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A meta study

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Aid effectiveness on accumulation

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Abstract:

The AEL (aid effectiveness literature) studies the macroeconomic effect of development aid using cross-country or panel data econometrics. It contains about 100 papers of which 43 study whether development aid increases accumulation in the recipient country. Taking all 43 aid-accumulation studies together, the results show that aid has a small insignificant positive effect on investment, and a (fairly) small significant negative effect on domestic savings. The aggregate result is thus an unclear effect on accumulation, but with regional differences. When only studies of Latin American or Asian economies are considered, a small positive and statistically significant investment effect is found, together with a small negative effect on domestic savings. We conclude that in Asia and Latin America, aid is a substitute to domestic savings, but has a net positive impact on investment.

Jel.: B2, E21, E22, F35,

Keywords: Aid effectiveness, meta study, investments, savings

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1. Introducing the AEL, the Aid Effectiveness Literature

The most robust determinant of economic development is capital accumulation.[1] It can be analyzed from the savings or the investment side, and has both domestic and foreign sources. The international community wants to eradicate world poverty, and is hence to increase accumulation in the LDCs (less developed countries). The main external sources are foreign direct investment and development aid. It seems obvious that aid to development projects must increase accumulation in the recipient country. In the early 1960s most DCs (developed countries) started development aid programs with high hopes that it would work as well as the Marshall Aid did for the reconstruction of Europe after World War II.

It quickly became evident that development is much tougher than reconstruction. And already in 1970 Griffin and Enos demonstrated that development aid may substitute domestic savings, and thus have an uncertain effect on accumulation and growth. Even when few data existed on aid, they did present evidence supporting that view. Their paper has remained a challenge to the very idea of development aid, and since then the large literature has emerged, using the steadily increasing *data sample* of macro data on aid, investment, growth and aid.

We define the AEL (Aid Effectiveness Literature) as the empirical macro papers analyzing whether aid increases development, notably accumulation and growth. A thorough search of the literature produced the AEL-list of 97 papers given in Appendix 2.[2] The AEL is thus large, and it has produced all results possible: Aid is effective, ineffective or even harmful. Recently the literature has argued that the effectiveness depends on certain conditions, but it disagrees as to what the conditions are. The AEL is therefore a controversial literature that contains many different models, which we have classified in figure 1, by causal structure into 3 families:

A: 43 papers contain *accumulation estimates* of the impact of aid on savings or investment. This is the papers of types (*s*) and (*i*) in Appendix 2. The 43 studies found in this family of the AEL are covered in the present study.

B: 68 papers contain a total of 613 *direct estimates*, using reduced form models of the effect of aid on growth. Appendix 2 classifies them as type (*g*). They are covered in Doucouli-

1. See Levine and Renelt (1992), Easterly (2001) and Barro and Sala-i-Martin (2004).

2. Extensive searches of Econlit, Proquest, Web of Science and Google were undertaken, from which we could track citations backward. The list is made to cover the entire body of the AEL, and we believe we have caught almost everything, fulfilling our criteria. Unpublished working papers are only covered for the last decade. The search for studies terminated 1/1-2005, and it is restricted to papers in English.

agos and Paldam (2005a), which conclude that the AEL shows that aid has a small positive, but insignificant effect on growth.

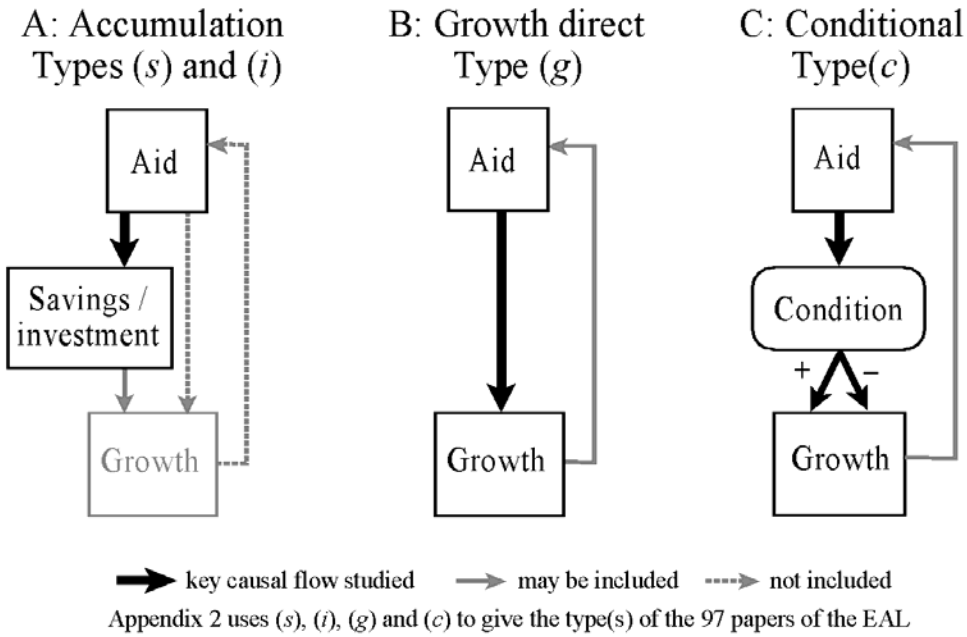
C: 31 papers contain *conditional estimates*, where the effect of aid on growth depends on a third factor *z*, so that growth results only if *z* is favorable. They are the papers of type (*c*) in Appendix 2, which are covered in Doucouliagos and Paldam (2005b). Till now 10 such *z*s have been proposed, but none have survived independent replication.

The present study – and the two parallel ones – applies the methods of meta-analysis to analyze and summarize the AEL. Appendix 1 gives a short introduction to the methods used, as the tests are specially developed to analyze studies using subsets of the same data. The paper asks two questions: (1) Has the literature determined if aid increases accumulation in the recipient country, and (if so) by how much? (2) Can we explain the pattern in the results?

This paper looks at aid effectiveness on economic development. We know that aid has many other explicit and implicit goals, but we believe that development is the ultimate goal of development aid.

The paper is organized as follows: Section 2 discusses the economic theory behind the models. Section 3 is the meta study of the aid-investment studies, while section 4 considers the aid-savings studies. Section 5 is the conclusion. Appendix 1 introduces the tools of meta-analysis used, while Appendix 2 lists the AEL.

Figure 1. The causal structure in the three families of AEL models



Appendix 2 uses (*s*), (*i*), (*g*) and (*c*) to give the type(s) of the 97 papers of the EAL

2. Theory of the causal link from aid to accumulation to growth

The accumulation part of the AEL is the oldest with the first paper from 1968, but it has continued to this day. As shown in figure 2, it started with savings studies using proxies for aid, and then it developed into a steady stream of either savings or investment models. As this research extends over almost 4 decades, it reflects a large part of the history of development economics. In spite of the changing theories, the basic empirical set-up has always been the models listed in table 1, though the control set $\boldsymbol{x}_{itj}$ has increased in size and sophistication. Also, the interpretation of the whole relation has changed.

Table 1. The studies included are based on models of the following types

$i_{it} = \alpha + \mu\, h_{it} + \boldsymbol{\gamma}_j \boldsymbol{x}_{jit} + u_{it}$		$s_{it} = \alpha + \mu\, h_{it} + \boldsymbol{\gamma}_j \boldsymbol{x}_{jit} + u_{it}$	
$i\ t$	index to countries and time [a)]	i_{it}	investment ratio of GDP, GNI
μ	estimated aid effectiveness	s_{it}	savings ratio of GDP, GNI
α, γ	coefficients to be estimated	h_{it}	aid as share of GDP, GNI
u_{it}	residuals	$\boldsymbol{x}_{itj}$	vectors of j controls

Note a. The time unit is normally 3-5 years. The aid variable h is often lagged by one period.

Figure 2. The development over time in the publication of AEL models

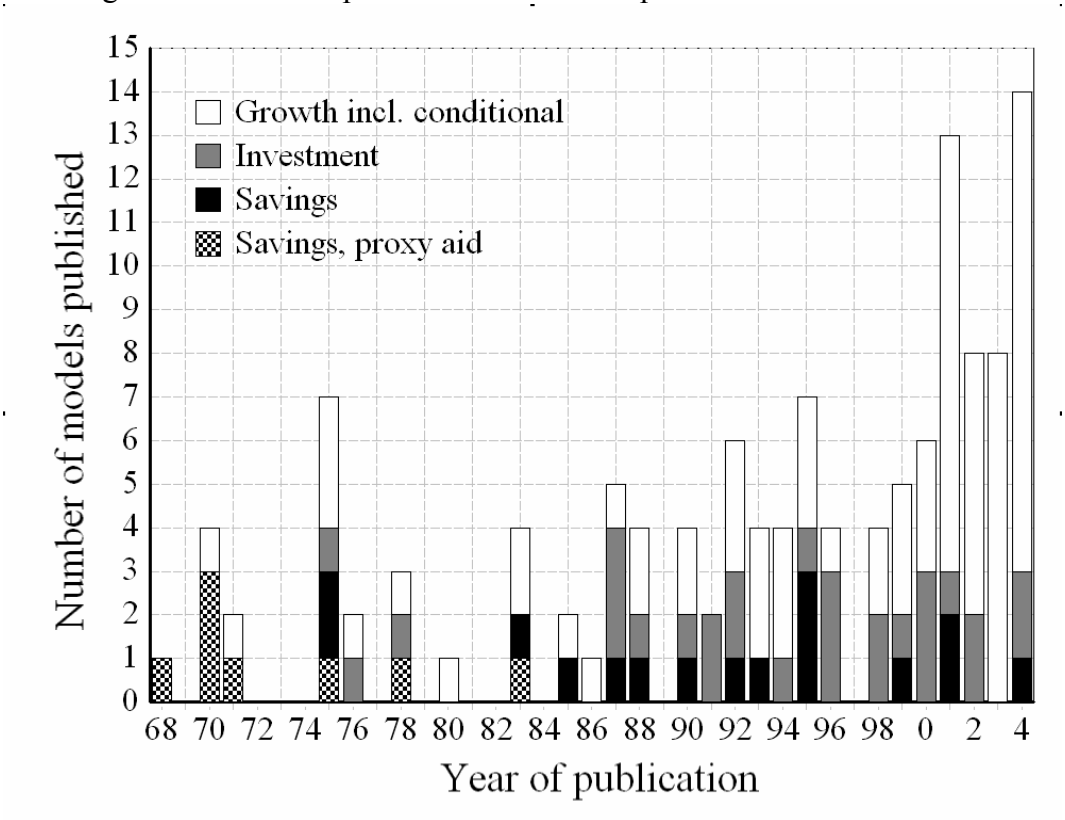


Table 2. The real variables in standard national accounting (GS: goods and services)

Variable	Definitions (see also table 1)	Some identities
Y	GDP, aggregate production	$Y = C + I + X - M$, domestic GS balance
	and aggregate private incomes	$Y = C + T + S_P$, private income balance
C_P, C_G	Private and public consumption	$C = C_P + C_G$
G	Government spending (net of transfers)	$G = C_G + I_G$
I_P, I_G	Private and public (gross) investments, $i = I/Y$ a)	$I = I_P + I_G$
S_P, S_G	Private and public savings, $s = S/Y$ a)	$S_P = Y - (C_P + T)$ and $S_G = T - C_G$
X, M	Exports on imports of goods and services	$XMB = X - M$, foreign GS balance
T, G	Taxes and government spending, both net of transfers	$TGB = T - G$, public GS balance
H	Development aid – financial variable, $h = H/Y$ a)	

Note a: The normalized variables s, i, h are used in the studies referred to in sections 3 and 4.

2.1 How to interpret the coefficients

When we turn to the empirical sections we shall meet a broad range of coefficients. Accordingly, it is important to know what the desired outcomes are: These follow from elementary national accounting. Table 2 presents the familiar definitions and the basic identities. With these definitions the domestic goods and service balance and the incomes balance are:

(1) $Y = C_P + C_G + I_P + I_G + (X - M) = C_P + I_P + G + XMB$

(2) $Y = C_P + T + S_P$ so that

$C_P + I_P + G + XMB = C_P + T + S_P$ or $(S_p - I_P) = XMB - TGB$

$S_G = T - C_G = TGB + G - C_G = TGB + I_G$ so that $S_G - I_G = TGB$, which gives us:

(3) $I - S = (I_P + I_G) - (S_P + S_G) = -XMB$, thus if $XMB \approx 0$, then domestic savings $S = I$

(4) $I - S = -H$ is the (ideal) situation where H finances a deterioration of XMB.

In this framework, development aid, H, is a device that allows the XMB to turn negative to allow investment to rise correspondingly. If S falls the rise in I is crowded out. The normalized variables (s, i, h) give the following classification of the possible results:

Table 3. Possible estimates of the coefficient, μ, to the investment and savings shares

Possible result for aid effectiveness	(1) Super	(2) Full	(3) Some	(4) None	(5) Harmful
Savings share, s	$\mu_s > 0$	$\mu_s \approx 0$	$0 > \mu_s > -1$	$\mu_s \approx -1$	$\mu_s < -1$
Investment share, i	$\mu_i > +1$	$\mu_i \approx +1$	$+1 > \mu_i > 0$	$\mu_i \approx 0$	$\mu_i < 0$

Note: The gray shading points to the less common results. Empirical results are given in tables 7 and 11.

2.2 Politics: New left and libertarian views

Several of the early papers on aid were rather explicitly political.[3] In the late 1960s to the mid 1970s some development researchers belonged to *New Left.* One of the key beliefs in that political orientation was that the poverty of the LDCs was due to the exploitation by the rich capitalist world. Development aid was a problem for this belief, as it was a flow on concessionary terms from the rich capitalist world to the poor countries. The writers of this school – most notably Griffin (1970) and Weisskopf (1972a and b), which will be further discussed – thus had to reveal why aid was counterproductive to its very purpose. The key result is that aid generates dependency, and that this is harmful in the longer run. This theme is explored by a dozen writers.

Some explicitly *libertarian* writers – notably Friedman (1958) and Bauer (1971) – have discussed aid and reached a critical view, by a remarkably parallel argument that only switched conclusions at the end: Aid allows countries to pursue unsound (socialist) policies that are harmful in the long run. Aid is thus often harmful. Finally, many trade-oriented economists have contrasted aid and trade, and concluded that trade is better, see e.g., Huges (2003) for a recent summary of the argument.

From both political schools thus follows that excessive aid may distort the economy of a country and create a low-growth economy. Several studies of such extreme cases exist, see e.g. Paldam (1997a). The recent literature on the Medicine Model of aid argues that an optimum amount of aid exists of about 10-20% of GDP, but the empirical proof of this position is not very strong.[4]

Three types of theory have played a large role in this family of the AEL, standard *IS-LM-macro theory* and the *Two-Gap model*, derived from Harrod-Domar growth theory, and modern *Growth Empirics*, derived from Neo-Classical as well as Endogenous growth theory.

2.3 IS-LM-macro theory:[5] *Fungibility and activity and capacity effects*

The AEL question deals with the activity or growth, ΔY or $g = \Delta Y/Y$, that is caused by a given amount H of aid that enters a country. The early AEL spent considerable efforts on classifying the primary effects, marginal effects and total effect in the categories of table 4. The table suggests two problems:

3. The papers by Weisskopf, Friedman and Bauer are not included in the AEL, but often cited.
4. The most spirited defense of the model is Hansen and Tarp (2000). It is one of the conditionality models covered in Doucouliagos and Paldam (2005b), see also Jensen and Paldam (2004).
5. Agenór and Montiel (1999) discuss how the standard theory is modified to be applicable to the typical LDC environment.

Table 4. Bookkeeping: The aid, H, received by a country

The aid is H	Consumption		Investment		Aggregate	Relation to
	Private	Public	Private	Public	GDP	the aid, H
Spent on (primary)	$\Delta^h C_p$	$\Delta^h C_g$	$\Delta^h I_p$	$\Delta^h I_g$	$\Delta^h Y$	*= H by definition*
Marginal change	$\Delta^a C_p$	$\Delta^a C_g$	$\Delta^a I_p$	$\Delta^a I_g$	$\Delta^a Y$	*≠ H normally*
Activity effect	ΔC_p	ΔC_g	ΔI_p	ΔI_g	$\Delta Y = m\,\Delta^a Y$	far from H
Capacity effect			ΔI_p	ΔI_g	$\Delta I = \Delta S$	far from H

Note: The superscripts to Δ are "h" for the expenditures actually financed by H, and "a" for the marginal activity due to H. The change in investments must be financed by a change in savings S – hence the equation in the bottom-right cell of the table.

The first problem is that aid is *fungible*, so even when it is easy to find out what aid actually finances (the Δ^h-set), it is surely different from the true marginal effects (the Δ^a-set) that differ from the total effect (the Δ-set). What gives the greatest difficulties is that while $H = \Delta^h Y$, it is unlikely that $H = \Delta^a Y$, i.e. that the marginal activity generated is anywhere like the size of the aid received. *A priori* it is not easy to predict the relation between the two. The AEL tries to bypass all fungibility complications by using *reduced form* estimates between aid and "final outcome" variables of table 1.

The second problem is to sort out the short-run *activity* effect, ΔY, and the longer run *capacity* effect, ΔI, which is surely the key purpose of development aid. The capacity effect deals with the accumulation effect of aid, i.e., the effect on investments, ΔI, which is, per definition, equal to the effect on *savings,* ΔS. The (IS, LM)-framework suggests that there is both an activity and a capacity effect. Table 5 shows how these effects can be analyzed in the annual level data, as was mainly done in the older AEL, and in the average growth rate data, as is mainly done in the newer AEL.

Table 5. Activity and capacity effects in the annual levels and average growth

	Annual level	Average 3-5 year rates			Problem
Effect	H	(h, g_{-1})-set	(h, g)-set	(h_{-1}, g)-set	Crowding out of
Activity	ΔY	None: Reverse	Full	None	ΔY or $g = \Delta Y/Y$
Capacity	$\Delta I = \Delta S$	causal direction	Some	Full	$\Delta I = \Delta S$

2.4 Crowding out: The challenges of Enos, Griffin and Boone

Standard IS-LM-theory typically starts with the calculation of the ideal effects, and then proceeds to show that some of both the activity and the capacity effect may be crowded out.

The AEL can thus be re-interpreted as a discussion of the amount of crowding out that occurs in practice from international transfers.

Consider first the crowding out of the activity effect: Within the IS-LM-framework it is hard to imagine that everything is crowded out, so that aid has no effect on economic activity with a time span of 1-2 years. It should still be visible with a time span of 3-5 years. We conclude that if the model is formulated unlagged, from h to g, it provides a crude estimate of $\mu \approx m$. However, if it is lagged, from h_{-1} to g, the estimate μ is the capacity effect, and hence it is much more what is meant by development.

Most of the discussion has concerned the crowding out of the capacity effect: The idea of a negative reaction of domestic savings to aid was known in the early literature as the *Havelmo hypothesis.*[6] It was considered by Rahman (1968) and Ahmed (1970), as regards external transfers in general, and aid in particular. It was sharpened and reformulated by Enos and Griffin (1970), Griffin (1970) and Weisskopf (1972) in an anti-imperialist framework as discussed earlier.

It was rediscovered by Boone (1996) in still another setting. He noted that almost all aid was given to government, and he found that the marginal activity of the average LDC government was government consumption, so aid leads to an increase in public consumption only, per the bookkeeping identities in section 2.1. This results in a fall in public savings of the same size as the aid, and thus a full crowding out of the investment effect of aid. Boone thus finds an activity effect, but a full crowding out of the capacity effect of aid.

Table 6. Two challenges to aid

	Marginal activity caused by aid	Origin of challenge
C1	Aid reduces domestic savings by the same amount	Enos and Griffin (1970) and Weisskopf (1972b)
C2	Aid increases public consumption by the same amount	Boone (1996)

Note: While (C2) => (C1) the reverse causality does not hold.

2.5 Two-gap models

From the start in 1970 to the mid 1980s, the AEL was based on linear Keynesian growth models of the *Harrod-Domar type*, which was made to dynamize the real parts of the IS-LM-model.[7] The policy implication of the theory was that the main constraint to development was the *savings* necessary to finance investments. The original Harrod-Domar-model is a closed

6. It appears as a suggestion in a comment to Leontieff (1965) on the savings function in LDCs.
7. In particular, this applies to the Harrod model that explicitly extends the 45° real Keynesian model.

private sector model, so savings are constrained by domestic savings behavior. The introduction of a public sector budget balance gives the *first gap*. When the model is opened, the balance of payment provides a *second gap*.[8] Here savings can be provided via transfers from the DC world, preferably in the form of development aid. Aid thus moves the constraint outward and increases investment and growth. To the extent that the savings effect of aid is crowded out, this conclusion fails.

The Harrod-Domar model gradually disappeared from the theory of economic growth during the 1960s, but somehow it lingered on in development economics due to its operationality, and the clear policy prescriptions it generated. However, gradually the Harrod-Domar framework was replaced by the more flexible *neo-classical framework*. Since the 1990s the AEL has used state of the arts growth theory. It implies a richer set of channels from aid to growth, and proposes that aid effectiveness is analyzed directly from aid to growth.

2.6 Modern growth empirics: The Barro model and the Fiscal Response model

During the past decade most models have been based on versions of the Barro model:

(5) $g_{it} = \alpha + \beta y_{it} + \boldsymbol{\gamma_j x_{jit}} + u_{it}$,

where g is growth, and y is initial GDP level at the start of each period, see table 1. This is the main framework in modern growth empirics. It is easy to amend to an aid effectiveness relation if the aid share, h_{it}, is included as one of the controls, and it is singled out as special, while y_{it} is regarded as just another control. The model thus becomes:

(6) $g_{it} = \alpha + \mu h_{it} + \boldsymbol{\gamma_j x_{jit}} + u_{it}$, this is the basic model in family (B) of the AEL.

In papers that estimate aid effectiveness on growth with (5), it is not uncommon to have a special section that takes up the challenge, and replaces growth with a savings or investment ratio. This gives the models of table 1.

The main problem with these models is that they put so few restrictions on the choice of the control set $\boldsymbol{x}$ that they can produce almost any result desired. Jensen and Paldam (2004) show that the result may easily be models that are due to mining of quirks in the data, so that they collapse once independent researchers try to replicate them on new data.

8. The best known model of this type is Chenery and Strout (1966), constructed to calculate the need for aid. Chapter 2 in Easterly (2001) tells the sad story of the savings gap in development.

Several attempts have been made to produce more structural models. The most prominent of these is the *Fiscal Response Model*. It was first proposed by Heller (1975), Gang and Khan (1991) and Boone (1996). Recently it has been used in 6 papers by Morrison, Mavrotas and others. These models attempt to model the underlying decision-making process and the underlying political economy considerations. There are problems associated with this. On the one hand, if the underlying structural modeling is incorrect, it can influence the estimated parameters and hence inference. On the other hand, these studies at least force the researcher to consider the underlying economic associations. In our meta study, we explore the differences in results arising from these categories, to see whether this methodological difference influences study outcomes.

3. Investment effects

The impact of aid on investment has been explored in 29 studies. As explained the criterion for aid effectiveness in the investment studies is simply that investment rises, but to the extent that aid is for development project, investment should rise by the same amount as the aid, so the coefficient should be +1, for full efficiency.

The studies are: Heller (1975); Halevi (1976); McGowan and Smith (1978); McGuire (1987); Mosley *et al.* (1987); Levy (1987; 1988); Mahdavi (1990);Gang and Khan (1991); Khilji and Zampelli (1991); Gyimah-Brempong (1992); Khan and Hoshino (1992); Boone (1994; 1996); Hadjimichael *et al.* (1995); Otim (1996); Snyder (1996); Feyzioglu *et al.* (1998); Franco-Rodriguez *et al.* (1998); Dollar and Easterly (1999); Lensink and Morrisey (2000); McGillivray (2000); Franco-Rodriguez (2000); Larson (2001); Hansen and Tarp (2001); Gomanee *et al.* (2002); Mavrotas (2002); Quazi (2004) and Collier and Dollar (2004); From these studies we derive two datasets. The ***best-set*** refers to the best estimates of the aid-investment association reported in each study. This produces 37 estimates.[9] The ***all-set*** refers to all estimates (of the aid accumulation relation) reported in each study.[10] The 29 studies report a total of 122 estimates of the aid-investment association.

9. In some cases, we include more than one estimate from each of the best set papers, when different sub-samples are used.
10. The datasets are available from the authors.

3.1 Features of the data

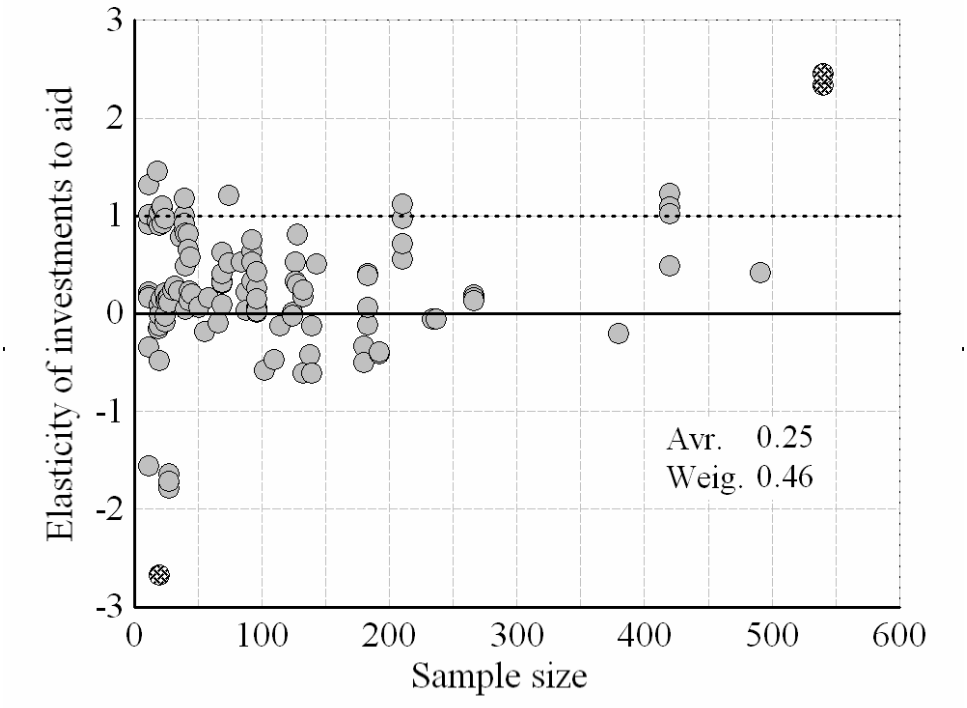
Table 7 categorizes the estimated aid-investment elasticities according to their statistical significance and direction as proposed in table 3. The first two columns of Table 7 are surely overly optimistic, as they test for a full effect, where all aid is invested or a greater amount in invested (first column). Not surprisingly it appears that it is not. However, most estimates are positive, although less than half are statistically significant. So, it appears that on average aid has some effect on investments.

Table 7. Meta-extreme bounds analysis: Aid-investment elasticities

Possible result for aid effectiveness	(1) Super	(2) Full	(3) Some	(4) None	(5) Harmful
Investment share, i	$\mu_i > +1$	$\mu_i \approx +1$	$+1 > \mu_i > 0$	$\mu_i \approx 0$	$\mu_i < 0$
Best-set of estimates (n = 37)	0 (0%)	10 (28%)	8 (22%)	15 (41%)	4 (11%)
All-set of estimates (n = 122)	1 (1%)	24 (20%)	18 (15%)	60 (50%)	19 (16%)

Note: See tables 3 and 11.

Figure 3. Funnel plot, aid-investment elasticities, all-set



Note: Two averages are given: "Avr" is the simple average, while "Weig" is the averages weighted by the sample size. The "upturn" for the large samples causes the weighted average to be almost twice as large as the simple average. The points with a checkered pattern appear unreasonable.

Figure 3 is a funnel plot showing combinations of sample size and aid-investment elasticities. The funnel looks unusual as it turns upward for large samples, due to several points with very high effectiveness at the right side. Unfortunately the two most positive points seem unreasonably high.

3.2 Is the aid-investment effect well established?

Table 8 presents our key meta-analysis for the best-set, all-set and various sub-sets of our data. The number of estimates is reported in column 1. The average aid-investment elasticities are reported in column 2. The medians are reported in column 3, and the weighted average elasticities in column 4. The sample size was used to weigh each elasticity. Since sample size differs between studies, it is strongly recommended that study results are weighted (see Hunter and Schmidt 2004). The weighted aid-investment elasticity is +0.60 for the best-set and +0.46 for the all-set, implying that a 10 percent increase in the aid/GDP ratio increases I/GDP by 6% and 4.5%, respectively. This is of economic significance.

The weighted average elasticity for public sector investment is +0.47, while for private sector investment the effect is, interestingly, in the opposite direction, -0.09. The last three rows present meta-analysis of specific groups of nations. Since it is not possible to separate the results entirely on a continent basis, we do so by exclusion. For example, the Asian nations sub-group includes all the studies that use data for Asian nations. However, it should be noted that this sub-group will also include observations relating to other countries.

Table 8. Descriptive statistics, aid-investment elasticities

	(1)	(2)	(3)	(4)	(5)		(6)	
Group	N	Unweighted Average	Median	Weighted average	MST [a)] Coeff	(t-test)	MSTMRA [a)] Coeff	(t-test)
Best-set	29	0.33	0.22	0.60	-0.04	(0.34)	-0.01	(0.02)
All-set	122	0.25	0.21	0.45	-0.01	(0.13)	0.03	(0.30)
Public Investment	30	0.37	0.38	0.47	-0.42	(1.16)	-0.15	(0.35)
Private Investment	26	0.08	0.11	-0.09	0.11	(1.05)	0.18	(1.48)
Gross Investment	66	0.25	0.16	0.62	0.13	(0.98)	-0.03	(0.24)
With Asian samples	67	0.15	0.15	0.20	0.14	(0.93)	0.33	(1.88)*
With Africa samples	91	0.36	0.23	0.51	0.10	(0.96)	0.06	(0.33)
With Latin samples	46	0.23	0.15	0.23	0.22	(1.64)	0.32	(2.30)*

Note a. Dependent variable is ln $|t_i|$. Reported coefficients to ln(df). * statistically significant at the 10% level.

Full regression results are available from the authors.

The key issue then is whether the effects reported in columns 2, 3 and 4 are statistically significant. We follow Stanley (2001 and 2005) and explore statistical significance through meta-significance tests. Following the work by Card and Krueger (1995), Stanley points out that if there is a real effect between two variables – in our case development aid investment – then there should be a positive relationship between the natural logarithm of the absolute value of the t-statistic and the natural logarithm of the degrees of freedom in the regression:

$$(7) \quad \ln \left| t_i \right| = \alpha_0 + \alpha_1 \ln df_i + \varepsilon_i$$

where t_i and df_i denote the t-statistic and degrees of freedom from study *i*, respectively, and ln is the natural logarithm. The MST results are presented in Table 8, column 5, where the coefficient on $\boldsymbol{\alpha_1}$ is presented and its associated t-statistic. The only sub-population that emerges with an MST slope coefficient that comes close to significance is Latin.

Doucouliagos (2005) and Stanley (2005) recommend that the MST be conducted in a multivariate context. This involves the addition of a vector of covariates. These control variables are listed in Table 9. Differences in data are captured by the *Panel*, *Size*, *Gross* and *Private* variables. Regional differences are captured by the *Asia* and *Latin* variables. Modelling differences are captured by the *Barro* and *Fiscal* variables. *Growth* is included as a proxy for additional equations considered in the other papers of our project. Studies that estimate growth regressions model how aid and investment affect the growth process. This raises the specter of endogeneity. Some studies control for endogeneity, while others do not. We wish to test whether this affects the results.

Table 9. Definition of variables for the meta-regression analysis

Variable	BD means binary dummy. It is 1 if condition fulfilled, otherwise 0	Mean	St dev
Endogeneity	BD if controlled for endogeniety of aid	0.34	0.48
Institutions	BD if controlled for institutions of aid	0.07	0.25
Panel	BD for use of panel data	0.48	0.50
Growth	BD if estimated also a growth equation	0.37	0.48
Fiscal	BD estimated a fiscal response model	0.27	0.45
Barro	BD estimated a Barro type model	0.46	0.50
Size	Sample size – number of countries times number of years	107	114
Gross	BD if study used Gross Investment data	0.54	0.50
Private	BD 1 if study used Private Investment data	0.21	0.41
Asia	BD if study used data relating to Asian economies	0.56	0.50
Latin	BD if study used data relating to Latin economies	0.43	0.50

When these control variables are added, the resulting model is known as a Meta-Significance Meta-Regression Model (MSTMRA). This informs on whether there is a real effect, after controlling for other key study characteristics. The results are presented in column 6 of table 8. We see now that both Asia and Latin emerge with a statistically significant association between aid and investment. Hence, we conclude that when we take the full pool of studies, there is *no* evidence of an aid-investment effect. However, there is an aid-investment effect among Asian and Latin American economies. Our best estimate, from the available set of evidence, of the aid-investment elasticity for the Asian and Latin American economies is +0.20 and +0.23, respectively. Hence, for Asian economies, increasing the aid share from 1% to 5% would increase the investment share by 0.8 percentage points.

Table 10. Meta-regression analysis of aid-investment elasticities

(Dependent variable = aid-investment elasticities)

Variable	(1) OLS		(2) OLS		(3) Bootstrap		(4) Bootstrap	
	Coeff	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
Constant	-0.45	(-1.10)	-0.24	(-1.22)	-0.45	(-0.94)	-0.24	(-1.28)
Institutions	0.30	(0.83)	0.33	(1.26)	0.30	(0.82)	0.33	(1.16)
Endogeneity	0.42	(2.84)***	0.43	(3.72)***	0.42	(2.39)**	0.43	(3.04)***
Panel Data	0.003	(0.02)	-		0.003	(0.01)	-	
Growth	0.33	(2.17)**	0.34	(2.38)**	0.33	(1.96)*	(0.34)	(2.17)**
Fiscal Response	0.73	(1.67)*	0.52	(2.33)**	0.73	(1.33)	0.52	(2.35)**
Barro type	-0.58	(-2.16)**	-0.59	(-2.75)***	-0.58	(-2.35)**	-0.59	(-3.03)***
Sample Size	0.002	(2.98)***	0.002	(3.97)***	0.002	(2.98)***	0.002	(3.66)***
Gross	0.24	(0.53)	-		0.24	(0.45)	-	
Private	0.22	(0.59)	-		0.22	(0.46)	-	
Asia	-0.27	(-1.12)	-0.23	(-1.05)	-0.27	(-1.02)	-0.23	(-1.09)
Latin	0.55	(1.65)	0.54	(1.84)*	0.55	(1.51)	0.54	(1.62)
Adjusted R^2	0.22		0.24		0.22		0.22	
Sample Size	122		122		122		122	

Note: *, **, *** statistically significant at the 10%, 5% and 1% levels, respectively.

3.3 Accounting for heterogeneity

As seen from figure 3, reported estimates differ widely across studies. Meta-regression analysis (MRA) can be used to explore the heterogeneity in the reported results. This involves estimating a regression model where the dependent variable is the aid-investment elasticity

and a vector of explanatory variables are included to capture study differences (listed in table 8). The MRA coefficients quantify the impact of studies' differences on the reported aid-investment elasticities.

The MRA results are reported in table 10 for the all-set. Column 1 reports the general model (with all control variables added) applied to the all-set, estimated by OLS. The MRA was reestimated with variables with t-statistics less than 1 eliminated, and the results are presented in column 2. Some of the observations in the all-set are statistically dependent.[11] Consequently we use the bootstrap to derive standard errors (Efron and Tibshirani 1993) as reported in columns 3 and 4

Controlling for endogeneity leads to larger aid-investment effects. Studies that also estimate growth equations also find larger aid-investment effects. Fiscal response models find larger effects, while Barro type models find smaller effects. Fiscal response studies use a system of equations that is estimated using 3SLS. Barro type studies are normally single equation studies. There is no difference between studies on the basis of the type of investment – private or public. Compared to African nations, the inclusion of Latin American countries in the sample leads to larger effects, while the inclusion of Asian countries leads to lower effects, although these results are not statistically significantly different from zero.[12]

4. Savings

We now turn to the 24 studies of the aid to savings relation. As discussed in section 2.1 the critical outcome is if the effectiveness coefficients are well above –1, although an effect between -1 and 0 also represents displacement.

4.1 The papers with some statistics

The aid-savings association was first studied by 8 studies, which used proxies for aid as genuine aid data were not available: Rahman (1968); Griffin and Enos (1970); Griffin (1970); Gupta (1970); Ahmed (1971); Over (1975); Fry (1978) and Giovannini (1983). The relation has been explored by 16 studies, using proper aid data. They are: Papanek (1973); Gupta (1975); Gupta and Islam (1983); Singh (1985); Bowles (1987); Rana and Dowling (1988);

11. That is, some studies contribute more than one estimate to our dataset, and these estimates are conceptual replications.

12. Note that there is no inconsistency between the results presented in Tables 8 and 10. Table 10 explores the factors that lead to differences in reported elasticities, while Table 8 explores whether the reported elasticities are statistically significantly different from certain values (0 and 1).

Snyder (1990); Gyimah-Brempong (1992); Lensink (1993); Hadjimichael et al. (1995); Bowen (1995); Reichel (1995); Campbell (1999); Hudson and Mosley (2001); Larson (2001) and Ouattara (2004).

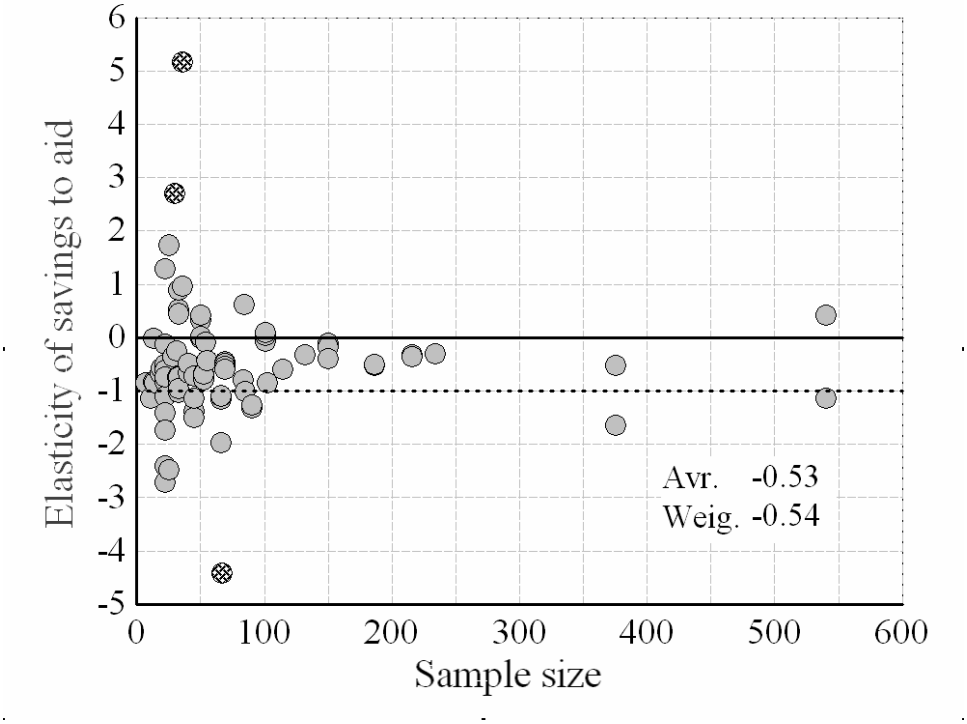
Table 11 gives a first survey of the results using the format of tables 3 and 7. The table shows that a great majority of the studies find that aid reduces domestic savings (columns 3 and 4). However, the results are not as bad as in the challenges presented in table 6. Many studies find that only *some* of the aid is crowded out by a fall in domestic savings.

Table 11. Meta-extreme bounds analysis: Aid-savings elasticities

Possible result for aid effectiveness	(1) Super	(2) Full	(3) Some	(4) None	(5) Harmful
Savings share, s	$\mu_s > 0$	$\mu_s \approx 0$	$0 > \mu_s > -1$	$\mu_s \approx -1$	$\mu_s < -1$
Best-set of estimates (n = 23)	3 (13%)	3 (13%)	5 (22%)	10 (43%)	2 (9%)
All-set of estimates (n = 89)	7 (8%)	24 (27%)	34 (38%)	21 (24%)	3 (3%)

Note: See tables 3 and 7.

Figure 4. Funnel plot of aid-savings elasticities



Note: See figure 3. It is assuring that the two averages are almost the same.

Figure 4 shows how the results look in the form of a funnel plot. It looks much more like a typical funnel plot than figure 3. The results have an amazing variation, but now the variation falls in the larger samples.

Seen from the point of view of simple bookkeeping one may interpret the investment-aid elasticity of $\eta(i,h) \approx 0.46$ and the savings-aid elasticity of $\eta(s,h) \approx -0.54$ as follows: As the two numbers are relative to the same aid variable, the fact that $\eta(i,h) - \eta(s,h) \approx 1$ means that the BOP remains unchanged by the aid, while a little more than half of the aid is crowded out by falling savings, so that investments increase by almost half of the aid. These are relatively optimistic conclusions. If the value of $\eta(i,h) \approx 0.25$ is considered more reasonable aid of 1% of GDP gives an improvement in the BOP of about 0.2% of GDP.

4.2 The meta-analysis

The results just presented show that aid is partly effective; but it is not obvious if the overall result is significant. Table 12 presents the basic meta-analysis results for the aid-savings elasticities (similar to table 8).

Table 12. Descriptive statistics, aid-savings elasticities

(1) Group	N	(2) Unweighted Average	(3) Median	(4) Weighted Average	(5) MST [a)] Coeff	(t-test)	(6) MSTMRA [a)] Coeff	(t-test)
Best-set	23	-0.90	-0.79	-0.83	0.02	(0.20)	-0.07	(0.53)
All-set	61	-0.66	-0.72	-0.62	0.23	(2.67)*	0.42	(2.26)*
Best-set, with proxies	31	-0.72	-0.61	-0.73	-0.05	(0.42)	-0.17	(0.99)
All-set, with proxies	86	-0.53	-0.59	-0.54	0.13	(1.54)	0.42	(2.24)*
With Latin samples	31	-0.82	-0.86	-0.77	0.01	(1.27)		
With Asian samples	16	-0.65	-0.49	-0.48	0.01	(0.95)		
With Africa samples	25	-0.32	-0.40	-0.32	0.01	(0.65)		
Regional dummies	49							
Africa					0.99			
Asia					4.93	†*		
Latin					5.64	†**		

Note a. Dependent variable is $\ln|t_i|$. Reported coefficients to ln(df). * statistically significant at the 10% level. Full regression results are available from the authors. † refers to Wald test.

Table 12 reports the summary statistics for the aid-savings elasticities, as well as the test results for MST and MSTMRA. Columns 5 and 6 show that the slope coefficient for the MST test is statistically significant for the all-set. That is, there is an established association between development aid and savings, but the effect disappears when we consider only the best estimates. We conclude that the literature provides evidence that aid has a negative effect on domestic savings. None of the MST results for the individual regions are statistically

significant, perhaps due to the small number of observations. Accordingly, we estimated an MST with three regional dummies as well as interaction terms between regional dummies and ln(*df*)[13]. The last three rows of column 8 report Wald tests on the restriction that the regional dummies and the interaction terms are jointly equal to zero.[14] We reject this hypothesis for the Asian and Latin American dummies. That is, MST indicates that there is an aid-savings association among Asian and Latin American economies. Our best estimate of the aid-savings effect is -0.34 and -0.29, for Asia and Latin America, respectively.

Table 13 reports the MRA analysis for the aid-savings elasticities (similar to Table 10). Our interpretation is again based on the bootstrap results. The use of panel data leads to larger aid-savings elasticities. Relative to non-Asian and non-Latin American economies, the aid-savings association is greater when Asian data is included and smaller when Latin American data is used.

Table 13. Meta-regression analysis of aid-savings elasticities

(Dependent variable = aid-savings elasticities)

Variable	(1) OLS		(2) OLS		(3) Bootstrap		(4) Bootstrap	
	Coeff	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
Constant	-0.18	(-0.17)	-0.63	(-1.16)	-0.18	(-0.22)	-0.66	(-1.09)
Lag Aid	-0.17	(-0.46)	-		-0.17	(-0.50)	-	
Lag Savings	-0.48	(-0.53)	-		-0.48	(-0.55)	-	
Panel Data	1.21	(1.85)*	1.25	(2.43)**	1.21	(1.70)*	1.25	(2.36)**
Endogeneity	0.51	(0.83)	0.35	(1.07)	0.51	(0.47)	-	
Proxy	-0.93	(-0.65)	-		-0.93	(-0.53)	-	
Sample Size	-0.004	(-1.26)	-0.003	(-1.48)	-0.004	(-1.07)	-0.002	(-1.17)
Asia	0.50	(1.25)	0.51	(1.55)	0.50	(1.15)	0.58	(1.72)*
Latin	-1.51	(-1.78)*	-1.21	(-2.25)**	-1.51	(-1.97)*	-1.21	(-2.25)**
Adjusted R^2	0.10		0.14				0.14	
Sample Size	50		50				50	

Notes: *, **, *** statistically significant at the 10%, 5% and 1% levels, respectively.

The result from the 24 savings studies is thus a small effect of dubious significance. The challenge of Enos and Griffin still stands. A large part – may be all – of aid is crowded out by a corresponding fall in domestic savings. The mechanism proposed by Boone is that the whole of the savings drop is caused by the public sector, which has public consumption as the marginal activity increased by aid, whereby public savings is correspondingly reduced. We

13. That is, we estimate $\ln \left| t_i \right| = \alpha_0 + \alpha_1 \ln df_i + \alpha_2 Asia + \alpha_3 Latin + \alpha_4 \ln df_i x Asia + \alpha_5 \ln df_i x Latin + \varepsilon_i$

14. Thus, for Asia the test restriction is that $\alpha_2 = \alpha_4 = 0$.

thus interpret the Enos-Griffin-Boone challenge as a strong crowding out effect: Aid causes domestic savings to fall, and this crowds out investments, but there is no full crowding out.[15]

5. Summary

The aim of this paper was to explore the family of aid effectiveness studies that takes aid to be effective if it increases accumulation in the recipient country. We here analyzed the entire literature consisting of 24 studies of the aid-savings relation and 29 studies of the aid-investment relation.

Aid is given for many reasons, so it is optimistic to expect that it increases accumulation by the same amount, and it certainly does not. These results are consistent with the results of our two meta-studies of the other parts of the literature. We get results that are positive, but small and insignificant throughout. However, we do find some regional variation. While aid appears to have no effect on investment in African nations, it does have a positive effect in Asian and Latin American nations.

These results are not what we would have liked to see, and it certainly suggests that aid should be reformed to perform better. We have read many thousand pages of "aid debates" in addition to the technical studies, we have subjected to the meta-studies. This has left us with a strong impression of the gulf between the promises and the accomplishments of development aid. It appears that there is a prominent phenomenon of *aid hype*, where the politicians of aid promise all kinds of good things. This may pay off in the short run, but it generates cynicism and aid fatigue in the longer run, and we believe that it is counterproductive. Let us suggest that realism and a simplification of goals toward *development* could help giving more aid effectiveness. It would surely be a great help for anybody concerned with world poverty if aid could be made to work in a more convincing way.

In this paper, we have considered only one source of funding capital accumulation. It will be important to compare the results of our paper with meta-analyses of the impact of foreign direct investment and other internal and external sources of development finance. Moreover, the political economy aspects of factor accumulation also warrant close scrutiny.

15. In addition to the crowding out effect, it might be an additional mechanism that aid increases an activity that is harmful to development. In the Barro-type growth empirics, discussed in section 2.4 it is a common (though not fully robust) finding that an increase in public consumption reduces growth. The reason given by Barro (1997; 26) and Barro and Sala-i-Martin (2004; 525-26) is not very sharp, but it appears to be an additional mechanism.

References (note also Appendix 2 covering the AEL)

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Note: Some papers, such as Weisskopf's have influenced the AEL, but do not contain model estimates which we have managed to include in our data.

16. Available from WP series, Department of Economics, University of Aarhus or http://www.martin.paldam.dk.

Appendix 1: Introduction to meta techniques, especially to the tests used

Meta analysis uses both descriptive statistics and significance tests, which are developed for the purpose. Note especially that the significance tests have to take into account that all studies are based on a common pool of available macro data that have been thoroughly mined.

Descriptive statistics

Average Effects. The effect between two variables (holding other effects constant) established by a literature can be derived as a weighted average of the associated estimates:

$$(1A) \quad \varepsilon = \sum [N_i \varepsilon_i] / \sum N_i$$

where ε is the *standardized* effect (elasticity or partial correlation) from the ith study and N is the sample size.

Regression-based tests

The data for the two following tests are a set of n estimates, e_i of the same effect, ε, with the associated tests statistics (t_i, s_i, d_i), where t_i is the t-statistics; s_i, is the standard error; d_i is the degrees of freedom of the estimate. All n estimates use variants of the same estimation equation and sub-samples of the same data. Both tests use the population of observations and are robust to data mining.

Meta-Significance Testing: The MST-test (Stanley 2001 and 2005). The idea is that a connection between two variables, such as foreign aid and economic growth, should exhibit a positive relationship between the natural logarithm of the absolute value of the t-statistic and the natural logarithm (ln) of the degrees of freedom in the regression:

$$(2A) \qquad \ln \left| t_i \right| = \alpha_0 + \alpha_1 \ln d_i + u_i$$

As the sample size for the ith study grows, the precision of the coefficient estimate for the ith study rises also, i.e., standard errors fall and t-statistics rise. Stanley (2005) shows that the slope coefficient in equation (3A) offers information on the existence of genuine empirical effects, publication bias, or both. If $\alpha_1 < 0$, the estimates are contaminated by selection effects, because t-statistics fall as sample size rises. That is, studies with smaller samples report larger t-statistics, indicating that it is easier to mine smaller samples in order to increase the prospects of publication. If $\alpha_1 > 0$, there is a genuine association between aid policy interaction and economic growth, since t-statistics rise as sample size increases. If $0 < \alpha_1 < 0.5$, then there is a genuine association between aid policy interaction and economic growth, as well as publication bias in the literature.

Meta-Regression Analysis. The impact of specification, data and methodological differences can be investigated by estimating a meta-regression model (known as a MRA) of the following form:

$$(3A) \quad r_{oi} = \alpha + \beta_1 N_i + \gamma_x \boldsymbol{X}_i + \delta_k \boldsymbol{K}_i + v_i, \text{ where}$$

r_{oi} is the observed partial correlation (or any other effect, such as an elasticity) derived from the ith study,

α is the constant,

N_i is the sample size associated with the i^{th} study,

$\boldsymbol{X}_i$ is a vector of dummy variables *j* representing characteristics associated with the i^{th} study,

$\boldsymbol{K}_i$ is a vector of continuous variables *j* associated with the i^{th} study, and

v_i is the disturbance term, with usual Gaussian error properties (see Stanley and Jarrell 1998).

The regression coefficients quantify the impact of specification, data and methodological differences on reported study effects (r_{oi}). The MST test can be combined with the MRA. The MSTMRA tests used in tables 8 and 12 have the following form:

(3B) $$\ln \left| t_i \right| = \alpha_0 + \alpha_1 \ln d_i + \alpha_x \boldsymbol{X_i} + \alpha_k \boldsymbol{K_i} + \varepsilon_i$$

Appendix 2: The AEL. This paper covers studies of type (*i*) and (*s*)

Only papers in English available till 1/1 2005 are included. Papers are classified in 7 *type*s as regards the model estimated: (*s*), (*sp*) and (*i*) are accumulation models, with savings, savings with aid proxies, and investment relations respectively. (*g*) and (*gc*) are growth and conditional growth models.

No	*Type*	*Author and publication details*
1	*sp*	Ahmed, N., 1971. A note on the Haavelmo hypothesis. *Review of Economics and Statistics* 53, 413-14
2	*g*	Amavilah, V.H., 1998. German aid and trade versus Namibian GDP and labour productivity. *Applied Economics* 30, 689-95
3	*ig*	Boone, P., 1994. The impact of foreign aid on savings and growth. WP London School of Econ.
4	*i*	Boone, P., 1996. Politics and the effectiveness of foreign aid. *European Economic Review* 40, 289-329
5	*sgc*	Bowen, J.L., 1995. Foreign aid and economic growth: An empirical analysis. *Geographical Analysis* 27, 249-61. Estimates also in Bowen, J.L., 1998. *Foreign aid and economic growth: A theoretical and empirical investigation*. Ashgate, Aldershot, UK
6	*s*	Bowles, P., 1987. Foreign aid and domestic savings in less developed countries: Some tests for causality. *World Development* 15, 789-96
7	*gc*	Brumm, H.J., 2003. Aid, policies and growth: Bauer was right. *Cato Journal* 23, 167-74
8	*gc*	Burnside, C., Dollar, D., 2000. Aid, policies and growth. *American Economic Review* 90, 847-68 (Working paper available fro World bank since 1996)
9	*gc*	Burnside, C., Dollar, D., 2004. Aid, policies and growth: Reply. *American Economic Review* 94, 781-84 (reply to Easterly, Levine and Roodman, 2004)
10	*sg*	Campbell, R., 1999. Foreign aid, domestic savings and economic growth: Some evidence from the ECCB area. *Savings and Development* 23, 255-78
11	*gc*	Chauvet, L., Guillaumont, P., 2004. Aid and growth revisited: Policy, economic vulnerability and political instability. Pp 95-109 in Tungodden, B., Stern, N., Kolstad, I., eds, 2004. *Toward Pro-Poor Policies - Aid, Institutions and Globalization*. World Bank/Oxford UP
12	*gc*	Collier, P., Dehn, J., 2001. Aid, shocks, and growth. WP 2688 World Bank Policy Research
13	*gc*	Collier, P., Dollar, D., 2002. Aid allocation and poverty reduction. *European Economic Review* 46, 1475-1500
16	*i*	Collier, P., Dollar, D., 2004. Development effectiveness: What have we learnt? *Economic Journal* 114, 244-71
15	*gc*	Collier, P., Hoeffler, A., 2004. Aid, policy and growth in post-conflict societies. *European Economic Review* 48, 1125-45
16	*gc*	Dalgaard, C.-J., Hansen, H., 2001. On aid, growth and good policies. *Journal of Development Studies* 37, 17-41
17	*gc*	Dalgaard, C.-J., Hansen, H., Tarp, F., 2004. On the empirics of foreign aid and growth. *Economic Journal* 114, 191-216

18 *gc* Dayton-Johnson, J., Hoddinott, J., 2003. Aid, policies and growth, redux. WP Dalhousie Univ.

19 *gc* Denkabe, P., 2004. Policy, aid and growth: A threshold hypothesis. *Journal of African Finance and Economic Development* 6, 1-21 (WP version used)

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22 *gc* Durbarry, R., Gemmell, N., Greenaway, D., 1998. New evidence on the impact of foreign aid on economic growth. Credit WP Univ. of Nottingham

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