quality on Labour Productivity: System-GMM (Blundell-Bond procedure)

Variables	Education aid		Health aid		Agriculture aid		Full sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Lag 1 growth	0.210***	0.130***	0.142***	0.125***	0.108***	0.149***	0.183***
	(8.24)	(6.23)	(8.45)	(3.87)	(8.25)	(4.88)	(5.24)
Education aid	0.095***	0.053***					0.137***
	(3.66)	(1.98)					(3.36)
(Education aid) x ICRG		0.191***					0.004***
		(3.22)					(3.64)
Health aid			0.016***	0.021***			0.009*
			(6.51)	(1.75)			(1.897)
(Health aid) x ICRG				0.085***			0.005*
				(3.68)			(1.77)
Agriculture aid					0.013**	0.018**	0.021**
					(2.84)	(2.16)	(2.086)
(Agriculture aid) x ICRG						0.053**	0.047**
						(2.88)	(2.11)
ICRG	0.001***	0.003**	0.027**	0.001**	0.001**	0.005**	0.043***
	(3.87)	(2.31)	(2.71)	(2.54)	(2.21)	(2.19)	(2.925)
Logarithm of initial income	-0.016***	-0.014***	-0.015***	-0.012***	-0.017***	-0.018***	-0.006
	(-9.43)	(-10.21)	(-9.54)	(-9.03)	(-3.94)	(-3.54)	(-1.18)
Trade openness	0.002***	0.018***	0.016***	0.002***	0.002**	0.017**	0.029***
	(6.68)	(6.95)	(5.63)	(4.38)	(2.19)	(2.01)	(3.91)
Life expectancy	0.001***	0.001***	0.001***	0.001***	0.001**	0.001**	0.002***
	(3.27)	(2.83)	(4.17)	(3.25)	(2.38)	(2.07)	(3.26)
Logarithm of inflation	-0.002***	-0.003***	-0.003**	-0.002*	-0.002	-0.003	-0.003**
	(-3.18)	(-2.69)	(-2.59)	(-1.99)	(-0.70)	(-1.11)	(-2.11)
Logarithm of M2/GDP	0.002***	0.002***	0.002***	0.001	0.002	0.013	-0.017***
	(3.32)	(3.90)	(2.93)	(1.46)	(0.71)	(0.55)	(-2.92)
Government expenditure (%GDP)	-0.014	-0.011	-0.007	-0.001	-0.001	-0.027	0.001
	(-1.45)	(-0.89)	(-0.66)	(-0.00)	(-0.63)	(-0.52)	(1.323)
Logarithm of population	0.006***	0.003	0.006**	0.009**	0.003	0.004	-0.003
	(4.74)	(1.54)	(2.63)	(2.30)	(0.50)	(0.82)	(-0.39)
Ethnic fractionalisation	-0.005**	-0.008***	-0.004	-0.004	-0.001	0.004	0.002
	(-2.24)	(-2.74)	(-0.99)	(-1.28)	(-0.05)	(0.39)	(0.74)
Interest rate differential	0.004**	0.005***	0.005***	0.003*	0.006	0.003	-0.002
	(2.10)	(4.19)	(3.12)	(1.92)	(1.26)	(0.60)	(-1.09)
Sargan test of over identification	122.02 (0.09)	120 (0.123)	118 (0.102)	102 (0.108)	104 (0.114)	134 (0.305)	98.2 (0.14)
AR(2) (test for serial correlation)	1.6 (0.473)	1.24(0.471)	0.98(0.479)	0.87(0.46)	1.65 (0.273)	1.54 (0.117)	1.52 (0.128)

Notes: The dependent variable is growth of labour productivity. Heteroscedasticity and autocorrelation robust t-statistics are in parentheses. ***, **, and * denote significance at the 1%, 5% and 10% level respectively. GMM type variables are lag 1 growth, sectoral aid, ICRG, initial income, openness, life expectancy, inflation, broad money, gov. expenditure, population, interest rate differential and their lags' range is set to from one to four in all models. Following the suggestions of Roodman (2009b), the standard type instrumental variables are ethnic fractionalisation and time dummies. Time dummies which are not reported in the table are included in our regressions to eliminating cross-sectional dependence following Sarafidis et al. (2009). Sargan test is a test of over identification restrictions, and p-values for this test are shown in parentheses. AR (2) is test for autocorrelation, and p-values are provided in parenthesis. We include 2,172 observations and 74 countries in all models.

Table 9: Impact of Sectoral Aid and Institutional Quality on Labour Productivity in Three Regions: *System-GMM (Blundell-Bond procedure)*

	Africa						Asia						South America					
Variables	Education aid		Health aid		Agriculture aid		Education aid		Health aid		Agriculture aid		Education aid		Health aid		Agriculture aid	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Lag 1 growth	0.133 (5.11)	0.124 (4.95)	0.147 (5.01)	0.151 (5.27)	0.140 (5.20)	0.126 (5.93)	0.134 (5.87)	0.101 (5.46)	0.155 (5.65)	0.113 (5.23)	0.137 (5.44)	0.123 (5.31)	0.182 (4.14)	0.120 (5.49)	0.119 (5.89)	0.144 (5.40)	0.152 (5.07)	0.157 (4.89)
Education aid	0.024 (1.85)	0.015 (1.91)					0.076 (1.96)	0.018 (2.12)					0.115 (1.80)	0.045 (1.84)				
(Education aid) x ICRG		0.053 (1.84)						0.113 (2.08)						0.138 (1.82)				
Health aid			0.005 (2.20)	0.015 (2.20)					0.039 (1.74)	0.019 (0.82)					0.051 (1.81)	0.031 (0.88)		
(Health aid) x ICRG				0.029 (1.81)						0.061 (2.35)						0.094 (1.91)		
Agriculture aid					0.002 (1.91)	0.008 (1.74)					0.021 (1.75)	0.013 (1.81)					0.04 (2.32)	0.018 (2.41)
(Agriculture aid) x ICRG						0.016 (4.56)						0.038 (1.83)						0.055 (2.94)
ICRG index	0.003 (1.87)	0.013 (1.88)	0.031 (2.05)	0.022 (2.47)	0.009 (2.19)	0.027 (1.73)	0.018 (2.35)	0.017 (2.09)	0.012 (2.59)	0.011 (2.45)	0.016 (2.37)	0.012 (1.73)	0.027 (1.91)	0.021 (2.13)	0.023 (1.73)	0.042 (1.98)	0.025 (2.62)	0.025 (2.20)
Sargan test of over identification	102 (0.12)	95.23 (0.54)	96.11 (0.13)	90.3 (0.44)	97.21 (0.42)	92.10 (0.53)	120 (0.74)	122.1 (0.69)	114 (0.19)	117.6 (0.12)	115.2 (0.126)	114.3 (0.15)	116.9 (0.12)	117.4 (0.16)	123.3 (0.15)	120.3 (0.14)	122.9 (0.13)	124 (0.15)
AR(2) (test for autocorrelation)	0.93 (0.21)	1.02 (0.511)	1.03 (0.54)	0.95 (0.56)	0.93 (0.55)	0.81 (0.38)	0.86 (0.04)	0.74 (0.09)	0.73 (0.61)	0.71 (0.68)	0.69 (0.47)	0.82 (0.86)	1.23 (0.14)	1.02 (0.94)	1.04 (0.81)	1.25 (0.79)	1.96 (0.92)	1.93 (0.76)

Notes: The dependent variable is growth of labour productivity. Heteroscedasticity and autocorrelation robust t-statistics are in parentheses. We didn't put asterisk on the top of the significant coefficients due to the paucity of space. Therefore, if t-stat is greater than 2.63, the coefficient is significant at the 1% level. Similarly, if the t-stat ranges from 1.97 to 2.63, and from 1.65 to 1.96 the coefficient is significant at the 5% and 10% level respectively. GMM type variables are lag 1 growth, sectoral aid, ICRG, initial income, openness, life expectancy, inflation, broad money, gov. expenditure, population, interest rate differential and their lags' range is set to from one to four in all models. Following the suggestions of Roodman (2009b), the standard type instrumental variables are ethnic fractionalisation and time dummies. Time dummies which are not reported in the table are included in our regressions to eliminating cross-sectional dependence following Sarafidis et al. (2009). Sargan test is a test of over identification restrictions, and p-values for this test are shown in parentheses. AR (2) is test for autocorrelation, and p-values are provided in parenthesis. We include 1,317observations and 45 countries in Africa, 559 observations and 19 countries in Asia, and 296 observations and 10 countries in our models. The estimated coefficients of the control variables are not reported in the table because their values don't show significant deviations from the values reported in Table 6 (the values are available upon request). We also ran full sample regressions in each region, and the results are available upon request.

We also check the robustness of our results from the system-GMM by excluding countries which have the highest per capita income growth from our full sample following Burnside and Dollar (2002)[28]. This is to check whether these outliers lead to over-estimate or under-estimate of the individual and joint effects of sectoral aid and ICRG index on growth in the range where most of our observations are located. Table 10 reports the effect of sectoral aid and the measure of institutional quality on growth after excluding the outliers. Our results are qualitatively similar with the findings reported in Table 5 that the estimated coefficients of the individual and interaction of education aid and ICRG index are larger than that of health and agriculture aid. Specifications 1 shows a one percentage point increase in education aid contributes 0.019 percentage point increase in growth of per capita income which is statistically significant at the 1% level. The effect of education aid is further augmented when it is interacted with the ICRG index as the estimated coefficient has increased to 0.332 which is also statistically significant at the 5% level (see specification 2).

In Table 11 below, we report the individual and joint effects of sectoral aid and ICRG index in Africa, Asia and South America after excluding the outliers. Our findings are qualitatively similar with those results provided in Table 6. In South America, the individual and joint effects of education and agriculture aid are larger than Africa and Asia (see specifications 13-16). Specifications 11 and 12 show that the effect of health aid and its interaction with ICRG index is larger in Asia. Results reported in Table 10 and 11 imply that our findings are not biased due to the outliers.

[28] The list of excluded countries is provided in Appendix 3

Table 10: Impact of Sectoral Aid and Institutional Quality on Growth: *System-GMM (Blundell-Bond procedure)*

Variables	Education aid		Health aid		Agriculture aid		Full Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Lag 1 growth	0.109***	0.103***	0.197***	0.115***	0.132***	0.136***	0.107***
	(11.52)	(8.54)	(7.75)	(5.95)	(10.16)	(6.46)	(3.18)
Education aid	0.019***	0.048***					0.159**
	(4.25)	(4.61)					(2.098)
(Education aid) x ICRG		0.332**					0.004**
		(2.37)					(2.23)
Health aid			0.009**	0.002***			0.006*
			(2.52)	(3.29)			(1.74)
(Health aid) x ICRG				0.059**			0.005*
				(2.35)			(1.73)
Agriculture aid					0.001**	0.003**	0.069**
					(2.36)	(2.44)	(2.07)
(Agriculture aid) x ICRG						0.028***	0.002*
						(2.84)	(1.76)
ICRG	0.001***	0.087***	0.097***	0.065***	0.069***	0.066***	0.007***
	(8.02)	(6.20)	(8.90)	(4.14)	(5.19)	(5.71)	(3.28)
Logarithm of initial income	-0.017***	-0.016***	-0.016***	-0.014***	-0.017***	-0.021***	-0.018***
	(-6.73)	(-7.44)	(-8.77)	(-5.14)	(-6.99)	(-7.60)	(-3.777)
Trade openness	0.002***	0.003***	0.002***	0.022***	0.002***	0.002**	0.001
	(2.87)	(3.36)	(3.45)	(4.10)	(2.97)	(2.61)	(0.024)
Life expectancy	0.002***	0.002***	0.002***	0.001**	0.001*	0.002***	0.002***
	(3.49)	(3.72)	(3.66)	(2.61)	(1.84)	(4.08)	(3.493)
Logarithm of inflation	0.006	0.004	0.002	-0.001	-0.002	-0.004	-0.004***
	(0.33)	(0.25)	(1.39)	(-0.77)	(-0.98)	(-2.85)**	(-3.35)
Logarithm of M2/GDP	-0.002***	-0.002***	-0.002***	0.016*	0.003***	0.002**	0.004
	(-3.03)	(-4.10)	(-5.69)	(1.93)	(3.92)	(2.36)	(0.169)
Government expenditure (%GDP)	0.013	0.018	0.019	0.003	0.001	0.001	0.00050
	(0.74)	(0.98)	(1.41)	(7.85)***	(5.00)***	(2.04)**	(0.478)
Logarithm of population	0.016***	0.014***	0.013***	0.013***	0.008**	0.006**	0.005
	(4.23)	(3.37)	(2.97)	(2.94)	(2.51)	(2.04)	(0.467)
Ethnic fractionalisation	-0.016**	-0.014*	0.006	-0.00026	-0.005	0.001	0.001
	(-2.10)	(-1.65)	(1.19)	(-0.03)	(-0.83)	(0.12)	(0.124)
Interest rate differential	-0.001***	-0.001***	-0.001***	-0.001**	-0.001**	-0.002*	-0.001
	(-5.00)	(-5.45)	(-5.23)	(-2.31)	(-2.36)	(-1.75)	(-0.432)
Sargan test of over identification	92.45 (0.081)	90.23	92.10	89.23	87.56	89.23	100.49
		(0.085)	(0.085)	(0.140)	(0.085)	(0.382)	(0.57)
AR(2) (test for serial correlation)	1.59	1.55	1.63	1.72	1.67	1.85	1.91
	(0.384)	(0.437)	(0.449)	(0.532)	(0.416)	(0.536)	(0.501)

Notes: The dependent variable is growth of per capita income. Heteroscedasticity and autocorrelation robust t-statistics are in parentheses. ***, **, and * denote significance at the 1%, 5% and 10% level respectively. GMM type variables are lag 1 growth, sectoral aid, ICRG, initial income, openness, life expectancy, inflation, broad money, gov. expenditure, population, interest rate differential and their lags' range is set to from one to four in all models. Following the suggestions of Roodman (2009b), the standard type instrumental variables are ethnic fractionalisation and time dummies. Time dummies which are not reported in the table are included in our regressions to eliminating cross-sectional dependence following Sarafidis et al. (2009). Sargan test is a test of over identification restrictions, and p-values for this test are shown in parentheses. AR (2) is test for autocorrelation, and p-values are provided in parenthesis. We include 2,053 observations and 70 countries in all models.

Table 11: Impact of Sectoral Aid on Growth in Africa, Asia and South America: *System-GMM (Blundell-Bond procedure)*

	Africa						Asia						South America					
Variables	Education aid		Health aid		Agri. aid		Education aid		Health aid		Agri. aid		Education aid		Health aid		Agri. aid	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Lag 1 growth	0.113	0.120	0.147	0.151	0.142	0.126	0.137	0.101	0.195	0.103	0.127	0.123	0.110	0.120	0.193	0.114	0.143	0.177
	(6.00)	(6.15)	(6.01)	(6.27)	(6.20)	(6.93)	(6.84)	(6.13)	(6.05)	(6.20)	(6.73)	(6.71)	(6.10)	(6.49)	(6.87)	(6.41)	(6.07)	(6.40)
Education aid	0.221	0.015					0.432	0.033					0.509	0.139				
	(2.14)	(1.97)					(0.03)	(0.13)					(1.01)	(1.44)				
(Education aid) x ICRG		0.316						0.531						0.704				
		(3.48)						(1.79)						(1.91)				
Health aid			0.026	0.007					0.036	0.017					0.076	0.026		
			(3.33)	(3.9)					(2.48)	(1.98)					(0.48)	(0.79)		
(Health aid) x ICRG				0.039						0.301						0.412		
				(3.93)						(1.99)						(1.79)		
Agriculture aid					0.005	0.009					0.018	0.013					0.027	0.021
					(1.67)	(1.73)					(1.71)	(2.10)					(2.26)	(2.51)
(Agriculture aid) x ICRG						0.014						0.104						0.306
						(2.56)						(1.78)						(2.81)
ICRG	0.024	0.007	0.039	0.011	0.062	0.003	0.228	0.004	0.008	0.026	0.007	0.019	0.002	0.091	0.032	0.038	0.032	0.041
	(3.67)	(3.20)	(3.23)	(3.35)	(3.45)	(3.07)	(3.89)	(3.12)	(2.04)	(2.09)	(2.69)	(2.87)	(4.53)	(4.84)	(3.78)	(3.90)	(2.80)	(2.72)
Sargan test of over identification	183.1	189.3	184.5	193	181.8	180.4	170.1	173.3	170.7	169.8	173.9	169.1	165.3	163.9	160.4	161.3	163.4	159.7
	(0.14)	(0.097)	(0.12)	(0.07)	(0.11)	(0.13)	(0.09)	(0.08)	(0.08)	(0.07)	(0.09)	(0.15	(0.14)	(0.17)	(0.11	(0.21	(0.22	(0.19)
AR(2) (test for autocorrelation)	1.23	1.21	1.39	1.30	1.24	1.10	1.24	1.34	1.20	1.45	1.85	1.72	1.42	1.25	1.69	1.45	1.74	1.82
	(0.74)	(0.58)	(0.85)	(0.58)	(0.97)	(0.52)	(0.43)	(0.38)	(0.32)	(0.30)	(0.57)	(0.31)	(0.39)	(0.73)	(0.29)	(0.15)	(0.16)	(0.31)

Notes: The dependent variable is growth of per capita income. Heteroscedasticity and autocorrelation robust t-statistics are in parentheses. We didn't put asterisk on the top of the significant coefficients due to the paucity of space. Therefore, if t-stat is greater than 2.63, the coefficient is significant at the 1% level. Similarly, if the t-stat ranges from 1.97 to 2.63, and from 1.65 to 1.96 the coefficient is significant at the 5% and 10% level respectively. GMM type variables are lag 1 growth, sectoral aid, ICRG, initial income, openness, life expectancy, inflation, broad money, gov. expenditure, population, interest rate differential and their lags' range is set to from one to four in all models. Following the suggestions of Roodman (2009b), the standard type instrumental variables are ethnic fractionalisation and time dummies. Time dummies which are not reported in the table are included in our regressions to eliminating cross-sectional dependence following Sarafidis et al. (2009). Sargan test is a test of over identification restrictions, and p-values for this test are shown in parentheses. AR (2) is test for autocorrelation, and p-values are provided in parenthesis. We include 1,258 observations and 43 countries in Africa, 499 observations and 17 countries in Asia, and 296 observations and 10 countries in our models. The estimated coefficients of the control variables are not reported in the table because their values don't show significant deviations from the values reported in Table 6 (the values are available upon request). We also ran full sample regressions in each region, and the results are available upon request.

4. Conclusion

In this paper, we address two important questions: Which sectoral aid is more effective in stimulating economic growth when it is interacted with institutional quality in developing countries? Do the individual and joint effects of sectoral aid and institutional quality vary among regions? These are probably the first questions in aid-growth nexus studies. We use a wide-ranging dataset covering 74 countries from Africa, Asia and South America, and covers the period 1960-2013. Our finds provide important understandings to policy-makers and international aid organisations in their allocation of aid to different sectors in developing countries.

Our findings from system-GMM regressions show that the magnitude of individual and joint effects of education aid with ICRG index are larger than that of health and agriculture aid. We find that these effects are higher in South America compared with Africa and Asia. This higher and positive effect of sectoral aid is mainly originated from significant improvements in policies associated with different sectors in the region. For example, in most of the South American countries, essential policy reforms which have been made to enhance resource utilisations in education sector since 1980. Further, the interaction effect of health aid with ICRG index is greater in Asia relative to Africa and South America. Next, show that these findings are robust and strongly hold after conducting various robustness checks. Our findings suggest that different types of aid have different effects on growth within and across regions. In the current context of the new modalities of aid (i.e. Sector-Wide-Approach), as evident from the Paris Declaration on Aid Effectiveness, our findings are remarkable and support the growing evidence that donors should consider "effective channels" of transferring foreign aid to developing countries. Thus, our findings are important to policy-makers and donors in their allocation of foreign aid to different sectors and regions.

Moreover, we show that the joint effect of sectoral aid with ICRG on growth is positive and significant in Africa, Asia and South America. Thus, policy-makers and aid organisations need to be careful about the quality of institutions when they provide aid to developing countries. We also show that the positive joint effect of sectoral aid with ICRG declines for countries which have higher political, financial and economic risks. This potentially elucidates that different "conditions" attached to the provision of aid need to be reinforced to improve aid effectiveness in the recipient countries. There is also an evidence that the World Bank attempts to explicitly link the provision of aid with policy reform conditions in developing countries since 1980s. The reform *inter alia* covers all areas of political, financial and economic policies,

such as inducing the degree of democracy, financial sector liberalisation, fiscal policy, trade liberalisation, privatisation of public enterprises, wage policies and financial sector liberalisation (Morrissey, 2004). The successfulness of these policy reforms has been empirically investigated by several researchers in which most of them find that aid enhances economic growth if the recipient countries have "good" policy environment (see Burnside and Dollar, 2002; Hansen and Tarp, 2001). Thus, the interaction of sectoral aid and ICRG has positive effect on growth of per capita income. All our findings have important implications for policy-makers and international aid organisations.

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Appendix 1: Correlation matrix

No.	Variables	1	2	3	4	5	6
1	Education aid	1.000					
2	(Education aid) x (ICRG)	0.815 (0.001)*	1.000				
3	Health aid	0.630 (0.015)*	0.510 (0.036)*	1.000			
4	Health aid x (ICRG)	0.550 (0.001)*	0.590 (0.042)*	0.946 (0.000)*	1.000		
5	Agriculture aid	0.730 (0.028)*	0.540 (0.008)*	0.931 (0.000)*	0.737 (0.000)*	1.000	
6	(Agriculture aid) x (ICRG)	0.612 (0.050)*	0.715 (0.024)*	0.632 (0.000)*	0.835 (0.000)*	0.897 (0.000)*	1.000

Note: * indicates the correlation is significant at 1% level of significance

Appendix 2: Description of Variables

Variable Name	Variable Description	Source
Real per capita GDP growth	Annual percentage growth rate of real per capita GDP which is measured by constant $US 2010. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.	WDI
Initial GDP	Log of per capita GDP measured based on the constant $US 2010 at the beginning of the relevant time period.	WDI
Inflation	It is measured by the consumer price index which reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.	WDI
Trade openness	It is calculated as the sum of merchandise exports and imports divided by the value of GDP which is measured by constant $US 2010.	WDI
Life expectancy	It indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life.	WDI
Financial depth	It is proxied by the broad money (M2) to real GDP which is measured based on constant $US 2010	WDI
Ethnic fractionalisation	It indicates the probability that two randomly selected individuals in a country belong to different ethnolinguistic groups.	Easterly's Web site
Government expenditure	Expense is cash payments for operating activities of the government in providing goods and services. It includes compensation of employees (such as wages and salaries), interest and subsidies, grants, social benefits, and other expenses such as rent and dividends.	WDI
Interest rate differential	It is calculated as the difference between the real interest rate of USA (using as the frontier economy) and the real interest rate of each recipient country.	WDI
Population	Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship.	PWT, version 9.1

Appendix 3: Sample of Countries

Africa		Asia	South America
Algeria	Malawi	Azerbaijan	Argentina
Angola	Mali	Bangladesh	Bolivia
Benin	Mauritania	Bhutan [e]	Brazil
Botswana [e]	Mauritius	Cambodia [e]	Chile
Burkina Faso	Morocco	India	Colombia
Burundi	Mozambique	Indonesia	Ecuador
Cameroon	Namibia	Iran	Paraguay
Cape Verde	Niger	Iraq	Peru
Central African Rep.	Nigeria	Jordan	Uruguay
Chad	Rwanda	Kyrgyz Republic	Venezuela
Cote D'Ivoire	Senegal	Malaysia	
Egypt	Seychelles	Nepal	
Equatorial Guinea [e]	Sierra Leone	Pakistan	
Ethiopia	South Africa	Philippines	
Gabon	Sudan	Sri Lanka	
Gambia	Swaziland	Syria	
Ghana	Tanzania	Thailand	
Guinea	Togo	Viet Nam	
Guinea-Bissau	Tunisia	Yemen	
Kenya	Uganda		
Lesotho	Zambia		
Liberia	Zimbabwe		
Madagascar			

[e] indicates the country is excluded for robustness check due to higher their outlier growth rate.