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Aid Proliferation and Economic Growth: A Cross-Country Analysis

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Summary. — We examine whether aid proliferation hinders economic growth by applying the standard aid-growth regression to Roodman's (2007) dataset, with proper correction for possible biases arising from omitted variable and endogeneity problems. Specifically, we include a donor-concentration index to capture a low degree of donor proliferation and its interaction terms with aid variables as additional independent variables. Our empirical results show that the effect of aid concentration on economic growth is positive and favors the hypothesis that aid proliferation has a negative effect on the economic growth of recipient countries, especially in Africa.

Key words — aid, aid proliferation, economic growth

1. INTRODUCTION

James D. Wolfensohn, the former president of the World Bank, stated that Tanzania annually files 2,400 reports to aid donors and hosts 1,000 aid missions from donor countries each year (Roodman, 2006b). [1] Under such circumstances, the efficiency of official capital inflow can be undermined significantly. This is a situation of aid proliferation or aid bombardment, where large numbers of donors and projects overwhelm the recipient government's capacity to manage and administer aid inflows. The immediate consequence of aid proliferation is an increase in the transaction costs incurred by recipient governments while absorbing foreign aid (Acharya, de Lima, & Moore, 2006). More than 20 years ago, Morss (1984) stated that "[t]he most important feature distinguishing foreign aid in the 1970s from earlier programmes was the proliferation of donors and projects." Cassen *et al.* (1994) also pointed out that "aid projects are planted here and there in an almost haphazard way and in excessive numbers, with a variety of untoward consequences" (p. 175). The issue appears to have been worsening over the past decades: on average, the number of donors acting in aid recipient countries has continued to increase during the last 30 years (Figure 1).

Recently, studies addressing the issue of aid proliferation have emerged, such as Acharya *et al.* (2006), Arimoto and Kono (2008), Easterly and Pfutze (2008), Knack and Rahman (2007), and Roodman (2006a,b). The subject is of great policy relevance these days, as donors and international agencies continue to strive for greater harmonization and coordination of practices—as per the recent Accra Declaration on Aid Effectiveness and its predecessors, the 2005 Paris and 2003 Rome Declarations. Aid proliferation induces competition for local experts or the available local matching funds for aid and thus decreases the average bureaucratic quality and effectiveness of aid projects, respectively, in aid recipient countries (Arimoto & Kono, 2008; Knack & Rahman, 2007). [2] Roodman (2006a) presents theoretical arguments regarding the proliferation of aid projects and the associated administrative burden for recipients. Largely speaking, since aid proliferation increases transaction costs, the effectiveness of aid is reduced significantly (Acharya *et al.*, 2006). However, as far as we are aware, there is no empirical study that investigates the effect of aid proliferation on the economic performance of a recipient country. This paper aims to bridge this gap by augmenting a standard cross-country growth regression approach to measuring aid effectiveness by including an aid proliferation index as an independent variable.

Our research strategy is based on the extensive existing literature, which spans over 30 years, on the aid-growth nexus (Burnside & Dollar, 2000; Clemens, 2005; Easterly, Levine, & Roodman, 2004; Rajan & Subramanian, 2008; Roodman, 2007). Burnside and Dollar (2000), the most influential work, demonstrates that foreign aid improves the income growth of a recipient country when it has a healthy policy environment. However, subsequent studies such as Hansen and Tarp (2001), Easterly *et al.* (2004), Roodman (2007), and Rajan and Subr-

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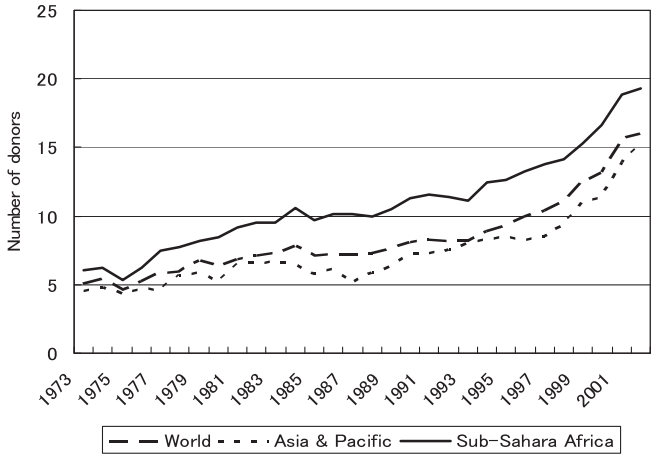


Figure 1. *Average number of bilateral DAC donors (per recipient country). Source: CRS/OECD.*

amanian (2008) find that the results of Burnside and Dollar (2000) are not robust to alternative specifications, extended data, or estimation methods.[3] An emerging consensus seems to be that, at best, there is a small positive, though insignificant, impact of aid on growth (Bourguignon & Sundberg, 2007). Yet, a common feature of these studies is their treatment of aid as being homogeneous regardless of its modality.[4] Clemens (2005), which examines the effect of short-term aid, is one of the few papers that take into account the heterogeneity of aid quality. Our study also attempts to address heterogeneity in foreign aid, distinguishing the degree of donor concentration from the amount of aid. To preview our findings using Roodman's (2007) data with proper corrections for possible endogeneity bias, our best empirical results are in favor of the hypothesis that aid proliferation has a negative effect on the economic growth of recipient countries, especially in Africa.

The remainder of the paper is organized as follows. Section 2 describes the data and variables, including the aid proliferation index, and then provides the results of the baseline estimation and robustness tests. Finally, in Section 3, we present our concluding remarks along with some policy implications.

2. DATA AND ESTIMATION RESULTS

The hypothesis to be tested in this paper is as follows: aid proliferation hinders aid effectiveness and economic growth. Before proceeding to the detailed investigations, it is necessary to clarify the definition of aid proliferation.

(a) *An aid proliferation index*

In the literature, there is no standard definition of aid proliferation. In order to quantify the degree of aid proliferation, we follow Knack and Rahman (2007) in constructing a Herfindahl Index of donor concentration[5] by summing the squared shares of aid over all donor agencies.[6] Suppose that the total amount of aid provided to a recipient country in a certain year is represented by Q and that there are N donors. The amount of aid supplied by donor i to this recipient is represented by q_i. It follows that

$$HI = \sum_{i=1}^{N} s_i^2, \tag{1}$$

where donor i's aid share is defined as $s_i \equiv q_i/Q$. Let us denote the mean and variance of donor shares by μ and σ^2, respectively. Then, we have $\mu \equiv \sum s_i/N = 1/N$ and $\sigma^2 \equiv \sum (s_i - \mu)^2/N = (HI/N) - (1/N^2)$. Therefore, the Herfindahl Index of donor concentration can be expressed by the following equation:

$$HI = N\sigma^2 + \frac{1}{N}. \tag{2}$$

If all donors have identical shares, then the variance becomes zero and HI equals $1/N$. Alternatively, if the number of donors is held constant, a higher variance will result in a higher index value. Hence, this index decreases when the aid proliferation becomes serious.

We assume that an index of aid proliferation should be considered in the context of "gross aid" because the absolute gross amount of aid inflows affects the efficient use of aid. Even small amounts of grants or concessional loans with a low grant element impose a burden on the absorptive capacity of the recipient government and may hinder the government's effectiveness. Similarly, net aid variables do not precisely depict the situation of aid proliferation. Therefore, based on the Creditor Reporting System (CRS) database of the Organization for Economic Cooperation and Development (OECD), we compute the donor Herfindahl concentration index with Eqn. (2), which acts as a proxy for aid proliferation in recipient countries.

The CRS provides detailed information on each activity funded by foreign aid from the member countries of OECD or OECD's Development Assistance Committee (DAC).[7] We use the disbursed amount, rather than the committed amount, of bilateral and multilateral foreign aid by donor and year to calculate the index for each recipient because a large part of the transaction cost associated with aid proliferation would be only incurred if committed amount is actually disbursed.[8] The computed Herfindahl Index ranges from zero to one, where a higher value indicates greater donor concentration.

(b) *Patterns of aid proliferation*

Figure 1 presents the upward trend in the average number of bilateral DAC donors per aid recipient country during the period 1973–2002. This trend may be understated because of the participation of not only bilateral DAC donors—as captured in Figure 1—but also multilateral donors, non-DAC bilateral donors such as China and the OPEC countries,[9] and numer-

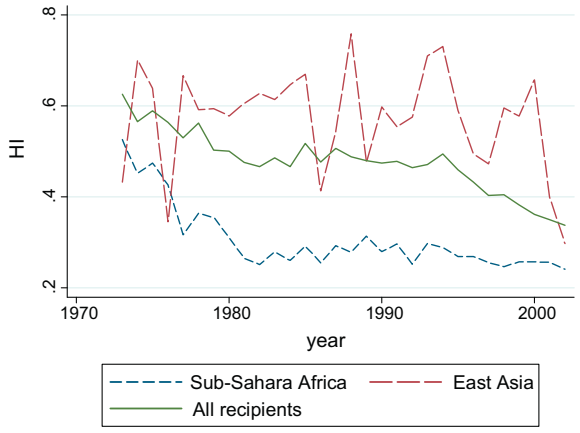
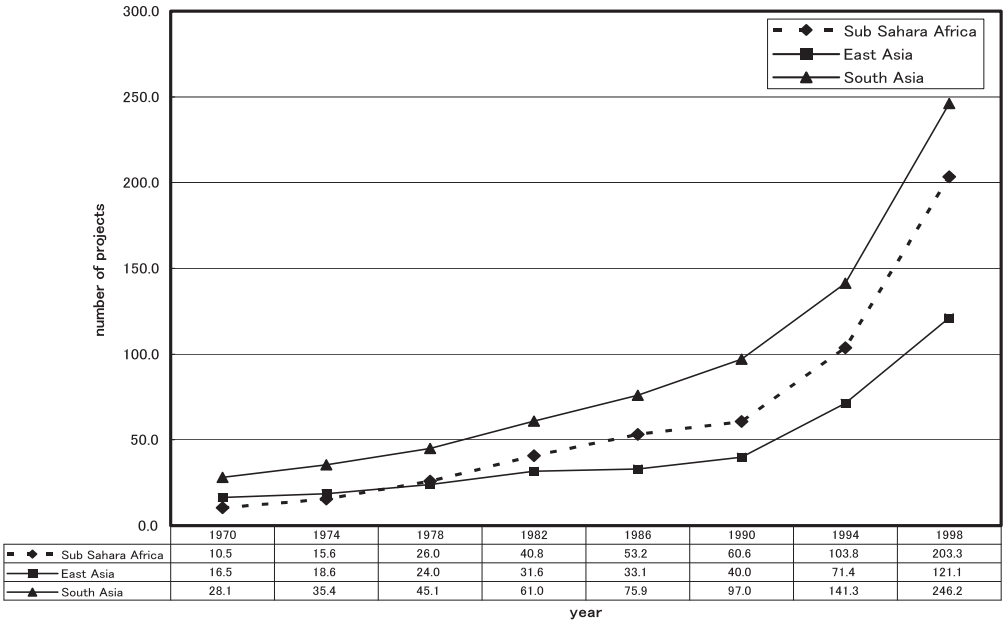


Figure 2. *Trend of Herfindahl index by recipients. Calculated by recipient countries and shown as regional averages. Source: CRS/OECD.*

ous NGOs, which facilitate the further proliferation of aid. As a consequence, for the period 1973–2002, the average Herfindahl Index has been decreasing since 1973 (Figure 2), while the average number of bilateral aid projects per recipient country has been increasing (Figure 3).

Further, it is useful to compare rapidly growing East Asian countries with the Sub-Saharan African countries, which have low economic growth rates. According to Figure 2, we can also verify that the Herfindahl Index is low and volatile in Sub-Saharan African countries, which is consistent with the fact that aid volatility and unpredictability is widespread and not improving (Bulir & Hamann, 2003, 2008) and can impede growth (Lensink & Morrissey, 2000). The average project sizes shown in Figure 4, which are calculated on the basis of total amounts of aid and number of projects, are consistently higher for the East Asia region as compared with those for the Sub-Saharan Africa region. This is especially true after the mid 1980s when regions both exhibit a downward trend as a result of heightened aid proliferation. Figures 5 and 6 illustrate the aid shares of major bilateral donors in East Asia and Sub-Saharan Africa. In East Asia, Japan appears to be the dominant donor throughout, while in Sub-Saharan Africa, aid is more or less equally shared by numerous donors. Figure 7A through 7D present the empirical cumulative distribution functions of the Herfindahl Index of East Asia and Sub-Saharan Africa by decade. We then use the two-sample Kolmogorov–Smirnov test to determine whether there are any differences in the distributions of the Herfindahl Index for the two groups. The test results reveal that there are significant differences in the Herfindahl Index between East Asia and Sub-Saharan Africa, which suggests that aid proliferation is more serious in Sub-Saharan Africa than in East Asia. These differences between East Asia and Sub-Saharan Africa suggest a positive nexus between economic growth and aid



	1970	1974	1978	1982	1986	1990	1994	1998
Sub Sahara Africa	10.5	15.6	26.0	40.8	53.2	60.6	103.8	203.3
East Asia	16.5	18.6	24.0	31.6	33.1	40.0	71.4	121.1
South Asia	28.1	35.4	45.1	61.0	75.9	97.0	141.3	246.2

Figure 3. *Average number of projects (bilateral DAC aid: per country). Note: The years shown in the table represent the starting years of 4-year averages. Source: CRS/OECD.*

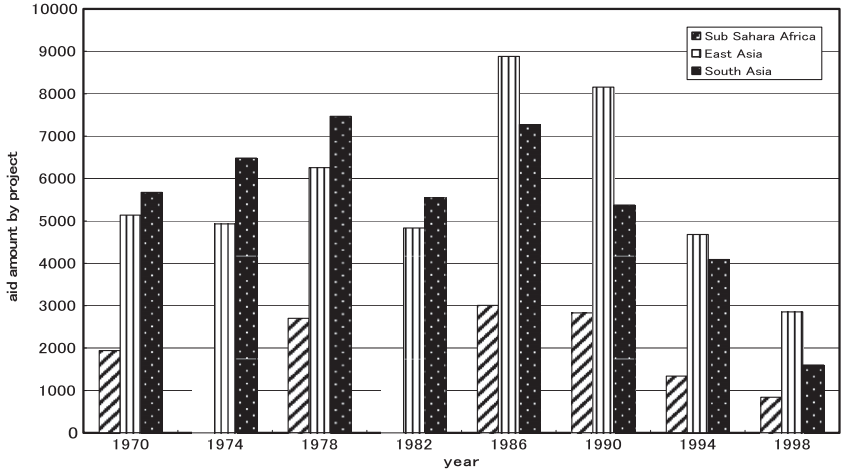


Figure 4. *Average project size (bilateral DAC aid). Note: The years shown in the table represent the starting years of 4-year averages. Source: CRS/OECD, commitment base.*

concentration or, equivalently, a negative relationship between growth and aid proliferation.

Figure 8 presents the Herfindahl Index from the perspective of donor differences, which are calculated on the basis of the number of recipients provided aid by each donor country, and the share of aid supplied to each recipient country. They appear to be on a slightly downward trend. The increase in US aid in 1991 is due to the large provision of aid that the US granted to Egypt after the Gulf War, while the increase in German aid in 1992 is due to the large provision of aid that Germany granted to Poland after the collapse of the Berlin Wall. [10] Indeed, all the donors have been providing aid to a significantly higher number of countries (Kimura *et al.*, 2007).

(c) *Empirical strategy*

Using the donor concentration index defined above, we employ the dataset of Roodman (2007), which is considered to be the most comprehensive dataset for investigations of the aid-growth nexus on the basis of cross-country regression. Roodman (2007) extends the data compiled by Burnside and Dollar (2000) and Easterly *et al.* (2004). [11] The resultant sample comprises 348 observations across 63 countries for the period 1974–2001. Among a wide variety of hypotheses tested by Burnside and Dollar (2000), Collier and Dehn (2001), Collier and Dollar (2002), Collier and Hoeffler (2002), Hansen and Tarp (2000), Hansen and Tarp (2001), Dalgaard, Hansen, and Tarp (2004), Chauvet and Guillaumont (2002), and Roodman (2007) reveals that the aid-policy nexus is proved to be the weakest while the aid-tropics link is found to be the most robust. Roodman (2007) also includes the variables of the fraction of tropical area (Tropic) and the interaction term between aid and the tropic variable (Aid $*$ Tropic), which are not included in the datasets in Burnside and Dollar (2000) and Easterly *et al.* (2004). The interaction terms between aid and the fraction of tropical area (Aid $*$ Tropic) are found to be consistently negative and statistically significant in Roodman (2007) indicating that, on average, aid works well outside the tropics but not in them. Adopting the same empirical strategies, we add the HI-related variables to Roodman's (2007) dataset and employ system generalized method of moments (GMM) estimation. To mitigate an estimation bias arising from a linear specification error, we include tercile-based categorical *HI* variables.

In particular, we postulate the following equation for the system GMM estimation:

$$Growth_{it} = f(HI_{it}, Aid_{it}) + E^{n}_{it}\beta_{En} + E^{x}_{it}\beta_{Ex} + \alpha_i + \alpha_t + \varepsilon_{it}, \qquad (3)$$

where subscripts i and t denote the recipient country of foreign aid and the time period, respectively. The dependent variable,

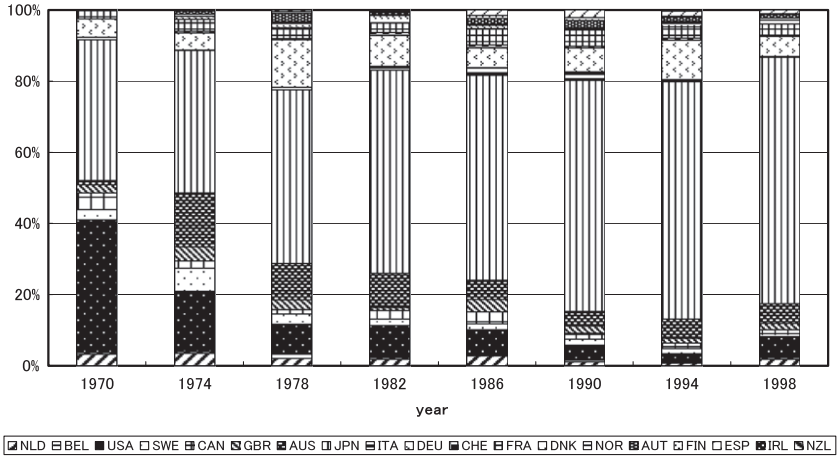


Figure 5. *Bilateral DAC aid share by donors (East Asia). Note: The years shown in the table represent the starting years of 4-year averages. Source: CRS/OECD, commitment base.*

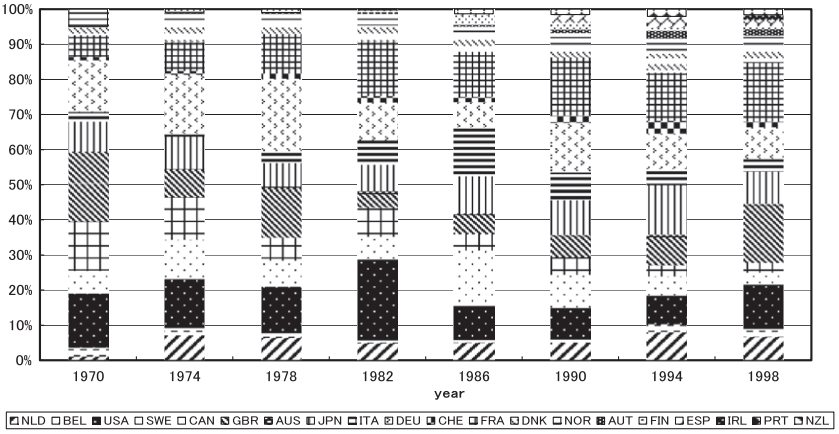


Figure 6. *Bilateral DAC aid share by donors (Sub-Saharan Africa). Note: The years shown in the table represent the starting years of 4-year averages. Source: CRS/OECD, commitment base.*

Growth, is per capita GDP growth rate as employed by Roodman (2007). Independent variables related to aid, *Aid*, and the Herfindahl Index, *HI*, are on the right-hand side. In OLS and system GMM estimation models, the function $f(\cdot)$ is specified as the tercile-based categorical *HI* variables interacted with the *Aid* variable. The equation also includes other aid-related interaction variables such as aid $*$ policy and aid $*$ tropics. E^n denotes a matrix of other predetermined and endogenous variables such as initial GDP per capita, institutional quality, and so on, while E^x represents a set of other exogenous variables such as regional dummy variables and ethnic fractionalization. Finally, α_i, α_t, and ε_{it} are country-specific fixed effects, year-specific effects, and a well-behaved error term, respectively.

Many existing studies estimating income-growth regression on foreign aid argue the existence of possible endogeneity biases wherein aid is provided to poorer countries or to countries that continue to perform poorly. In fact, these studies find that OLS estimators are very different from the estimators correcting for endogeneity (Boone, 1996; Burnside & Dollar, 2000; Hansen & Tarp, 2001; Rajan & Subramanian, 2008; Roodman, 2007). Therefore, in order to correct for biases arising from possible correlations between the error terms and explanatory variables as well as omitted variables, we employ the system GMM estimation developed by Blundell and Bond (1998).[12] The system GMM estimation corrects for omitted variable bias by eliminating fixed effects through first differencing and corrects for endogeneity bias by using lagged endogenous regressors as effective instruments.[13] We test whether instruments are orthogonal to the error term using the Hansen *J* statistic and whether the error term is auto-correlated using the Arellano–Bond statistic.[14]

(d) *Variables employed*

The variables used in this study are summarized in a table in the Appendix. In the system GMM estimations applied to Roodman's (2007) data, we assume that the regional dummy variables, the dummy variables for years, measure of tropical land (tropic), and measure of ethnic fractionalization (ethnic) are exogenous and that the values of these variables do not change over time. In addition, we assume that the logarithm of initial gross domestic product per capita (lgdp), the rate of political assassinations (assas), the interaction term between ethnic fractionalization and political assassinations (ethnic $*$ assas), and a measure of financial depth (m21) are considered to be predetermined. All other regressors such as tercile-based categorical *HI* variables, the interaction terms

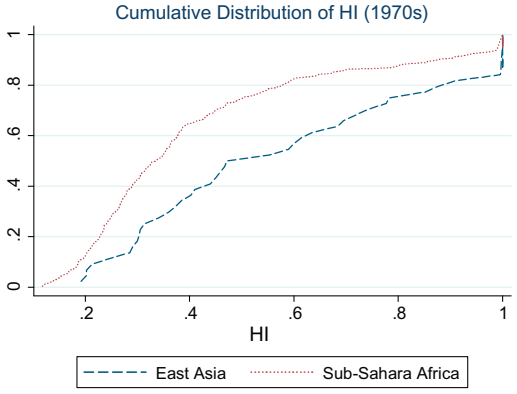


Figure 7A. *Cumulative distribution of HI by region in the 1970s. Note: The two-sample Kolmogorov–Smirnov tests for the equality of distributions strongly reject the equality between these two probability distributions of the HI (p value is 0.000).*

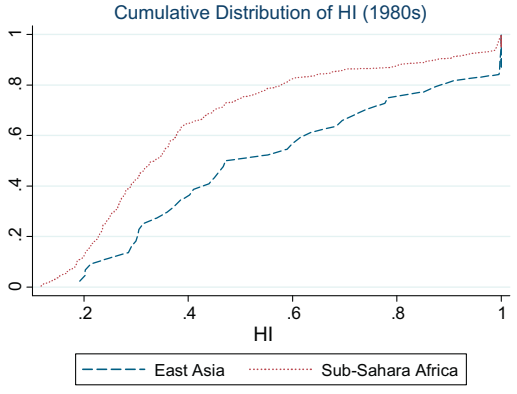


Figure 7B. *Cumulative distribution of HI by region in the 1970s. Note: The two-sample Kolmogorov–Smirnov tests for the equality of distributions strongly reject the equality between these two probability distributions of the HI (p value is 0.000).*

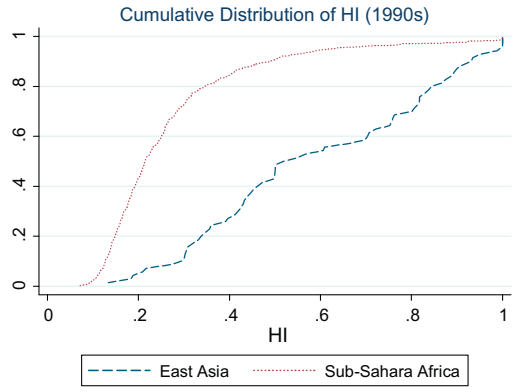


Figure 7C. *Cumulative distribution of HI by region in the 1990s. Note: The two-sample Kolmogorov–Smirnov tests for the equality of distributions strongly reject the equality between these two probability distributions of the HI (p value is 0.000).*

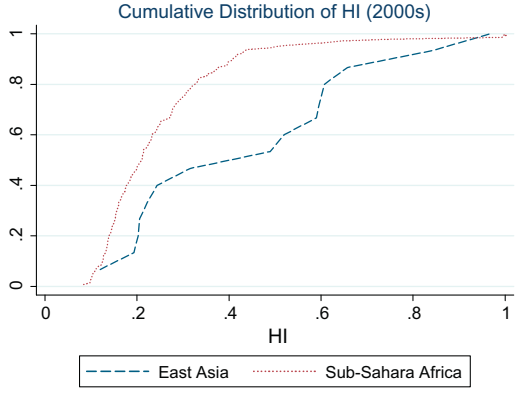


Figure 7D. *Cumulative distribution of HI by region in the 2000s. Note: The two-sample Kolmogorov–Smirnov tests for the equality of distributions strongly reject the equality between these two probability distributions of the HI (p value is 0.000).*

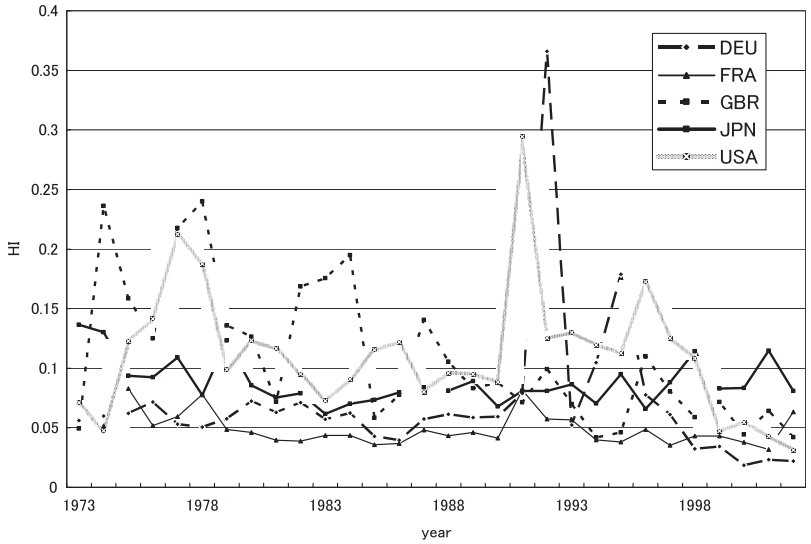


Figure 8. *Trend of HI by donors. Calculated for five major donor countries. The increase in US aid in 1990 is due to the Gulf War and the provision of aid that the US granted to Egypt. The increase in German aid in 1992 is due to the collapse of the Berlin Wall and the provision of aid that Germany granted to Poland. Source: CRS/OECD, commitment base.*

between aid and categorical *HI*, and the other interaction terms involving *HI* are considered to be endogenous.

One caveat of our empirical strategy is the exogeneity assumption with regard to institutional quality (icrg). The index of institutional quality is based on the International Country Risk Guide (ICRG) published by the Political Risk Services (PRS) group, which has been available since 1982. Burnside and Dollar (2000) use the fixed value of the ICRG index, assuming that institutional factors change slowly over time. Moreover, Easterly *et al.* (2004) follow the same method, although they use a wider dataset from the original ICRG. However, since the ICRG index varies over time, Roodman (2007) assigns 1982 values to the observations before 1982 and uses varying values to reflect the real-world changes for the observations after 1982. We basically consider institutional quality to be endogenous in the growth regression; however, it is not possible to take differences in the system GMM estimation if their values do not change over time. [15] We therefore estimate both specifications, i.e., one including the ICRG index as an endogenous regressor and the other including the ICRG index as an exogenous regressor, specifying that this would be used only in the estimations of the levels equations along with other exogenous variables such as regional dummies and ethnic fractionalization. Since the results do not differ to any great extent, our results are based on the assumption of endogenous institutional quality.

We limit the number of lags to one period in order to avoid problems arising from the presence of excessive instruments in the system GMM estimations. According to Roodman (2009), the rule of thumb is that the number of instruments should not exceed the number of countries in the regression. As the instruments become numerous relative to the sample size, they can overfit the instrumented variables, thus biasing the results toward those of the OLS. It should be noted that the *p* value of the Hansen *J* statistic approaches one when there are too many instruments. [16] We employ the one-step robust estimator of the system GMM.

(e) *Estimation results*

Using the GMM estimation method, we investigate whether the interaction between foreign aid and a degree of aid proliferation promotes economic growth. To accomplish this, we add the interaction term of aid and HI and the other interaction terms involving HI with other control variables such as Policy and regional dummies to see the combined effect of aid proliferation on growth. The GMM estimation results are presented in Table 1. The *p* values of the Hansen *J* statistic and the Arellano–Bond statistic shown in the last two rows indicate that the instruments are orthogonal to the error term in specifications (3)–(6) and that the error term is not auto-correlated in the system GMM estimation for all specifications. The interaction term between the highest tercile *HI* dummy and *Aid* has a positive and significant coefficient. This suggests that the aid provided in a more concentrated condition, i.e., "in a less proliferated condition," possibly facilitates growth.

To verify the robustness of the results, we estimate the model using the sample for the period of 1986–2001. The results are shown in Table 2. While the interaction term between the highest tercile *HI* dummy and *Aid* has a positive and significant coefficient as before, the coefficient on the highest tercile *HI* dummy is negative and marginally significant. The latter finding may suggests one of the aid concentration effects arising from less competition or the lack of peer monitoring among donors. Yet, such an effect may not be serious because, with the highest 20% of the level of *Aid*, the total effect of *HI* on growth will be positive in specifications (3) and (5).

3. CONCLUDING REMARKS

This paper investigates whether aid proliferation affects the economic growth of recipient countries by incorporating a donor concentration index and related interaction terms into the regression results of Burnside and Dollar (2000), Easterly *et al.* (2004), and Roodman (2007), which have been widely discussed in the literature. Since Roodman's (2007) dataset is the most comprehensive of the three datasets considered in this study, we use it to derive our baseline results. Our empirical results are in favor of the hypothesis that aid proliferation has a negative effect on the economic growth of recipient countries, especially in Africa.

Aid coordination has become one of the most pressing issues in the current international aid community. On the one hand,

Table 1. *Aid concentration and economic growth. Dependent variable: per capita GDP growth*

	(1)	(2)	(3)	(4)	(5)	(6)
lgdp (Pre)	−0.179	0.066	−1.569	−1.314	−1.984	−1.527
	(1.176)	(1.398)	(1.780)	(1.608)	(1.762)	(1.661)
ethnic (Ex)	0.073	0.226	−0.177	0.195	−0.313	0.246
	(1.312)	(1.519)	(1.642)	(1.348)	(1.620)	(1.652)
Tropic (Ex)	−1.390**	−1.338*	−2.904**	−2.820**	−3.128***	−2.992***
	(0.700)	(0.778)	(1.179)	(1.141)	(1.090)	(1.055)
Assas (Pre)	−0.324	−0.295	−0.296	−0.308	−0.291	−0.294
	(0.345)	(0.383)	(0.484)	(0.482)	(0.489)	(0.508)
ethnic*assas (Pre)	−0.002	−0.108	−0.148	−0.01	−0.21	−0.005
	(0.786)	(0.975)	(1.210)	(1.257)	(1.193)	(1.346)
icrg (En)	0.724*	0.626**	0.3	0.395	0.356	0.453
	(0.369)	(0.319)	(0.348)	(0.373)	(0.344)	(0.358)
m21 (Pre)	−0.043	−0.041	−0.031	−0.026	−0.029	−0.03
	(0.029)	(0.030)	(0.028)	(0.029)	(0.029)	(0.031)
ssa (Ex)	−1.199	−1.077	−3.252**	−3.563*	−3.565**	−3.917*
	(1.001)	(1.022)	(1.535)	(1.990)	(1.568)	(2.018)
easia (Ex)	1.800**	1.881**	3.052**	2.868***	1.921	5.314
	(0.794)	(0.803]	(0.992)	(0.986)	(11.624)	(11.862)
policy (En)	1.212***	1.171**	1.195*	1.397*	1.211*	1.413*
	(0.469)	(0.498)	(0.675)	(0.768)	(0.646)	(0.773)
aid (En)	0.087	0.07	−1.189	−1.093	−1.418	−1.197
	(0.864)	(0.902)	(1.181)	(1.398)	(1.131)	(1.450)
aid * tropic (En)	−0.404	−0.434	0.861	0.827	1.061	0.952
	(0.744)	(0.819)	(1.052)	(1.269)	(1.034)	(1.343)
aid * policy (En)	−0.39	−0.352	−0.014	0.085	−0.056	0.071
	(0.474)	(0.528)	(0.561)	(0.559)	(0.528)	(0.573)
aid^2 * policy (En)	0.055	0.051	0.013	−0.009	0.021	−0.008
	(0.069)	(0.075)	(0.075)	(0.076)	(0.070)	(0.079)
$1[1/3 < HI \leqslant 2/3]$ (En)		−0.96	−0.738	−1.577	−0.512	−1.678
		(2.053)	(2.182)	(1.734)	(2.502)	(1.799)
$1[2/3 < HI \leqslant 1]$ (En)		−1.037	−1.266	−2.316	−1.067	−2.136
		(1.822)	(1.929)	(1.878)	(1.890)	(1.774)
aid * $1[1/3 < HI \leqslant 2/3]$ (En)			−0.735	0.417	−0.702	0.641
			(1.004)	(1.129)	(1.043)	(1.062)
aid * $1[2/3 < HI \leqslant 1]$ (En)			1.593***	1.600**	1.695**	1.555**
			(0.554)	(0.624)	(0.679)	(0.783)
easia * $1[1/3 < HI \leqslant 2/3]$ (En)					0.192	−2.524
					(11.968)	(12.612)
easia * $1[2/3 < HI \leqslant 1]$ (En)					1.384	−2.479
					(12.122)	(12.101)
aid * policy * $1[1/3 < HI \leqslant 2/3]$ (En)				−0.7		−0.725
				(0.527)		(0.527)
aid * policy * $1[2/3 < HI \leqslant 1]^2$ (En)				0.105		0.198
				(0.802)		(0.926)
Observations	348	348	348	348	348	348
Hansen *J* stat	0.02	0.05	0.18	0.42	0.22	0.5
AR2 stat	0.72	0.78	0.72	0.89	0.72	0.8

Note: Standard errors are in parentheses. **, *, and + denote statistical significance at the 1%, 5%, and 10% levels, respectively. All variables except HI are taken from Roodman's homepage [http://www.cgdev.org/content/experts/detail/2719/]. The HI index is constructed on the basis of committed amounts of aid by bilateral donors and multilateral donors as recorded in the CRS database of the OECD. The variables labeled (Pre) are considered to be predetermined in the system GMM estimations. Likewise, the variables labeled (EX) are considered to be exogenous and the variables labeled (En) are considered to be endogenous in the system GMM estimations. 1[.] is an indicator function which takes one when the statement is true and zero otherwise.

the increase in aid volume is still being emphasized, particularly after the Monterrey conference in 2002. However, without close examinations of past aid effectiveness and aid modalities, it is difficult to reach a meaningful agreement regarding increases in the amount of aid. On the other hand, the problems of aid proliferation and the necessity of aid coordination among donors have been recognized widely in the international aid community. The main point is that the lack of international aid coordination leads to the weak ownership and inefficient aid-absorption capacities of aid recipients. This situation hinders the recipients' growth potential.

The importance of aid coordination cannot be underestimated, since not only the current DAC donors but also the emerging donors—who are currently operating outside the international aid coordination framework—are soon expected to play an important role in the aid community. Yet, the main finding of this paper—starting from an initial situation of excessive aid proliferation, more aid concentration is likely to be correlated with higher economic growth—may or may not be consistent with the logic behind aid coordination. If aid coordination leads to aid concentration by reducing transaction costs, then it may promote economic growth. However,

Table 2. *Aid concentration and economic growth. Dependent variable: per capita GDP growth*

	(1)	(2)	(3)	(4)	(5)	(6)
lgdp (Pre)	−0.529	0.067	−0.692	−0.458	−0.829	−0.372
	(1.134)	(1.447)	(1.595)	(1.674)	(1.579)	(1.638)
ethnic (Ex)	−0.298	0.097	0.826	0.875	0.956	1.265
	(1.151)	(1.298)	(1.455)	(1.178)	(1.486)	(1.428)
Tropic (Ex)	−0.913	−1.077	−2.287**	−2.111**	−2.347**	−2.114**
	(0.792)	(0.841)	(1.021)	(1.029)	(0.932)	(0.870)
Assas (Pre)	−0.116	0.008	0.44	0.495	0.41	0.493
	(0.364)	(0.346)	(0.519)	(0.463)	(0.544)	(0.506)
ethnic * assas (Pre)	−0.53	−0.776	−1.562	−1.42	−1.571	−1.438
	(0.732)	(0.852)	(1.161)	(1.055)	(1.297)	(1.227)
icrg (En)	0.722**	0.37	0.427	0.466	0.496	0.569
	(0.303)	(0.346)	(0.423)	(0.461)	(0.402)	(0.439)
m21 (Pre)	−0.046	−0.041	−0.008	−0.006	−0.018	−0.014
	(0.030)	(0.030)	(0.039)	(0.032)	(0.040)	(0.034)
ssa (Ex)	−1.216	−1.016	−2.278	−2.05	−2.593	−2.465
	(1.390)	(1.466)	(1.842)	(1.906)	(1.760)	(1.814)
easia (Ex)	2.646**	3.144***	3.555***	3.178***	9.483	11.625
	(1.285)	(1.176)	(1.301)	(1.226)	(11.398)	(12.879)
policy (En)	1.060**	1.081**	0.888	1.537**	0.846	1.446**
	(0.518)	(0.532)	(0.666)	(0.720)	(0.646)	(0.716)
aid (En)	−0.12	−0.279	−1.992**	−1.277	−1.852**	−1.208
	(0.396)	(0.448)	(0.803)	(1.172)	(0.855)	(1.234)
aid * tropic (En)	−0.341	−0.223	1.520*	1.07	1.455*	1.113
	(0.376)	(0.409)	(0.842)	(1.098)	(0.885)	(1.173)
aid * policy (En)	−0.33	−0.28	−0.034	0.184	0.015	0.308
	(0.476)	(0.551)	(0.617)	(0.613)	(0.627)	(0.658)
aid^2 * policy (En)	0.047	0.044	0.017	−0.019	0.012	−0.038
	(0.069)	(0.081)	(0.086)	(0.082)	(0.087)	(0.089)
$1[1/3 < HI \leqslant 2/3]$ (En)		−1.352	−2.388	−1.192	−1.788	−1.107
		(2.032)	(2.443)	(1.616)	(2.613)	(1.561)
$1[2/3 < HI \leqslant 1]$ (En)		−2.854*	−3.761*	−3.787**	−3.059	−3.317**
		(1.494)	(2.047)	(1.663)	(2.006)	(1.654)
aid * $1[1/3 < HI \leqslant 2/3]$ (En)			−0.314	0.644	−0.371	0.84
			(0.842)	(0.815)	(0.894)	(0.741)
aid * $1[2/3 < HI \leqslant 1]$ (En)			1.856**	1.766**	1.772**	1.576*
			(0.798)	(0.821)	(0.851)	(0.842)
easia * $1[1/3 < HI \leqslant 2/3]$ (En)					−6.713	−8.94
					(12.899)	(14.457)
easia * $1[2/3 < HI \leqslant 1]$ (En)					−5.777	−8.731
					(11.776)	(13.408)
aid * policy * $1[1/3 < HI \leqslant 2/3]$ (En)				−1.036**		−1.123**
				(0.416)		(0.451)
aid * policy * $1[2/3 < HI \leqslant 1]^2$ (En)				−0.359		−0.254
				(0.652)		(0.644)
Observations	215	215	215	215	215	215
Hansen *J* stat	0.01	0.05	0.11	0.26	0.2	0.29
AR2 stat	0.81	0.96	0.67	0.41	0.94	0.63

Note: Standard errors are in parentheses. **, *, and + denote statistical significance at the 1%, 5%, and 10% levels respectively. All variables except HI are taken from Roodman's homepage [http://www.cgdev.org/content/experts/detail/2719/]. The HI index is constructed on the basis of committed amounts of aid by bilateral donors and multilateral donors as recorded in the CRS database of the OECD. The variables labeled (Pre) are considered to be predetermined in the system GMM estimations. Likewise, variables labeled (EX) are considered to be exogenous and the variables labeled (En) are considered to be endogenous in the system GMM estimations. 1[.] is an indicator function which takes one when the statement is true and zero otherwise.

if the proliferation problem arises from a free-rider problem among donors as pointed by Rahman and Sawada (2010) and Kimura *et al.* (2007), aid coordination does not necessarily facilitate growth. In the future, it will be imperative to elaborate on these careful analyses of the role of aid coordination.

NOTES

1. According to Roodman (2006b), these numbers are based on the misleading data of van de Walle and Johnston (1996), while the reality was even worse.

2. Another possibility is that the free-rider problem arises from the fact that aid outcomes in recipient countries are a kind of joint production by a wide variety of resources provided by both donor and recipient countries (Kimura, Sawada, & Mori 2007; Rahman & Sawada, 2010).

3. However, the GMM estimations of Rajan and Subramanian (2008) may have a problem, namely, the use of too many instruments because of an unrestricted number of lags. The inconclusive results may be a manifestation of the general problem that estimates of aid-growth regressions appear to be sensitive to the composition of the country sample.

4. There are some other papers that investigate whether aid modalities matter (e.g., Cordella & Dell'Ariccia, 2003; Cordella & Ulku, 2004).

5. There are two aid fragmentation indices computed by Knack and Rahman (2007). The first fragmentation index is the Herfindahl index subtracted from 1 and multiplied by 100. The second fragmentation index of Knack and Rahman (2007) is a fragmentation index is computed from donors' shares of projects using the Development Gateway's AiDA (Accessible Information on Development Activities) data base. Project counts and aid volumes provide somewhat different pictures of donor fragmentation. The indices based on the number of projects may reflect actual problems associated with lack of donor coordination better than fragmentation indexes based on aid volumes, for which budget support provided by many donors could produce a high value. A disadvantage of the project data, however, is that unlike the aid volume data, one cannot construct annual fragmentation values, because about 60% of the activities included in AiDA lack project start and end dates. Since indexes computed for any given subperiod require dropping all projects without start dates, the index will therefore be based on very incomplete project data.

6. With this index, we apply O'Connell and Soludo's (2001) notion of "transaction intensity" of aid. The "proliferation" variable should not be interpreted as simple function of the number of donors but also as a function of the extent to which donors coordinate their actions.

7. The CRS database contains detailed information on the individual aid activities of most of the 23 members of the OECD's DAC as well as those of multilateral development banks and UN agencies. The entire dataset is available at <http://www.oecd.org/dataoecd/20/29/31753872.htm>.

8. We exclude the aid activities coded as 900 in the CRS, since this class of aid includes "administrative costs of donors" and "spending in the donor country for heightened awareness/interest in development co-operation," which are clearly not related to aid proliferation in recipient countries. Unlike Roodman (2006a), we include the aid activities for which the grant element is less than 25%, since these aid activities impose an administrative burden similar to that of aid activities with larger grant elements.

9. OPEC stands for Organization of the Petroleum Exporting Countries.

10. The US provided 51% of bilateral aid to Egypt in 1991, and Germany provided 52% of bilateral aid to Poland in 1992.

11. The published Effective Development Assistance (EDA) data (Chang, Fernandez-Arias, & Serven, 1998), which is used in Burnside and Dollar (2000), cover only 1975–95. Roodman (2007) extrapolates the EDA data to the remaining years in 1970–2001 via a regression of the EDA on net Official Development Assistance (ODA), which is available for the entire period.

12. Note that the use of a fixed-effects model does not correct for endogeneity even if lagged variables are employed as regressors. System GMM models are estimated by the *xtabond2* program developed by Roodman (2009).

13. In the difference equations, predetermined and endogenous variables are instrumented with suitable lags of their own levels, while in the levels equations, they are instrumented with the lags of their first differences. The predetermined variables are correlated with past errors, and the endogenous variables are correlated with past and present errors. See Blundell and Bond (1998).

14. System GMM reports a test of over identifying restrictions (Hansen *J* statistic), which tests whether the instruments, as a group, appear exogenous and are robust to heteroscedasticity. System GMM also reports a test of autocorrelations.

15. In this sense, the ICRG index in Roodman (2007) is mixed with fixed values and changing values.

16. See Roodman (2009) for details about the system GMM.

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APPENDIX

Description of variables.

Variable	Code	Original data source	Notes
Per-capita GDP growth	gdpg	World Bank (2003)	
Initial GDP per capita	lgdp	Summers and Heston (1991)	Natural logarithm of GDP/capita for first year of period; constant 1985 dollars
Ethno-linguistic fractionalization	ethnf	Roeder (2001)	Probability that two individuals belong to different ethnic groups
Tropical area fraction	tropic	Gallup and Sachs (1999)	
Assassinations/capita	assas	Banks (2002)	
Institutional quality	icrg	PRS Group's IRIS dataset (see Knack and Keefer (1995))	Revised version of variable. Computed as the average of the three components still reported after 1997
M2/GDP, lagged one period	m21	World Bank (2003)	
Sub-Saharan Africa Dummy	ssa	World Bank (2003)	
East Asia Dummy	easia	Burnside and Dollar (2000)	Dummy for China, Indonesia, South Korea, Malaysia, Philippines, and Thailand, following Burnside and Dollar (2000)
Aid (Effective Development Assistance)/PPP GDP	aid	Chang *et al.* (1998), DAC (2002), IMF (2003), World Bank (2003), Summers and Heston (1991)	Available values for 1975–95 from Chang *et al.* Missing values extrapolated based on the regression of EDA on Net ODA. Converted to 1985 dollars with World Import Unit Value index from IMF, series 75. GDP computed like LGDP above
Policy index	policy	Roodman (2007)	
Population	lpop	World Bank (2003)	Natural logarithm
Herfindahl index	HI	CRS	

Note: All variables except HI are taken from Roodman's homepage [http://www.cgdev.org/content/experts/detail/2719/]. The HI index is constructed on the basis of committed amounts of aid by bilateral donors and multilateral donors as recorded in the CRS database of the OECD. Prefixes such as bd-, elr-, and ra- are added to code the datasets of Burnside and Dollar (2000), Easterly *et al.* (2004), and Roodman (2007), respectively.