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A meta-analysis of aid effectiveness

Revisiting the evidence

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Abstract: As research on the empirical link between aid and growth continues to grow, it is time to revisit the accumulated evidence on aid effectiveness. This paper does this by building on the meta-analysis in our previous work. The availability of more data enables us to conduct a sub-group analysis by disaggregating the sample into different time horizons and assess if there are temporal shifts in aid effectiveness. Our new and updated results show that the previously reported positive evidence of aid's impact is robust to the inclusion of more recent studies in the meta-analysis and this holds for different time horizons as well. The authenticity of the observed effect is also confirmed by results from funnel plots, regression-based tests, and a cumulative meta-analysis for publication bias.

Keywords: aid and growth, meta-analysis, heterogeneity and publication bias
JEL classification: F35, O1, O4

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1 Introduction

Analysing the aid-growth nexus continues to be a focus area in development economics. While the empirical evidence from individual studies was somewhat mixed until 2007, the past decade has witnessed convergence towards a more positive assessment regarding the potency of aid in spurring economic growth (see, among others, Arndt et al. 2010, 2016). One approach to investigating the aid-effectiveness issue is to ask what the stock of accumulated empirical evidence in the past three to four decades, on average, had to say about aid effectiveness. In Mekasha and Tarp (2013) we addressed this question relying on aid and growth empirical studies carried out over the 1970–2004 period. We demonstrated that the accumulated evidence showed a positive impact of aid on growth during the 34-year period in question, and we documented that this effect is authentic, not an artefact of publication selection.

As the sample period in Mekasha and Tarp (2013) is only until 2004 and more than a decade has passed since then, we update the accumulated evidence here by including aid and growth empirical papers produced after 2004. Apart from enlarging the sample coverage and hence working with a larger sample size, this deepens the analysis in two main ways: (i) we now cover a longer time period and so are able to do a more disaggregated analysis, mainly by splitting the sample into different time periods (sub-groups); and (ii) we can assess whether the aid-effectiveness result holds for all time horizons, i.e. we can assess whether there are temporal shifts in aid effectiveness.

In this line of thinking, the present study aims to answer the following key questions. First, does the addition of new studies have any impact on the results we documented in Mekasha and Tarp (2013)? Second, has aid effectiveness changed over time and if so is the change genuine or an artefact of publication bias? Third, is there heterogeneity between studies and if so what explains the observed heterogeneity? To address these questions, we rely on a data set of 141 empirical studies on aid and growth that were conducted over the 1970–2011 period.[1] This gives us a total of 1,778 estimates for the meta-analysis.

The paper is structured as follows. Section 2 starts by updating the aid-effectiveness meta-analysis evidence documented in Mekasha and Tarp (2013) and then proceeds to present a sub-group analysis by disaggregating the data by time period/year of publication. Section 3 presents a cumulative meta-analysis to establish how the weight of the evidence has shifted over time. This is followed by an in-depth investigation of publication bias in Section 4. In Section 5, we present a multivariate meta-regression analysis to understand the sources of heterogeneity in effect estimates across studies. Finally, concluding remarks are given in Section 6.

2 Revisiting the accumulated evidence

2.1 Overall effect

One of the main objectives of meta-analysis is to obtain an overall effect estimate (weighted average) from a body of literature by combining the appropriate summary statistics from each study. The choice of an appropriate model to be used to combine the summary statistics extracted from each study is one major step in meta-analysis and this depends on the degree of heterogeneity

[1] The study by Doucouliagos and Paldam (2015) covers a similar period, enabling us to put our results into perspective.

in effect sizes.[2] In this regard, there are two alternative models: a fixed-effects model, which assumes away heterogeneity between studies and hence only uses within study variances as study weights, and a random-effects model, which takes the across study variation in the true effect estimates into account and uses both the within and between study variances as weights.

Denoting the number of studies considered for the meta-analysis by k and the corresponding effect size estimates by $x_1, x_2, x_3 \ldots x_k$, the overall effect estimate is given by:

$$\hat{\theta} = \frac{\sum_{1}^{k} \hat{w}_i x_i}{\sum_{1}^{k} \hat{w}_i} \tag{1}$$

Where $\hat{w}_i$ in the case of the random and fixed-effects model is respectively given by $\frac{1}{\sigma_i^2+\tau^2}$ and $\frac{1}{\sigma_i^2}$

where σ_i^2 and τ_i^2 are within and between study variance of effect estimates respectively.

As can be seen from Equation 1, the random-effects model accounts for both within and between study variance to calculate the weighted average effect. Compared to the fixed-effects model, which only accounts for the within study variance, the random-effects model gives a wider confidence interval for the overall effect and hence conservative estimates compared to the fixed-effects model (see also Konotopanteles et al. 2013). The effect homogeneity assumption of the fixed-effect model is often criticized. In practice, a certain degree of variation in the true effect is expected due to differences in study populations as well as the type, duration, and intensity of interventions (see Thompson and Pocock 1991).[3]

In this study we rely on a random-effects model to obtain an overall average effect from the aid-effectiveness literature by combining study level summary estimates from empirical aid-growth papers that became available over the 1970–2011 period. This choice is motivated by the apparent between study heterogeneity in aid-growth empirical studies. This can easily be checked using statistical tests and graphical tools as shown in Mekasha and Tarp (2013) where we have also carefully discussed why the random-effects model is more appropriate in conducting a meta-analysis of aid and growth empirical studies.

Accordingly, in estimating the random-effects model we used the Bootstrapped DerSimonian–Laird (BDL) model. This is a non-iterative moments-based estimator which improves upon the DerSimonian–Laird model, a commonly used random-effects model, by estimating the between study variance and other heterogeneity parameters applying a non-parametric bootstrap method. The BDL model has proven to be the best method in terms of detecting any heterogeneity particularly for large-scale meta-analysis (see Konotopanteles et al. 2013).

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[2] Heterogeneity in effect size is used to refer to the variation in true effect sizes, i.e. the effect size that would have prevailed if the study had no sampling error (an infinitely large sample size) (see Borenstein et al. 2009).

[3] This is what is termed as 'clinical heterogeneity' in the meta literature. The other form of heterogeneity is methodological heterogeneity which emanates from differences in study design (see Thompson 1994).

Against this background, Table 1 presents the weighted average overall effect estimate from the aid-growth literature. We first disaggregated the sample into 'old period' and 'new period', where the former is the same as the sample period used in Mekasha and Tarp (2013) and the latter is a new sample focusing on the years added in this study. We finally report an overall effect estimate for the full sample period by combining the old and new periods indicated above.[4] Such a sub-group analysis is useful in assessing whether the effect size has shifted over time (see Borenstein et al. 2009). Factors like improvement in data quality, changes in donor priorities, and evolution of better estimation techniques, among others, are the likely explanations for potential changes in research findings in the aid-effectiveness literature.

As can be seen from Table 1, the overall effect is found to be positive and statistically significant at 5 per cent level of significance. This is true both in the full and disaggregated samples. Even if the magnitude of the effect varies across periods and shows some decline over time, the overall conclusion about the potency of foreign aid in spurring growth stays the same.[5]

Apart from the above analysis, we have also estimated the overall effect at study level, i.e. by taking a single estimate from each study. The results from this exercise are presented in Table A2, which shows that the combined effect remains positive, statistically significant, and is higher compared to the case where the estimation is done based on study by regression level data. The main finding reported in Table 1 is also robust to a different sample disaggregation, as can be seen from Table A3 in the appendix.

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4 Moreover, as a robustness check, we report in the appendix a weighted average overall effect using a different sample disaggregation. This sample disaggregation is guided by discussion in the aid effectiveness literature regarding the different generations of aid-growth empirical studies (see Arndt et al. 2010).

5 Regarding the practical relevance of the effect size estimate from meta-analysis, as such, no standard cut-off value exists to label an effect estimate as 'small', 'medium', or 'large'. The most common guideline used in the literature to assess the practical importance of a meta average is the Cohen (1988) guideline. According to this guideline, the magnitude of an effect size (here the partial correlation) is small if it is 0.1, medium if it is 0.3, and large if it is 0.5. However, there is no consensus on Cohen's guideline, and its application for empirical studies in economics is criticized. For instance, Doucouliagos (2011) argues that Cohen's guideline is too restrictive when applied to economics. Particularly, the author indicates that Cohen's guideline is developed assuming zero order correlation and points out that this guideline 'tends to underestimate the economic significance of the underlying empirical effect'. This author thus develops a new preliminary guideline, including field-specific guidelines. Accordingly, for aid and growth small, medium, and large are respectively defined as 0.047, 0.107, and 0.188. Thus, this preliminary guideline suggests that the effect sizes (the partial correlations) from our meta-analysis reported in Table 1, fall in the small to medium range. However, given that this is a preliminary guideline, one needs to be cautious about drawing firm conclusions.

Table 1: Meta-analysis of the aid and growth literature

Impact of aid on growth	Overall effect (bdl)	[95% CI]	Heterogeneity value (I^2) %	[95% CI]	Between study variance (τ^2)	N
Old period (1970–2004)	0.095	[0.083 0.107]	71.49	[69.31 73.51]	0.016	731
New period (2005–11)	0.039	[0.032 0.047]	79.78	[78.62 80.88]	0.009	1,047
Full sample (1970–2011)	0.058	[0.052 0.064]	77.31	[76.28 78.30]	0.011	1,778

Note: bdl refers to Bootstrapped DerSimonian-Laird random-effects model. Bootstrap of 10,000 repetitions is used in all cases. I^2 is a heterogeneity measure ranging from 0–100% where a larger score shows a higher level of heterogeneity.

Source: Authors' estimates.

Apart from showing the average effect size from studies included in the meta-analysis, the results presented in Table 1 show the level of heterogeneity as indicated by the I^2 statistics. In particular, I^2 statistic shows the percentage of the between study heterogeneity that can be attributed to the variability in the true treatment effect instead of sampling variation. An I^2 value of more than 50 per cent is normally considered to be high (see, for example, Kontopantelis et al. 2013).

In Table 1, there is, in all the cases, considerable heterogeneity (in the true effect of aid) across studies, suggesting that the effect homogeneity assumption implied by the fixed-effects model is not valid. In other words, the use of a random-effects model, which allows the true effect of aid to vary between studies, is an appropriate choice in the meta-analysis of aid and growth literature.

To put our results into perspective, our finding stands in stark contrast to the results reported in Doucouliagos and Paldam (2015), henceforth DP15. These authors mainly focus their analysis on the 2007–11 period and particularly argue that the 2007–08 years are 'dark years' in aid effectiveness. They further add that the effect estimates in the 2009–11 period show presence of an 'upward kink' which, according to these authors, is purely a result of publication bias instead of a real improvement in aid effectiveness.

We are using the same dataset as DP15, so we believe that checking the assertions made in DP15 will make our analysis more complete. We do so by way of answering the following four questions: (i) Is there any reasonable justification behind the classification of the different periods? (ii) Is the 2007–08 period really a dark period in aid effectiveness? (iii) Is the 'upward kink' real and is there any theoretical or intuitive reason to expect an upward kink in the 2009–11 period? (iv) Can the publication bias anxiety be justified by the data at hand?

To begin, we find that the decision to categorize the years 2005 and 2006 as an 'old period' is arbitrary and in fact matters for the results. It is indicated in DP15 that 'the period covered by D&P (2008) is taken as the old period and ***two more years with broadly similar results are added*** [emphasis added], so the old period (1) goes to the end of 2006. The paper concentrates on the new period (2) commencing in 2007' (DP15: 6). However, given that the sample in Doucouliagos and Paldam (2008) is from 1970 to 2004, there is no clear and convincing reason to categorize years 2005 and 2006 as belonging to an old period. As can be seen in the replication table below (Table 2), comparing row 2 and row 3 in the middle section, this choice matters for the results. That is, when one includes years 2005 and 2006 in the 'new period', the effect of aid is positive (albeit small) and statistically significant and the bias coefficient is statistically indistinguishable from zero, which is contrary to the case where the new period starts from 2007.

Table 2: Replication of Table 1 in Doucouliagos and Paldam (2015)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Observations			**Arithmetic mean**				**FAT-PET MRA**					
	Period	N	Papers	Mean	(t1)	(t2)	p	PET	(t)	(trc)	FAT	(t)	(trc)
				Top section: all 1,779 estimates									
All	1970–2011	1,779	141	.066	.9	14.6	15.25	0.031	5.96	2.12	0.378	4.56	1.38
				Middle section: all estimates divided into old and new									
(1)	1970–2006	904	88	.098	1.1	13.8	13.67	0.036	5.27	3.56	0.586	5.86	3.37
(2)	2007–11	875	53	.034	.6	6.3	16.88	0.036	4.50	1.36	0.000	0.00	0.00
(3)	2005–11	1,047	68	.037	.699	7.4	17.9	.0416	7.22	2.54	-.0448	-0.41	-0.11
				Bottom section: the new estimates starting in 2007 divided into two sub-periods									
(A)	2007–08	534	28	.002	.2	.27	15.95	0.039	3.06	1.01	-.423	-2.21	-0.67
(B)	2009–11	341	25	.084	1.3	11.0	18.32	0.019	1.92	0.91	.915	4.59	1.75
				New classification for period A and period B									
(A)	2005–07	430	32	0.029	.580	3.47	20.4	.039	5.03	1.99	-.214	-1.14	-0.41
(B)	2008–11	617	36	0.043	.785	6.93	16.17	.055	5.75	1.94	-.098	-0.61	-0.15

Note: FAT—funnel asymmetry test, PET—precision estimate test, MRA—meta regression analysis, trc—robust cluster corrected t-statistics, where the clustering is done at the paper level. t1 is the average t-statistics of the estimates, t2 is t-statistics given by the ratio of the mean and standard error of the N estimates and p is the average of the precision of the estimates.

Source: Authors' estimates.

We also believe there is no clear and convincing reason to pick 2009 as a starting year for period B (2009–11), and the results and main conclusion of DP15 are sensitive to a change in the starting year of period B. Following the discussion above, we redefine periods A and B by including 2005 and 2006 in period A and 2008 in period B, and the results are presented in the last panel of Table 2. As can be seen from this table (see the last panel), the effect of aid on growth remains positive and statistically significant in both the 2005–07 and 2008–11 periods. And if one starts period B from 2008 instead of 2009 (last row of Table 2), the result appears to be contrary to what DP15 find. That is, in the 2008–11 sample period, the impact of aid on growth is, on average, positive (0.05) and is precisely estimated. On the other hand, the bias coefficient is negative and statistically indistinguishable from zero. Moreover, the DP15 claim of an 'upward kink' in the 2009–11 period is not robust to how one defines periods A and B. Given that there is no clear reason why one should expect any jump in this period, the 'upward kink' reported in DP15 does not seem to reflect real changes. As it will become clear in what follows, this jump is exclusively due to the inclusion of a large set of observations from one single study.

The 0.084 mean estimated in DP15's classification/definition of period B (2009–11) is almost twice as large as the 0.043 mean estimated in an alternative classification of period B covering the years 2008–11. This clearly shows that the results reported in DP15 vary a lot depending on whether one puts observations from year 2008 in either period A or period B. A closer look at the data shows that this is due to the influence of a large set of estimates from the paper by Rajan and Subramanian (2008), which contributes 138 estimates (observations) out of the total 276 estimates coded for 2008. Observations taken from Rajan and Subramanian (2008) account for about 25 per cent of the total observations used in the 2007–08 period. Thus, DP15's labelling of 2007–08 as a dark period for aid effectiveness is mainly driven by the large number of observations taken from Rajan and Subramanian (2008). This is surprising,[6] and we highlight that estimating the effect of

[6] See Arndt et al. (2010) for an assessment of the study by Rajan and Subramanian (2008).

aid on growth by excluding estimates from Rajan and Subramanian (2008) gives us a positive and statistically significant effect of aid on growth for the 2007–08 period.

2.2 Patterns of evidence over time—cumulative meta-analysis

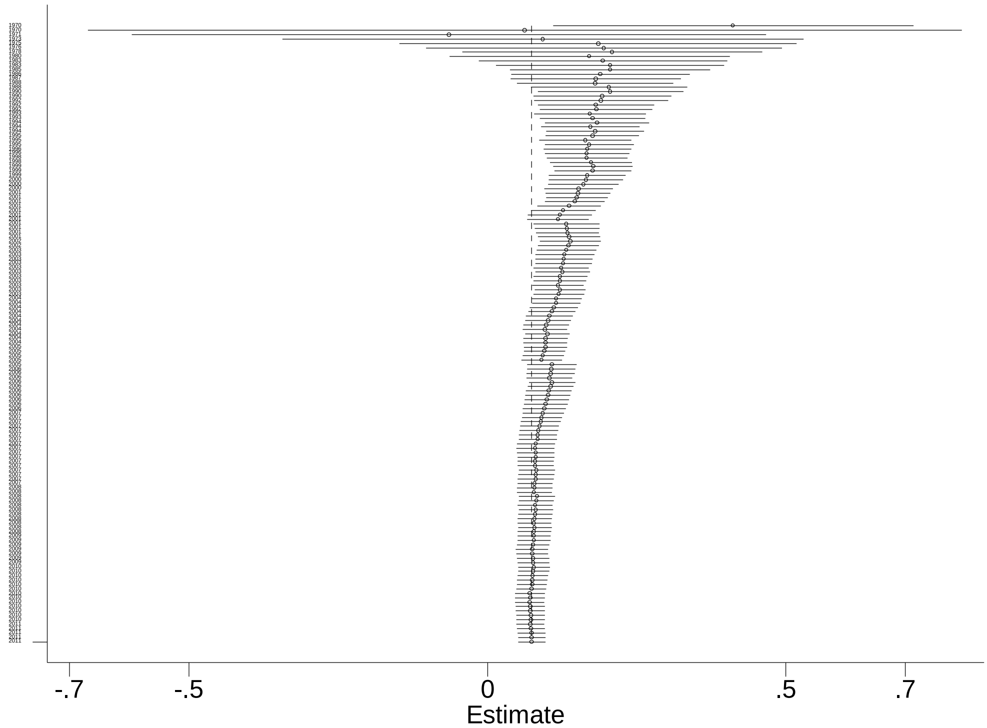
Another question of interest to both researchers and policy makers is whether there are temporal changes in aid effectiveness. In this section, an effort is made to assess whether the magnitude and precision of the impact of aid on growth changes with the passage of time and following the addition of newer studies. To this end, we follow the work of Lau et al. (1992) and conduct a cumulative meta-analysis where studies are sequentially added to the analysis according to a variable of interest, and a new pooled estimate is recalculated every time a new study is added to the analysis. Since our interest is to uncover the pattern of evidence over time and see how the conclusions may have shifted, our variable of interest is the year of publication for each study. Thus, in doing the cumulative meta-analysis, studies are sorted in chronological order for the 1970-2011 period.[7]

Figure 1 and Table A4 in the appendix present the results from cumulative random-effects meta-analysis of the aid-growth literature. In Figure 1, the circles show the estimates from the cumulative meta-analysis and the horizontal lines show the 95 per cent confidence interval. Moreover, the vertical dotted line in the middle of the figure shows the combined estimate. The value for each row shows the summary estimate for a meta-analysis based on all studies up to and including that row. The point estimate in the last row is the same as the effect estimate shown in the summary line as the analysis in the last row includes data from all the 141 studies.

As can be seen from the results from Figure 1 and Table A4, the evidence on the positive impact of aid on growth was there since the early 1980s with a magnitude of 0.206. As one moves further down the plot, the effect size shows some decline and stabilizes around a combined effect equal to 0.074 with a confidence interval from 0.051 to 0.097. Over the years, the addition of new studies is not found to substantially change the aid-effectiveness conclusion.

[7] In cases where studies report multiple estimates, the data is pooled by study and an overall effect estimate is calculated for each study.

Figure 1: Cumulative random-effects meta-analysis



Source: Authors' computation.

3 Assessing publication bias

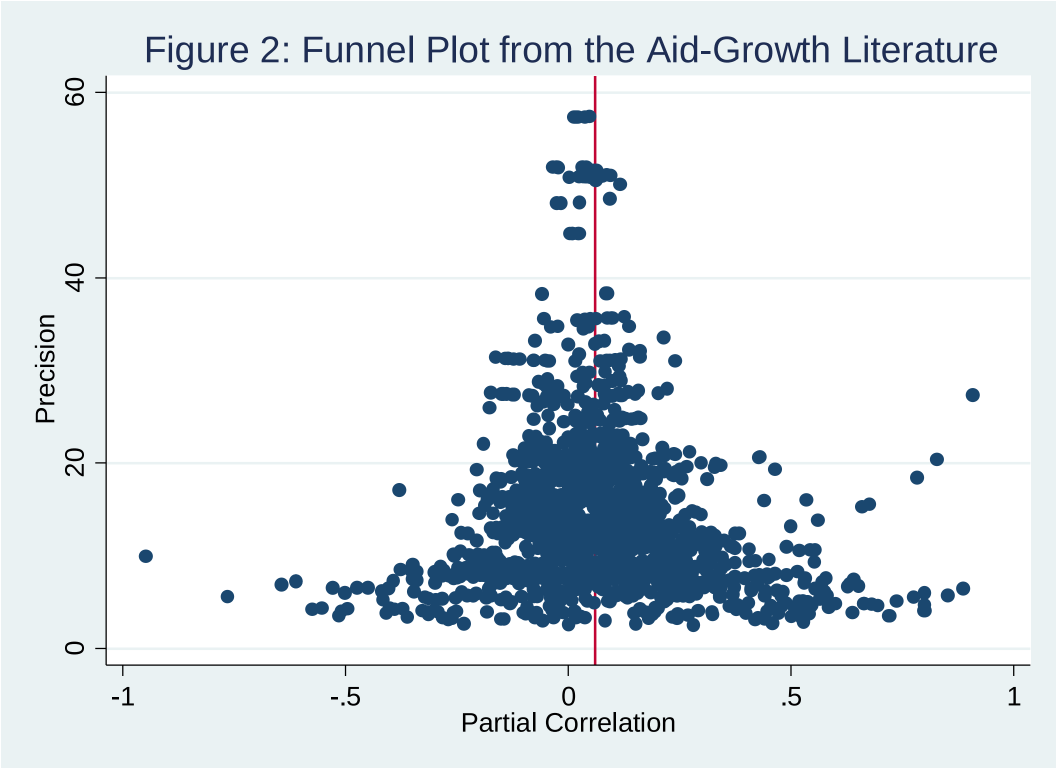
One issue that can jeopardize the credibility of results from meta-analysis is the issue of publication bias. It arises if there is a tendency to only publish research findings with statistically significant treatment effect (Sterne et al. 2000). That is, if studies included in the meta-analysis are a biased sample of the target population of studies (for example, if small studies with statistically insignificant findings remain unpublished/in the grey literature), the combined effect from the meta-analysis may overestimate the true effect (see Borenstein et al. 2009). In this section, we assess whether publication bias is a concern in the aid-effectiveness literature using various methods.

3.1 Funnel plot

One way to assess the issue of publication bias in a body of literature is to use funnel plots that relate the precision of studies (study size) to the size of the effect estimate. In the absence of publication bias, smaller studies are expected to scatter widely at the bottom of the graph and the spread gets narrower as study precision increases. Thus, if publication bias is not a problem in the literature under consideration, the plot takes the shape of a symmetrically inverted funnel.

Figure 2 presents a funnel plot of the aid-effectiveness literature. The vertical line at the centre of the plot shows the combined effect estimate from the aid-effectiveness literature. As can be seen from the figure, the estimates appear randomly distributed around the combined effect estimate, and the plot exhibits symmetry. So, there is no evidence here to suggest the existence of a publication bias in the aid-growth literature. Note especially that smaller studies with statistically insignificant results are not missing.

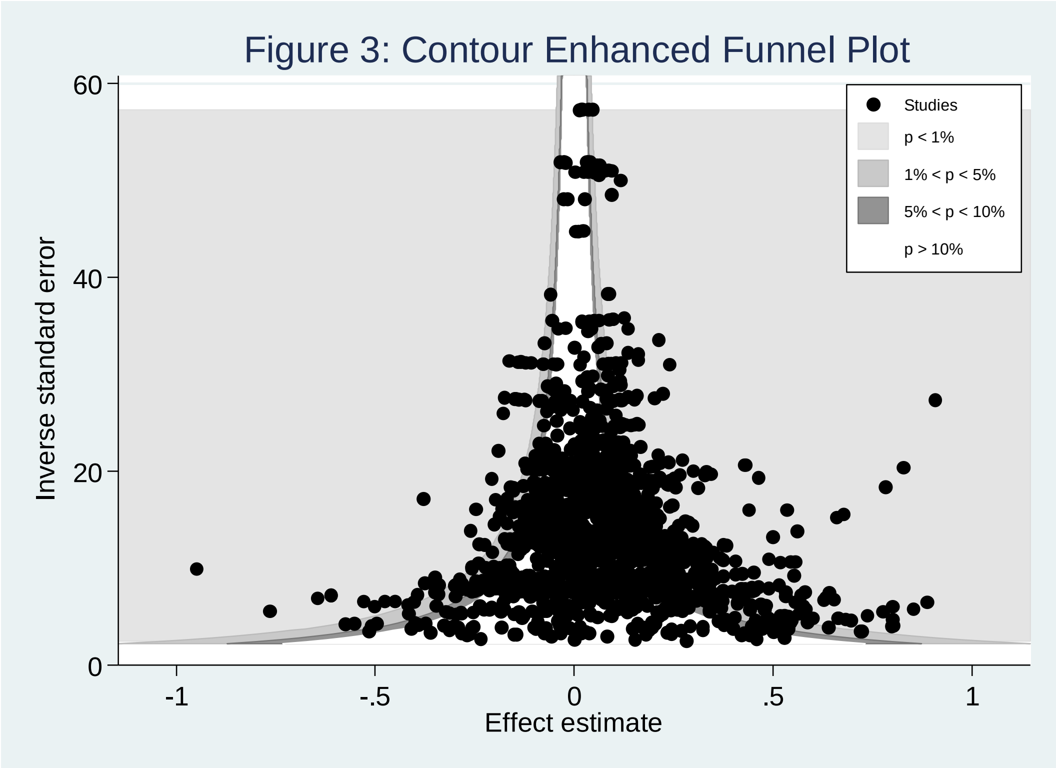
Figure 2: Funnel plot from the aid-growth literature



Source: Authors' computation.

A further check for publication bias can be done using contour enhanced funnel plots. This is based on the idea that the main reason for studies to remain unpublished is lack of statistical significance, with studies that cannot achieve standard levels of statistical significance being left out of mainstream publications (Dickersin 1997; Ioannidis1998). To check whether or not this is the case in the aid-effectiveness literature, we add contours of statistical significance on the funnel plot shown in Figure 1. This makes it easier to assess the statistical significance of hypothetically missing studies. That is, we can check whether the areas where studies are likely to be missing are areas of low statistical significance and whether areas where studies are more visible are areas of high statistical significance. Publication bias is likely to exist if the areas where studies are believed to be missing are areas of low statistical significance. As can be seen from the contour enhanced funnel plot depicted in Figure 3, this is not the case for the aid-effectiveness literature studied here.

Figure 3: Contour enhanced funnel plot



Source: Authors' computation.

Overall, the estimates are found to be reasonably distributed in the regions of both low and high statistical significance, and there is no evidence that studies with insignificant results are suppressed.

3.2 Cumulative meta-analysis and publication bias

Cumulative meta-analysis can also be used to display whether the combined effect estimate presented in Section 2 suffers from publication bias in the literature. This is done by first sorting studies based on their level of precision (from the most precise to the least precise) and adding studies to the analysis sequentially. That is, in the cumulative meta-analysis the first estimate represents an estimate of the most precise study, and the second estimate represents meta-analysis of the first two precise studies, and so on. The assumption here is that precise studies are less likely to suffer from publication bias, and it is the less precise studies that are likely to overstate their effect estimates to compensate for their large standard errors and arrive at a statistically significant effect. In other words, this can help us to see if the combined effect estimate is influenced by the effect estimates of the less precise studies that are likely to report biased (larger) effect estimates to increase their chances of publication. Thus, if the effect size increases as less precise studies are included in the analysis, it is likely that there is a bias from small studies (see Borenstein et al. 2009).

Figure 4 presents the cumulative meta-analysis of studies conducted over the 1970–2011 period. Here studies are sorted from most to least precise, and the vertical reference line represents the combined effect estimate based on the random-effects model.[8] While the circles show the cumulative effect estimates, the horizontal lines show the 95 per cent confidence intervals. On the vertical axis, study names ordered based on their level of precision are shown and the horizontal axis shows the partial effect estimate. Since the names of these 141 studies and respective cumulative effect estimates are not visible from this plot, we have presented the same cumulative meta-analysis in a table format (see Table A5).

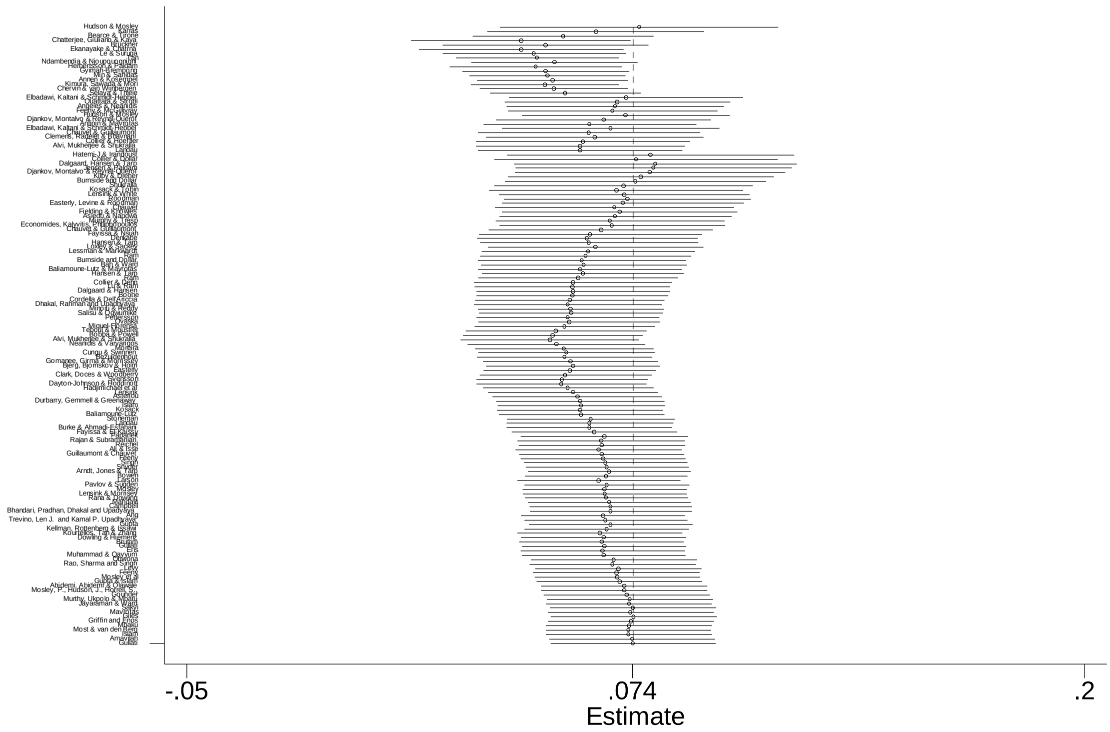
As can be seen from Figure 4 and Table A5, there is no as such consistent pattern of an increase in the cumulative effect estimate as less and less precise studies are added to the analysis. For instance, the most precise study has an effect estimate of 0.076 with a confidence interval from 0.037 to 0.115, while the cumulative meta-analysis of the ten most precise studies shows an estimate of 0.05. After that, the combined effect estimate starts to increase, reaching 0.07 and 0.08 with the top 20 and 30 precise studies added, respectively. As more and more (relatively less precise) studies are added, the cumulative effect rather shows a decline reaching 0.05 and slowly/gradually converging to 0.074.

In general, a further addition of the less and less precise studies does not reveal a steadily increasing clear pattern of the cumulative effect estimates to suggest existence of publication bias in the literature. Moreover, it is also worth noting that the confidence intervals from the cumulative meta-analysis of the least precise studies do overlap with the confidence intervals obtained from the cumulative effect estimates of the most precise studies.[9] This shows that the effect estimates from the most precise and least precise studies are not statistically significantly different, making the issue of publication bias less of a concern here.

[8] Unlike in the 0.058 combined effect estimate obtained from the standard random-effects study-regression level observations estimation reported in Section 2 (see Table 1), the 0.074 combined effect estimate obtained from this cumulative meta-analysis is based on study level 141 observations (see Table A2).

[9] i.e. comparing the confidence interval from the final rows (the least precise studies) with the confidence interval when the 1st, 10th, 20th etc. most precise studies are added to the analysis.

Figure 4: Cumulative meta-analysis: 1970–2011



Source: Authors' computation.

3.3 Regression-based test

Since visual inspection of a funnel plot is subjective, we also conduct a regression-based test to objectively assess the presence or absence of publication bias in the aid-effectiveness literature. Egger et al. (1997) is the most commonly used test to assess asymmetry in funnel plots. It regresses the standardized effect from each study on precision (inverse of standard error). The regression to be estimated takes the following form:

$$t_i = \beta_0 + \beta_1 \frac{1}{SE_i} + \nu_i \qquad (2)$$

where t_i is the standardized effect and $1/SE_i$ is the measure of precision. The parameters of interest are β_0 and β_1 which respectively capture bias and genuine effect. We estimate both a bivariate and multivariate version of Equation 2, where the latter is important given the considerable heterogeneity observed in the aid-effectiveness literature. Detailed discussion on the test and the importance of doing a multivariate analysis can be found in Mekasha and Tarp (2013).[10]

The result from the Egger et al. (1997) funnel asymmetry test is reported in Table 3. As can be noticed from the results in both the bivariate and multivariate regressions, the bias coefficient is found to be statistically indistinguishable from zero, confirming the absence of publication bias in the aid-growth literature in line with the funnel plot analysis. Moreover, in both the bivariate and

[10] For the multivariate FAT we used the same set of covariates as in Mekasha and Tarp (2013).

multivariate results, the coefficient of precision, which gives us the estimate of the impact of aid on growth, is found to be positive and statistically significant. Note that when we look at our preferred estimation which controls for all study characteristics (Column 2), the estimated effect of aid from the existing literature is 0.053 and statistically significant at 1 per cent. This is in stark contrast to the finding of DP15 who reported that this coefficient is insignificant in both a statistical and an economic sense.

Table 3: Funnel asymmetry test (FAT) meta-regression analysis (MRA) (dependent variable: standardized effect (t-stat))

	Old period		New period		Full sample	
	Bivariate	Multivariate	Bivariate	Multivariate	Bivariate	Multivariate
Precision	0.05	0.13***	0.04**	0.05**	0.03**	0.05**
	(0.03)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)
_cons	0.54*	0.37	-0.05	-1.42	0.38	-0.09
	(0.31)	(0.75)	(0.40)	(1.0)	(0.27)	(0.59)
N	731	715	1,047	1,047	1,778	1,762

Note: Standard errors in parentheses. * p < .1, ** p < .05, *** p < 0.01. Old period (1970–2004), new period (2005–11) and full sample (1970–2011).

Source: Authors' estimates.

Overall, based on graphical tools and the regression-based tests, publication bias is not found to be a concern in the aid-growth empirical literature. This confirms that the overall effect estimate obtained from the aid-effectiveness literature is not an artefact of publication bias.

4 Meta-regression analysis

As seen in Table 1, there is considerable heterogeneity in the aid-effectiveness literature. In this section we explore whether this observed heterogeneity can be attributed to one or more of the study characteristics. To this end, we employ a random-effects meta-regression analysis. In this regression, after estimating the between study variance τ^2 using methods of moments, the coefficient estimates are estimated using weighted least squares where $\frac{1}{\sigma_i^2 + \tau^2}$ is the weight.

The results from the meta-regression are presented in Table A6 in the appendix. According to the statistics reported at the bottom of the table, 72 per cent of the residual variation is due to heterogeneity of the true effect, with the remaining 18 per cent attributed to sampling variability. Moreover, the proportion of between study variance explained by the covariates can be seen from the adjusted R^2. This is calculated by comparing the estimated between study variance with its value when no covariates are included.[11] We note that 25 per cent of the between study variance is explained by the covariates and the remaining between study variance is found to be 0.008.

Coming to the role of the study characteristics in explaining the variation in reported effects, it appears that more than 20 covariates are important. However, caution needs to be exercised in interpreting the results from this regression. According to Higgins and Thompson (2004), testing several covariates without adjusting for multiplicity will lead to increased false positive rates in meta-regression. To deal with this issue, these authors suggest a permutation test to assess statistical significance in meta-regression and warn researchers not to make claims about statistical significance before conducting such a test. Thus, following the suggestion of Higgins and Thompson (2004), we conduct the permutation test on the meta-regression reported in the appendix.

The results are reported in Table 4. While the first column shows permutation p-values without adjustment for multiplicity, the second column shows p-values that are adjusted for multiplicity. After adjusting for multiple testing, only ten of the included covariates appear to have a role in explaining the heterogeneity in effect size and these are shown in bold in Table 4. We highlight that the type of publication outlet, data type (structure), and type of controls included in the growth regression are found to be important in explaining the observed heterogeneity in reported effect estimates of the impact of aid on economic growth.

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[11] $R^2_{Adj} = \frac{(\hat{\tau}_0^2 - \hat{\tau}^2)}{\hat{\tau}_0^2}$

Table 4: Monte Carlo permutation test for meta-regression p-values unadjusted and adjusted for multiple testing

Number of obs. = 1,761 Permutations = 20,000		
Partial	Unadjusted	Adjusted
Gender	0.891	1.000
Working paper	0.963	1.000
Cato	0.293	1.000
JDS	0.494	1.000
JID	0.498	1.000
EDCC	0.000	**0.000**
AER	0.654	1.000
Applied economics	0.039	0.829
Sub-sample	0.000	**0.007**
Low income	0.019	0.581
World Bank	0.519	1.000
Influence	0.112	0.991
Theory	0.004	0.174
Gap model	0.088	0.977
Panel	0.000	**0.005**
No. of countries	0.000	**0.008**
No. of years	0.488	1.000
Average	0.026	0.696
y1960s	0.006	0.238
y1970s	0.064	0.941
y1980s	0.006	0.238
y1990s	0.099	0.985
y2000	0.312	1.000
Outliers	0.820	1.000
Single country	0.000	**0.008**
EDA	0.080	0.968
Asia	0.122	0.995
Latin	0.813	1.000
Aid-institutions interaction	0.002	**0.078**
Aid-policy interaction	0.003	0.137
Aid square	0.010	0.391
Lag used	0.287	1.000
System growth and aid	0.064	0.941
System growth and capital	0.179	0.999
Capital	0.700	1.000
Human capital	0.077	0.958
FDI	0.402	1.000
Policies	0.030	0.750
Instability	0.423	1.000
Inflation	0.000	**0.001**
Fiscal	0.029	0.725
Size of government	0.000	**0.001**
Region dummy	0.031	0.753
Ethnic fractionalization	0.000	**0.002**
Financial development	0.000	**0.004**
Openness	0.219	1.000
Population	0.316	1.000
Per capita income	0.051	0.886
OLS	0.516	1.000
Africa	0.582	1.000

Note: See Table A1 for detailed description of the variables used in Table 4.

Source: Authors' estimates.

5 Conclusion

The main aim of this paper was to update the aid-effectiveness meta-analysis evidence documented in Mekasha and Tarp (2013), adding newly available studies that emerged from 2004 to 2011. To this end, we employed a random-effects model as this is the appropriate choice in the presence of considerable heterogeneity in the true effects, which is found to be the case in the aid-effectiveness literature.

The positive impact of aid on growth documented in Mekasha and Tarp (2013) is found to be robust to the inclusion of new studies in the meta-analysis and this appears to be true for different time horizons.

Having established this result, we carefully assessed whether publication bias has any impact on the observed effect estimates. Results from funnel plots, a regression-based test, and a cumulative meta-analysis for publication bias all suggest that publication bias is not a concern in the aid-growth literature and the observed effect is not an artefact hereof.

Finally, given the considerable heterogeneity observed in the data, we conduct a meta-regression analysis to explain the heterogeneity in reported effect estimates. After adjusting the p-values for multiple testing, it is found that only ten out of the 50 study characteristics appear to be important in explaining the observed heterogeneity. These include the type of publication outlet, data types, and the type of controls used in the growth regression.

In sum, careful meta-analysis, including more recent studies, does not suggest any material changes in the previously established insight that aid promotes growth in a statistically significant manner.

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Appendix

Table A1: Variables and their descriptions

Variables	Description	Variables	Description
Working paper	Binary dummy (BD) for unpublished paper	No. of countries	Number of countries included in the sample
Cato	BD for Cato journal	No. of years	Number of years covered in the analysis
JDS	BD for Journal of Development Studies	Africa	BD if countries from Africa included
JID	BD for Journal of International Development	Asia	BD if countries from Asia included
EDCC	BD for Economic Development and Cultural Change	Latin	BD if countries from Latin America included
AER	BD for American Economic Review	Single Country	BD if data from single country
Applied Economics	BD for Applied Economics	y1960s	BD if data for the 1960s
World Bank	BD for authors affiliated with the World Bank	y1970s	BD if data for the 1970s
Gender	BD if at least one of the authors is female	y1980s	BD if data for the 1980s
Expectations	BD for authors with realized expectations about aid-growth relation	y1990s	BD if data for the 1990s
Influence	BD for authors who acknowledge feedback from other authors in aid-effectiveness literature	Sub-sample	BD if data relate to sub-sample of countries
Panel	BD for use of panel data	Low income	BD if data related to sub-sample of low-income countries
EDA	BD for use of Effective Development Assistance Data	Financial development	BD for control of financial development
Aid square	BD if aid square term added	Ethnic fractionalization	BD for control of ethnic fractionalization
Interaction policy	BD for aid interacted with policy	Region dummy	BD for regional dummies
Interaction institutions	BD for aid interacted with institutions	Human capital	BD for control of human capital
Capital	BD for control of domestic savings or investment	Openness	BD for control of trade openness
FDI	BD for control of foreign capital flows other than aid	Population	BD for control of population size
Gap model	BD for two gap model	Per capita income	BD for control of per capita income
Theory	BD for paper developing a theory	Policy	BD for control of policies
Average	Number of years involved in data averaging	OLS	BD for use of OLS
Lag used	BD for use of lagged value of aid	Growth and aid	BD for equation system with a growth and an aid equation
Inflation	BD for control if inflation	Growth and capital	BD for equation system with a growth and a saving equation
Instability	BD for control of political instability		
Fiscal	BD for control of fiscal stance		
Size of govt.	BD for control of government size		

Source: Based on Doucouliagos and Paldam (2008).

Table A2: Meta-analysis of aid and growth literature: using observations at study level

Impact of aid on growth	Overall effect (bdl)	[95% CI]	Heterogeneity value (I^2) %	[95% CI]	Between study variance (τ^2)	N
Old period (1970–2004)	0.097	[0.061 0.134]	60.90	[49.57 69.69]	0.013	73
New period (2005–11)	0.058	[0.027 0.088]	77.53	[71.80 82.09]	0.010	68
Full sample (1970–2011)	0.074	[0.051 0.098]	71.28	[66.01 75.73]	0.011	141

Note: bdl refers to Bootstrapped DerSimonian-Laird random-effects model. Bootstrap of 10,000 repetitions is used in all cases. I^2 is a heterogeneity measure ranging from 0–100% where a larger score shows higher level of heterogeneity.

Source: Authors' estimates.

Table A3: Meta-analysis of aid and growth literature

Impact of aid on growth	Overall effect (bdl)	[95% CI]	Heterogeneity value (I^2) %	[95% CI]	Between study variance (τ^2)	N
Full sample	0.058	[0.052 0.064]	77.39	[76.36 78.37]	0.011	1,778
Period I: 1st Generation (1970–79)	0.292	[0.142 0.442]	90.48	[87.41 92.79]	0.139	28
Period II: 2nd Generation (1980–95)	0.108	[0.083 0.133]	46.44	[35.78 55.33]	0.009	169
Period III: 3rd Generation (1996–2007)	0.055	[0.047 0.064]	80.43	[79.26 81.53]	0.012	964
Period IV: 4th Generation (2008–11)	0.049	[0.040 0.058]	71.24	[68.83 73.46]	0.007	617

Note: bdl refers to Bootstrapped DerSimonian-Laird random-effects model. Bootstrap of 10,000 repetitions is used in all cases. I^2 is a heterogeneity measure ranging from 0–100% where a larger score shows higher level of heterogeneity.

Source: Authors' estimates.

Table A4: Cumulative random-effects meta-analysis of 141 studies: pattern of aid effectiveness over time

(Studies sorted in chronological order)

Trial	Cumulative estimate	95% CI Lower	95% CI Upper	z	P value
1970	0.411	0.110	0.713	2.671	0.008
1970	0.062	-0.670	0.795	0.167	0.867
1971	-0.065	-0.596	0.467	-0.238	0.812
1973	0.093	-0.343	0.530	0.418	0.676
1975	0.185	-0.148	0.518	1.090	0.276
1976	0.195	-0.103	0.493	1.285	0.199
1978	0.209	-0.042	0.460	1.634	0.102
1980	0.171	-0.064	0.406	1.429	0.153
1983	0.193	-0.015	0.401	1.819	0.069
1983	0.206	0.014	0.397	2.109	0.035
1985	0.205	0.038	0.373	2.401	0.016
1986	0.189	0.039	0.339	2.476	0.013
1987	0.181	0.039	0.324	2.499	0.012
1988	0.180	0.049	0.311	2.689	0.007
1988	0.203	0.072	0.334	3.042	0.002
1990	0.206	0.084	0.328	3.308	0.001
1990	0.192	0.077	0.308	3.265	0.001
1992	0.190	0.078	0.302	3.330	0.001
1992	0.182	0.085	0.279	3.663	0.000
1992	0.182	0.088	0.276	3.799	0.000
1993	0.172	0.078	0.265	3.607	0.000
1993	0.176	0.088	0.264	3.913	0.000
1994	0.183	0.096	0.271	4.115	0.000
1994	0.173	0.090	0.255	4.109	0.000
1994	0.180	0.098	0.262	4.322	0.000
1995	0.176	0.098	0.254	4.418	0.000
1995	0.164	0.087	0.241	4.180	0.000
1995	0.170	0.096	0.245	4.479	0.000
1996	0.168	0.094	0.241	4.485	0.000
1996	0.167	0.096	0.237	4.630	0.000
1998	0.167	0.099	0.235	4.829	0.000
1998	0.174	0.105	0.242	4.954	0.000
1999	0.177	0.110	0.243	5.209	0.000
1999	0.176	0.112	0.241	5.341	0.000
1999	0.167	0.103	0.231	5.115	0.000
2000	0.165	0.103	0.227	5.188	0.000
2000	0.161	0.101	0.220	5.320	0.000
2000	0.153	0.095	0.210	5.186	0.000
2001	0.152	0.098	0.206	5.490	0.000
2001	0.150	0.098	0.202	5.667	0.000
2001	0.146	0.096	0.196	5.751	0.000
2001	0.137	0.084	0.190	5.068	0.000
2001	0.127	0.073	0.182	4.595	0.000
2001	0.121	0.068	0.175	4.445	0.000
2001	0.118	0.066	0.170	4.476	0.000
2001	0.132	0.077	0.187	4.689	0.000
2001	0.134	0.080	0.188	4.836	0.000
2001	0.134	0.082	0.186	5.027	0.000
2001	0.136	0.085	0.188	5.148	0.000
2002	0.139	0.088	0.190	5.340	0.000
2002	0.136	0.085	0.186	5.231	0.000
2003	0.132	0.082	0.183	5.147	0.000
2003	0.130	0.080	0.179	5.143	0.000
2003	0.128	0.080	0.176	5.215	0.000
2003	0.127	0.080	0.174	5.277	0.000
2003	0.124	0.078	0.170	5.249	0.000
2003	0.126	0.080	0.171	5.382	0.000
2003	0.122	0.077	0.167	5.288	0.000
2003	0.121	0.077	0.166	5.382	0.000
2003	0.118	0.075	0.162	5.349	0.000
2003	0.122	0.079	0.165	5.555	0.000
2003	0.119	0.077	0.162	5.538	0.000
2004	0.116	0.074	0.157	5.428	0.000
2004	0.115	0.075	0.155	5.574	0.000
2004	0.111	0.071	0.151	5.395	0.000
2004	0.108	0.069	0.148	5.386	0.000
2004	0.104	0.064	0.143	5.166	0.000
2004	0.102	0.063	0.140	5.151	0.000
2004	0.098	0.060	0.136	5.039	0.000
2004	0.096	0.059	0.133	5.040	0.000
2004	0.100	0.063	0.138	5.242	0.000
2004	0.097	0.060	0.134	5.110	0.000
2004	0.097	0.060	0.133	5.218	0.000
2005	0.097	0.061	0.133	5.289	0.000
2005	0.096	0.061	0.130	5.433	0.000
2005	0.093	0.059	0.128	5.335	0.000
2005	0.091	0.057	0.125	5.239	0.000
2005	0.108	0.066	0.149	5.104	0.000
2006	0.107	0.066	0.148	5.118	0.000
2006	0.106	0.065	0.147	5.096	0.000
2006	0.104	0.065	0.142	5.264	0.000
2006	0.108	0.069	0.147	5.455	0.000
2006	0.106	0.067	0.144	5.385	0.000
2006	0.102	0.064	0.140	5.225	0.000
2006	0.101	0.064	0.139	5.270	0.000
2006	0.099	0.062	0.137	5.246	0.000
2006	0.097	0.061	0.134	5.215	0.000
2006	0.095	0.059	0.132	5.118	0.000
2007	0.093	0.059	0.128	5.348	0.000
2007	0.091	0.058	0.125	5.306	0.000
2007	0.089	0.056	0.123	5.231	0.000
2007	0.087	0.055	0.120	5.240	0.000
2007	0.086	0.054	0.118	5.230	0.000
2007	0.084	0.053	0.116	5.182	0.000
2007	0.084	0.053	0.116	5.247	0.000
2007	0.081	0.050	0.113	5.029	0.000
2007	0.080	0.049	0.112	4.974	0.000
2007	0.081	0.050	0.112	5.078	0.000
2007	0.082	0.051	0.113	5.151	0.000
2007	0.081	0.050	0.111	5.144	0.000
2007	0.081	0.050	0.111	5.170	0.000
2007	0.083	0.052	0.113	5.325	0.000
2007	0.081	0.051	0.112	5.293	0.000
2007	0.081	0.051	0.111	5.274	0.000
2007	0.080	0.050	0.109	5.254	0.000
2008	0.079	0.049	0.108	5.230	0.000
2008	0.078	0.049	0.107	5.257	0.000
2008	0.083	0.053	0.113	5.413	0.000
2008	0.082	0.053	0.112	5.486	0.000
2008	0.080	0.051	0.109	5.364	0.000
2008	0.081	0.052	0.110	5.473	0.000
2008	0.080	0.051	0.109	5.435	0.000
2008	0.079	0.051	0.108	5.455	0.000
2008	0.078	0.050	0.107	5.467	0.000
2008	0.080	0.052	0.108	5.569	0.000
2008	0.078	0.051	0.106	5.517	0.000
2009	0.078	0.050	0.105	5.505	0.000
2009	0.078	0.051	0.105	5.578	0.000
2009	0.077	0.050	0.104	5.548	0.000
2009	0.075	0.048	0.102	5.392	0.000
2009	0.075	0.048	0.102	5.487	0.000
2009	0.077	0.050	0.103	5.612	0.000
2009	0.077	0.050	0.103	5.667	0.000
2010	0.078	0.052	0.105	5.760	0.000
2010	0.077	0.051	0.103	5.863	0.000
2010	0.076	0.051	0.102	5.827	0.000
2010	0.075	0.049	0.100	5.759	0.000
2010	0.075	0.049	0.100	5.802	0.000
2010	0.073	0.049	0.098	5.795	0.000
2010	0.071	0.046	0.096	5.548	0.000
2010	0.071	0.047	0.096	5.655	0.000
2010	0.071	0.047	0.096	5.690	0.000
2010	0.072	0.047	0.096	5.794	0.000
2010	0.072	0.048	0.096	5.827	0.000
2010	0.072	0.048	0.096	5.898	0.000
2010	0.072	0.049	0.096	6.003	0.000
2011	0.072	0.049	0.095	6.054	0.000
2011	0.072	0.049	0.096	6.095	0.000
2011	0.074	0.050	0.097	6.194	0.000
2011	0.074	0.051	0.097	6.261	0.000
2011	0.074	0.051	0.097	6.317	0.000

Source: Authors' computation.

Table A5: Cumulative random-effects meta-analysis of 141 studies: assessing publication bias

(Studies sorted from most to least precise)

Trial	Cumulative estimate	95% CI Lower	Upper	z	P value
Hudson & Mosley	0.076	0.037	0.115	3.850	0.000
Karras	0.064	0.034	0.094	4.155	0.000
Bearce & Tirone	0.055	0.030	0.080	4.263	0.000
Chatterjee, Giuliano & Kaya	0.043	0.013	0.074	2.767	0.006
Brückner	0.050	0.021	0.078	3.411	0.001
Ekanayake & Chatrna	0.043	0.015	0.072	2.964	0.003
Le & Suruga	0.047	0.021	0.072	3.589	0.000
Tan	0.048	0.025	0.070	4.119	0.000
Ndambendia & Njoupouognigni	0.052	0.029	0.076	4.439	0.000
Herbertsson & Paldam	0.047	0.023	0.071	3.842	0.000
Gyimah-Brempong	0.050	0.027	0.073	4.220	0.000
Min & Sanidas	0.050	0.029	0.072	4.547	0.000
Annen & Kosempel	0.052	0.031	0.073	4.842	0.000
Kimura, Sawada & Mori	0.050	0.029	0.070	4.708	0.000
Chervin & van Wijnbergen	0.052	0.032	0.073	4.958	0.000
Selaya & Thiele	0.055	0.034	0.076	5.163	0.000
Elbadawi, Kaltani & Schmidt-Hebbel	0.072	0.040	0.105	4.344	0.000
Ouattara & Strobl	0.070	0.038	0.101	4.359	0.000
Angeles & Neanidis	0.069	0.039	0.100	4.490	0.000
Feeny & McGillivray	0.069	0.039	0.098	4.596	0.000
Hudson & Mosley	0.072	0.043	0.101	4.884	0.000
Djankov, Montalvo & Reynal-Querol	0.066	0.036	0.096	4.328	0.000
Antipin & Mavrotas	0.062	0.033	0.092	4.121	0.000
Elbadawi, Kaltani & Schmidt-Hebbel	0.068	0.038	0.098	4.407	0.000
Chauvet & Guillaumont	0.062	0.031	0.093	3.925	0.000
Clemens, Radelet & Bhavnani	0.064	0.033	0.094	4.126	0.000
Collier & Hoeffler	0.060	0.030	0.090	3.958	0.000
Alvi, Mukherjee & Shukralla	0.060	0.030	0.089	4.008	0.000
Landau	0.059	0.031	0.088	4.086	0.000
Hatemi-J & Irandoust	0.079	0.039	0.119	3.884	0.000
Collier & Dollar	0.075	0.036	0.114	3.736	0.000
Dalgaard, Hansen & Tarp	0.080	0.041	0.120	4.004	0.000
Jensen & Paldam	0.080	0.041	0.118	4.067	0.000
Djankov, Montalvo & Reynal-Querol	0.079	0.041	0.117	4.103	0.000
Kilby & Dreher	0.076	0.039	0.113	4.037	0.000
Burnside and Dollar	0.075	0.039	0.111	4.039	0.000
Shukralla	0.072	0.036	0.108	3.906	0.000
Kosack & Tobin	0.070	0.034	0.105	3.859	0.000
Lensink & White	0.072	0.037	0.107	4.033	0.000
Roodman	0.073	0.038	0.107	4.154	0.000
Easterly, Levine & Roodman	0.071	0.038	0.105	4.154	0.000
Chauvet	0.069	0.036	0.102	4.063	0.000
Fielding & Knowles	0.071	0.038	0.103	4.213	0.000
Asiedu & Nandwa	0.069	0.037	0.102	4.205	0.000
Murphy & Tresp	0.068	0.036	0.100	4.175	0.000
Economides, Kalyvitis, Philippopoulos	0.068	0.037	0.100	4.270	0.000
Chauvet & Guillaumont	0.065	0.034	0.097	4.095	0.000
Fayissa & Nsiah	0.062	0.031	0.094	3.928	0.000
Denkabe	0.062	0.031	0.092	3.926	0.000
Hansen & Tarp	0.062	0.032	0.092	4.015	0.000
Loxley & Sackey	0.064	0.034	0.094	4.170	0.000
Lessman & Markwardt	0.062	0.032	0.092	4.077	0.000
Ram	0.061	0.032	0.090	4.073	0.000
Burnside and Dollar	0.060	0.031	0.089	4.053	0.000
Bah & Ward	0.061	0.032	0.089	4.138	0.000
Baliamoune-Lutz & Mavrotas	0.059	0.031	0.088	4.102	0.000
Hansen & Tarp	0.060	0.032	0.088	4.214	0.000
Ram	0.059	0.031	0.087	4.152	0.000
Collier & Dehn	0.057	0.030	0.085	4.082	0.000
Lu & Ram	0.057	0.030	0.085	4.117	0.000
Dalgaard & Hansen	0.058	0.031	0.085	4.185	0.000
Boone	0.057	0.031	0.084	4.208	0.000
Cordella & Dell'Ariccia	0.057	0.030	0.083	4.203	0.000
Dhakal, Rahman and Upadhyaya	0.056	0.030	0.082	4.204	0.000
Minoiu & Reddy	0.057	0.031	0.083	4.297	0.000
Salisu & Ogwumike	0.057	0.031	0.083	4.348	0.000
Pettersson	0.056	0.031	0.082	4.320	0.000
Ovaska	0.056	0.031	0.082	4.385	0.000
Miquel-Florensa	0.055	0.030	0.080	4.313	0.000
Teboul & Moustier	0.053	0.028	0.078	4.113	0.000
Bobba & Powell	0.052	0.027	0.077	4.072	0.000
Alvi, Mukherjee & Shukralla	0.051	0.026	0.076	4.036	0.000
Neanidis & Varvarigos	0.053	0.028	0.078	4.191	0.000
Moreira	0.055	0.030	0.080	4.361	0.000
Cungu & Swinnen	0.056	0.031	0.080	4.440	0.000
Bezuidenhout	0.055	0.031	0.080	4.434	0.000
Gomanee, Girma & Morrissey	0.057	0.032	0.081	4.578	0.000
Bjerg, Bjornskov & Holm	0.058	0.033	0.082	4.667	0.000
Easterly	0.057	0.033	0.081	4.624	0.000
Clark, Doces & Woodberry	0.055	0.031	0.079	4.535	0.000
Svensson	0.055	0.031	0.078	4.487	0.000
Dayton-Johnson & Hoddinott	0.054	0.031	0.078	4.501	0.000
Hadjimichael et al	0.056	0.032	0.080	4.647	0.000
Lensink	0.058	0.034	0.081	4.768	0.000
Asteriou	0.059	0.035	0.082	4.881	0.000
Durbarry, Gemmell & Greenaway	0.060	0.036	0.083	4.971	0.000
Islam	0.060	0.036	0.083	5.019	0.000
Kosack	0.059	0.036	0.083	5.022	0.000
Baliamoune-Lutz	0.060	0.037	0.083	5.088	0.000
Stoneman	0.062	0.039	0.086	5.247	0.000
Landau	0.062	0.039	0.085	5.250	0.000

Burke & Ahmadi-Esfahani	0.062	0.039	0.085	5.272	0.000
Fayissa & El-Kaissy	0.063	0.040	0.086	5.390	0.000
Papanek	0.066	0.043	0.090	5.555	0.000
Rajan & Subramanian	0.065	0.042	0.089	5.504	0.000
Reichel	0.066	0.042	0.089	5.551	0.000
Ali & Isse	0.065	0.042	0.088	5.487	0.000
Guillaumont & Chauvet	0.066	0.043	0.089	5.580	0.000
Feeny	0.066	0.043	0.089	5.637	0.000
Singh	0.067	0.044	0.089	5.714	0.000
Snyder	0.067	0.044	0.090	5.775	0.000
Arndt, Jones & Tarp	0.068	0.045	0.090	5.851	0.000
Bowen	0.067	0.044	0.089	5.794	0.000
Larson	0.065	0.042	0.087	5.573	0.000
Pavlov & Sugden	0.067	0.044	0.090	5.715	0.000
Mosley	0.066	0.043	0.089	5.682	0.000
Lensink & Morrisey	0.066	0.044	0.089	5.718	0.000
Rana & Dowling	0.067	0.044	0.090	5.770	0.000
Mahdavi	0.068	0.045	0.090	5.849	0.000
Campbell	0.068	0.045	0.091	5.903	0.000
Bhandari, Pradhan, Dhakal and Upadyaya	0.068	0.046	0.091	5.930	0.000
Ang	0.066	0.043	0.089	5.663	0.000
Trevino, Len J. and Kamal P. Upadhyaya	0.067	0.044	0.089	5.744	0.000
Gupta	0.068	0.045	0.091	5.854	0.000
Kellman, Rottenberg & Issawi	0.067	0.044	0.090	5.739	0.000
Kourtellos, Tan & Zhang	0.065	0.042	0.088	5.548	0.000
Dowling & Hiemenz	0.066	0.043	0.089	5.635	0.000
Brumm	0.065	0.043	0.088	5.602	0.000
Gullati	0.066	0.043	0.089	5.671	0.000
Eris	0.066	0.043	0.089	5.654	0.000
Muhammad & Qayyum	0.066	0.043	0.089	5.697	0.000
Obwona	0.069	0.046	0.092	5.830	0.000
Rao, Sharma and Singh	0.069	0.045	0.092	5.817	0.000
Levy	0.070	0.047	0.093	5.926	0.000
Feeny	0.070	0.046	0.093	5.884	0.000
Mosley et al	0.070	0.047	0.093	5.923	0.000
Gupta & Islam	0.070	0.047	0.094	5.979	0.000
Abidemi, Abidemi & Olawale	0.072	0.049	0.095	6.077	0.000
Mosley, P., Hudson, J., Horrell, S.,	0.072	0.049	0.095	6.085	0.000
Gounder	0.072	0.049	0.096	6.147	0.000
Murthy, Ukpolo & Mbatu	0.073	0.050	0.097	6.224	0.000
Jayaraman & Ward	0.073	0.050	0.096	6.213	0.000
Sakyi	0.074	0.051	0.097	6.295	0.000
Mavrotas	0.074	0.051	0.097	6.250	0.000
Giles	0.074	0.051	0.098	6.315	0.000
Griffin and Enos	0.074	0.051	0.097	6.248	0.000
Mbaku	0.073	0.050	0.096	6.208	0.000
Most & van den Berg	0.073	0.050	0.096	6.211	0.000
Islam	0.073	0.050	0.096	6.226	0.000
Amavilah	0.074	0.051	0.097	6.290	0.000
Gullati	0.074	0.051	0.097	6.317	0.000

Source: Authors' estimates.

Table A6: Meta-regression analysis (dependent variable: partial correlation)

	Partial
Gender	-0.004
	(0.011)
Working paper	0.003
	(0.010)
Cato	-0.044
	(0.041)
JDS	0.018
	(0.021)
JID	-0.011
	(0.017)
EDCC	-0.178***
	(0.034)
AER	-0.016
	(0.033)
Applied Economics	-0.053*
	(0.029)
Sub-sample	-0.047***
	(0.014)
Low income	0.037**
	(0.018)
World Bank	-0.011
	(0.019)
Theory	0.027**
	(0.011)
Gap model	0.041
	(0.026)
Panel	0.093***
	(0.024)
No. countries	-0.001***
	(0.000)
No. years	-0.001
	(0.001)
Average	0.003**
	(0.001)
y1960s	-0.037**
	(0.014)
y1970s	0.026
	(0.016)
y1980s	-0.057***
	(0.020)
y1990s	-0.033*
	(0.019)
y2000	-0.010
	(0.011)
Outliers	-0.002
	(0.011)
Single country	0.140***
	(0.036)
EDA	-0.018
	(0.012)
Asia	-0.029
	(0.021)
Latin	0.009
	(0.021)
Aid-Institutions Interaction	-0.061***
	(0.019)
Aid-Policy Interaction	-0.036***
	(0.013)
Aid square	0.029***
	(0.010)
Lag used	0.012
	(0.010)
System growth and aid	-0.033
	(0.021)

System growth and capital	-0.037
	(0.030)
Capital	0.007
	(0.014)
Human capital	0.028*
	(0.016)
FDI	0.014
	(0.019)
Policies	-0.032**
	(0.015)
Instability	-0.008
	(0.011)
Inflation	-0.063***
	(0.015)
Fiscal	0.036**
	(0.015)
Size of government	0.056***
	(0.014)
Region dummy	0.019*
	(0.010)
Ethnic fractionalization	-0.049***
	(0.013)
Financial development	0.042***
	(0.011)
Openness	0.014
	(0.012)
Population	0.012
	(0.013)
Per capita income	-0.020
	(0.013)
OLS	-0.006
	(0.009)
Africa	-0.011
	(0.021)
Constant	0.146***
	(0.043)
Number of Obs.	1,761
F-stat	9.2
Between study variance	0.01
Heterogeneity Measure (%)	0.72
Adj R-squared	25.39

Note: Standard errors in parenthesis * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Source: Authors' estimates.