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Aid effectiveness on accumulation

A meta study

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Abstract:

The AEL (aid effectiveness literature) studies the macroeconomic effects of development aid using cross-country or panel data econometrics. It contains 97 papers of which 43 study whether development aid leads to increasing accumulation. The aggregate results of the 43 studies are that aid increases investment with about 25% of the aid, while most of the remaining 75% of the effect is crowded out by a fall in savings. However, these aggregate results are so variable that it is dubious if accumulation rises.

Jel.: B2, E21, E22, F35,

Keywords: Aid effectiveness, meta study, investments, savings

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I. 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 it hence tries 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 showed that aid may substitute domestic savings, and thus have an uncertain effect on development. 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 sample of macro data on aid, investment, savings and growth.

We define the AEL (Aid Effectiveness Literature) as the empirical macro papers analyzing the effect of aid on 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 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 of many 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. These are 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, and citations tracked 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. Two later papers with very similar and largely negative results, Rajan and Subramanian (2005) and Herbertsson and Paldam (2005) are not included.

agos and Paldam (2005a), concluding 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.

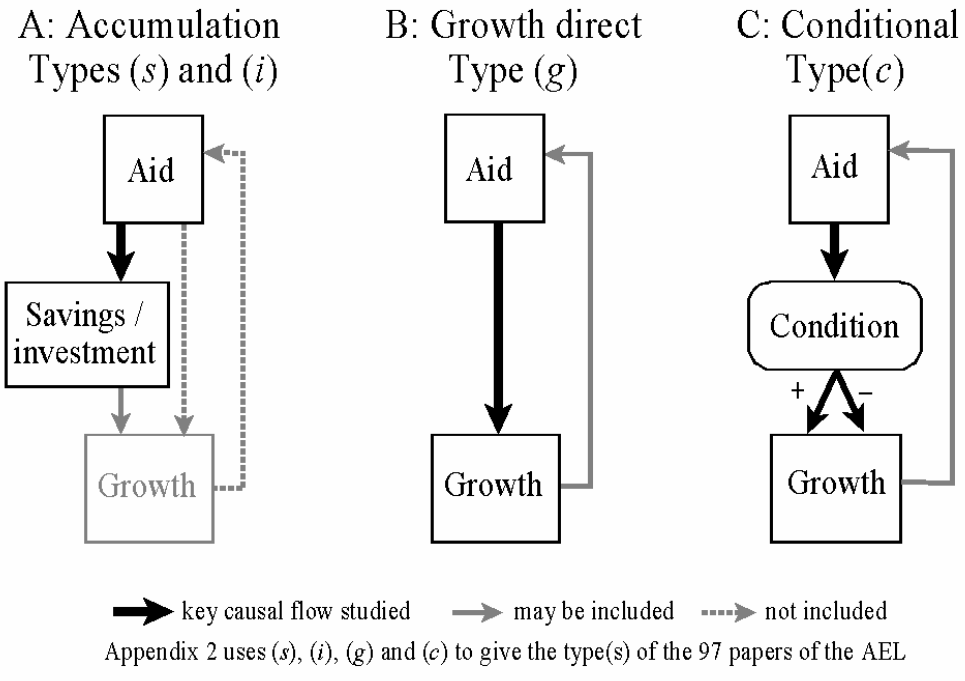
The present study and the two parallel ones apply the methods of meta-analysis to analyze and summarize the AEL. Appendix 1 gives a short introduction to the methods used, as the tests are specially developed to analyze studies using subsets of the same data. The paper asks two questions: (1) Has the 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 aggregate aid effectiveness on economic development. Aid can be disaggregated in many ways, but this is not done in the literature analyzed. Also, we know that aid has many explicit and implicit goals, but we believe that development is the ultimate goal of development aid.

The paper is organized as follows: Section II discusses the economic theory behind the models. Section III is the meta study of the aid-investment studies, while section IV considers the aid-savings studies. Section V 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 AEL

II. THEORIES OF THE CAUSALITY 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

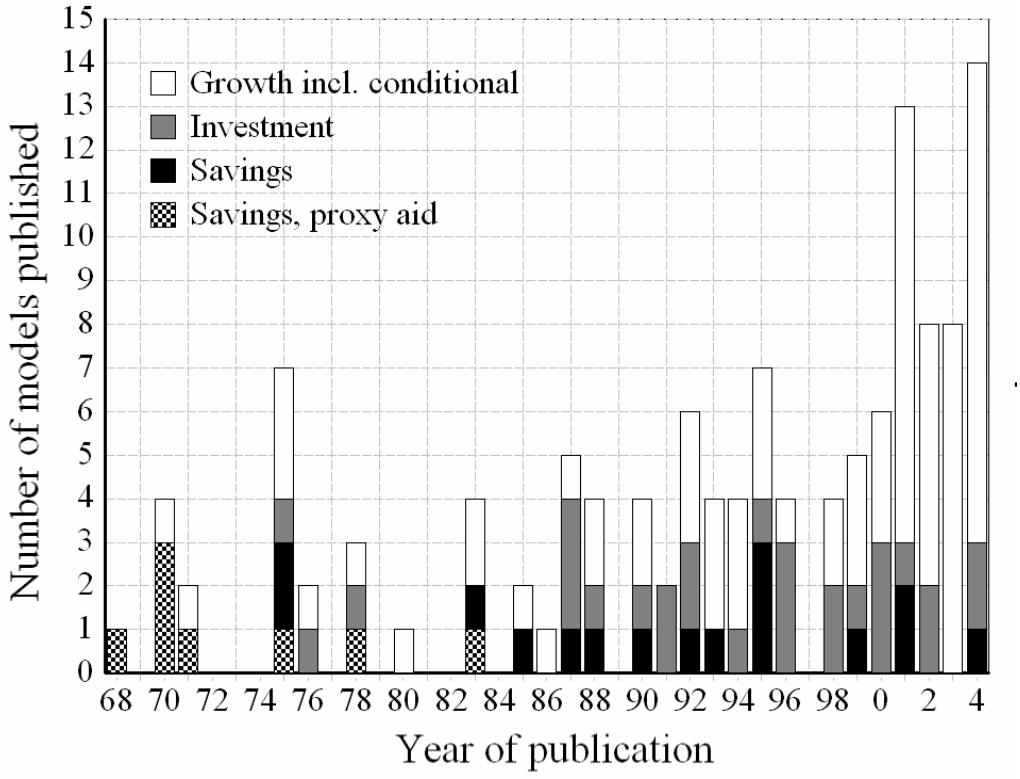


Table 2.

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 III and IV.

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 increase 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 results 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. 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 the *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 – starting with Griffin (1970) and Weisskopf (1972a and b) – thus had to reveal why aid was counterproductive to its very purpose. The key result is that aid generates dependency by replacing domestic savings. This is harmful in the longer run.

Some explicitly *libertarian* writers – notably Friedman (1958) and Bauer (1971) – have discussed aid and reached a critical view by a remarkably parallel argument: Aid generates dependency by allowing countries to expand public spending and hereby to pursue unsound (socialist) policies that are harmful in the long run.[4]

From both political schools thus follows that *excessive aid* may distort the economy of a country and create a dependent low-growth economy. Several studies of such extreme cases exist; see e.g. Paldam (1997). Recently the *Medicine Model* of aid has been proposed (Hansen and Tarp, 2000), where growth is explained by aid (positive) and aid squared (negative) where an optimum amount of aid exists of about 10-20% of GDP. Aid dependency becomes an increasing problem after that point. The empirical proof of this position is not strong.[5]

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

3. IS-LM-macro theory:[6] 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

3. The papers by Weisskopf, Friedman and Bauer are not included in the AEL as they contain no statistical tests, but they are often cited.
4. 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.
5. It is one of the models covered in Doucouliagos and Paldam (2005b), see also Jensen and Paldam (2004).
6. Agenór and Montiel (1999) discuss how the standard theory is modified to be applicable to the typical LDC environment.

the primary effects, marginal effects and total effect in the categories of table 4. The table suggests two problems:

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*, while m is the multiplier 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	$\Delta I = \Delta S$

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 also a crude estimate of aid effectiveness, μ, as the multiplier, m, so that $\mu \approx m$. 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.*[7] It was considered by Rahman (1968) and Ahmed (1971) as regards external transfers in general and aid in particular. It was sharpened and reformulated by Griffin and Enos (1970), Griffin (1970) and Weisskopf (1972a and b) 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 II.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	Griffin and Enos (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.

7. It appears as a suggestion in a comment to a paper by Leontieff, see Havelmo (1965) on the savings function in LDCs.

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.[8] 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 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*.[9] 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.

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.

8. In particular, this applies to the Harrod model that explicitly extends the 45^o real Keynesian model.
9. 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.

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.

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) and has since been used by several authors. 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.

III. 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 (1994); 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 *as chosen by the author*. Unfortunately, it is not always clear what is the authors' preferred estimate, so we have sometimes had to

assess. This produces 39 estimates.[10] The ***all-set*** refers to all estimates (of the aid accumulation relation) reported in each study. The 29 studies report a total of 133 estimates of the aid-investment association.

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 is invested (first column). Not surprisingly it appears that it is not. However, most reported estimates are positive, although less than half are statistically significantly greater than zero. 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 = 39)	0 (0%)	10 (26%)	6 (15%)	16 (41%)	7 (18%)
All-set of estimates (n = 133)	1 (1%)	25 (19%)	31 (23%)	56 (42%)	20 (15%)

Note: The gray shading points to the less common results.

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. The two most positive points have high standard deviations as well, so the average of 25% seems more reasonable than the weighted one of 46%.

2. Is the aid-investment effect well established?

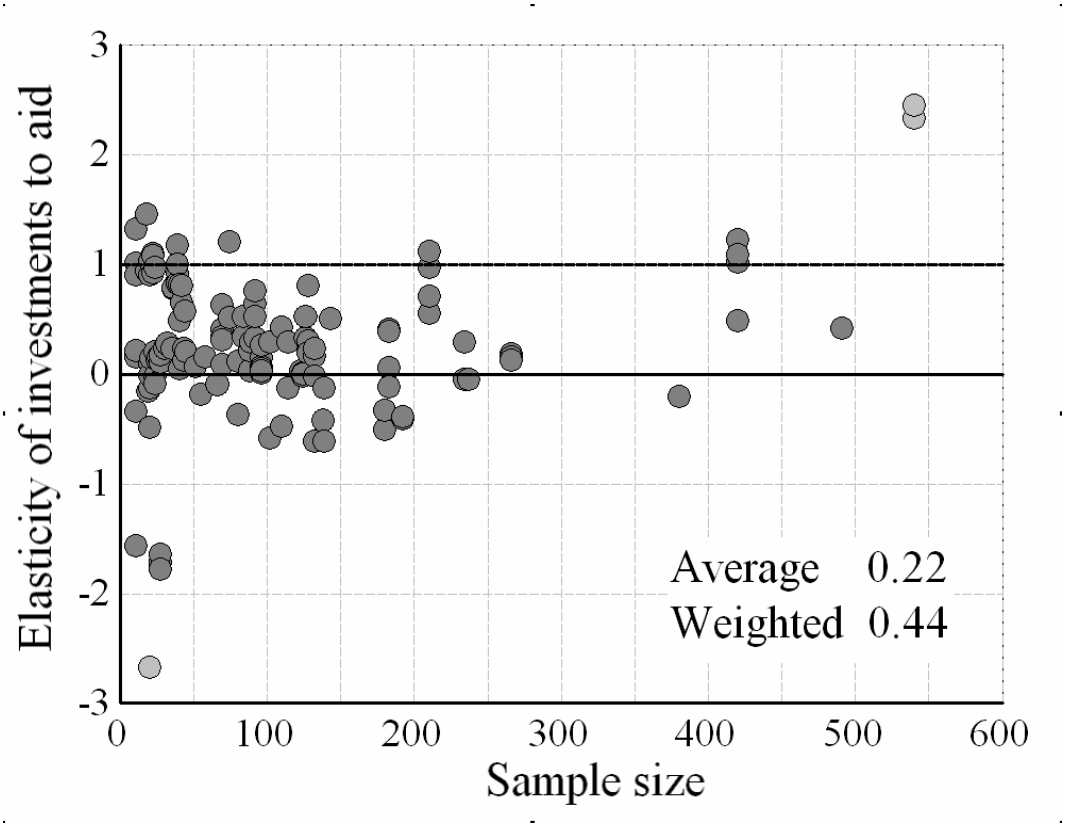
Table 8 presents our key meta-analysis for the best-set, all-set and various sub-sets of the all-set. The number of estimates is reported in column 1. The average aid-investment elasticities are reported in column 2. The medians are reported in column 3, and the weighted average elasticities in column 4. The sample size was used to weight each elasticity. Since sample size differs between studies, it is recommended that study results are weighted (see Hunter and

10. In some cases, we include more than one estimate from each paper in the best-set, when different statistically independent sub-samples are used.

Schmidt 2004). The weighted aid-investment elasticity is +0.57 for the best-set and +0.44 for the all-set. After removing outliers, the weighted aid-investment elasticity is +0.30 for the best-set and +0.28 for the all-set, implying that a 10 percent increase in the aid/GDP ratio increases I/GDP by around 3 percent. This is of some economic significance, but less than the full value of the aid received.

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 light gray coloring appear unreasonable. They cause the attempts to summarize the results to have very high variation.

The weighted average elasticity for public sector investment is +0.37, while for private sector investment the effect is, interestingly, in the opposite direction, -0.10. The next 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 and significance tests, aid-investment elasticities

Group	(1) N	(2) Unweighted Average	(3) Median	(4) Weighted average [a]	(5) MST [b] Coef	(t-test)	(6) MSTMRA [b] Coeff	(t-test)
Best-set	39	0.30	0.21	0.57 [0.30]	-0.06	(-0.47)	0.32	(1.04)
All-set	133	0.25	0.22	0.44 [0.28]	0.03	(0.29)	0.11	(0.71)
Gross Investment	69	0.27	0.19	0.61 [0.38]	0.14	(1.00)	-0.01	(-0.06)
Public Investment	36	0.35	0.33	0.37	-0.26	(-0.85)	-0.42	(-0.51)
Private Investment	28	0.07	0.09	-0.10	0.09	(0.86)	0.03	(0.17)
With Asian samples	73	0.15	0.15	0.20	0.14	(0.98)	-0.11	(-0.59)
With Africa samples	103	0.35	0.24	0.48 [0.31]	0.11	(1.08)	0.09	(0.65)
With Latin samples	57	0.23	0.15	0.23	0.21	(1.52)	-0.04	(-0.16)
Regional dummies [c]	131							
Asia		-	-	-	1.92	(0.17)†	1.45	(0.23)†
Latin		-	-	-	0.75	(0.39)†	0.51	(0.47)†

Note a) Averages in square brackets exclude outliers. b) MST are Meta-Significance Testing, and MRA is Meta-Regression Analysis, see appendix 1. Dependent variable is $\ln|t_i|$. Reported coefficients to ln(df). * denotes statistically significant at least at the 10% level. All regressions involving the All-Set and sub-groups use the bootstrap to derive robust standard errors. Full regression results are available from the authors. c) country composition not reported for some estimates. † refers to prob-value of Wald test.

The key issue then is whether the effects reported in columns 2, 3 and 4 are statistically significantly different from zero, when all studies are considered as a group. We follow Stanley (2001 and 2005) and explore statistical significance through meta-significance tests (MST). Building on Card and Krueger (1995), Stanley points out that if there is a real effect between two variables – e.g. aid and 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:

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

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 (Meta-Significance Testing) results are presented in Table

8, column 5, where the coefficient on $\boldsymbol{\alpha_1}$ is presented and its associated t-statistic (using robust standard errors). None of the MST slope coefficients are statistically significant.

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. Modeling 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 may also 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 (All-Set)

Variable	BD means binary dummy. It is 1 if condition fulfilled, otherwise 0	Mean (Investment)	St dev Investment)	Mean (Savings)	St dev (Savings)
$ln\lvert t_i \rvert$	Dependent variable in the MST and MSTMRA	0.53	1.29	0.81	0.79
Elasticity	Dependent variable in MRA	0.25	0.69	-0.66	1.20
Endogeneity	BD if controlled for endogeniety of aid	0.30	0.46	0.18	0.39
Institutions	BD if controlled for institutions (e.g	0.06	0.24	nu	nu
Panel Data	BD for use of panel data	0.53	0.50	0.61	0.49
Growth	BD if estimated also a growth equation	0.40	0.49	0.77	0.42
Fiscal Response	BD estimated a fiscal response model	0.26	0.44	nu	nu
Barro Type	BD estimated a Barro type model	0.41	0.49	nu	nu
Sample Size	Sample size – number of countries times	107	110	96	112
Gross	BD if study used gross (total) investment data	0.51	0.50	nu	nu
Private	BD 1 if study used private investment data	0.22	0.41	nu	nu
Asia	BD if study used data relating to Asian	0.55	0.50	0.37	0.49
Latin	BD if study used data relating to Latin	0.43	0.50	0.63	0.49
FDI	BD if controlled for Foreign Direct Investment	nu	nu	0.31	0.47

nu = variable not used

When these control variables are added, the 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 estimated also an MST using all observations and the two regional dummies, as well as

interaction terms between regional dummies and ln(*df*)[11]. The last three rows of columns 5 and 6 report Wald tests on the restriction that ln(*df*) and the interaction terms are jointly equal to zero.[12] Whether we take the entire pool of studies, or a sub-group of studies, none of the MST coefficients is positive and statistically significant. Hence, the conclusion is the same - there is *no* evidence of statistically significant aid-investment effect.[13]

3. Accounting for heterogeneity

As seen from figure 3, reported estimates differ widely across studies. The variation can arise from sampling error as well as differences in research design. 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 is included to capture study differences (listed in table 9). 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 (one at the time), and the results are presented in column 2. Some of the observations in the all-set are statistically dependent.[14] Consequently we use the bootstrap to derive standard errors (Efron and Tibshirani 1993) as reported in columns 3 and 4.[15]

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 than other methodologies (mainly simple regressions and the earlier studies). Fiscal response studies typically 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, public or total. Compared to African nations, the inclusion of Latin American

11. That is, we estimate $\ln|t_i| = \alpha_0 + \alpha_1 \ln df_i + \alpha_2 Asia + \alpha_3 Latin + \alpha_4 \ln df_i x Asia + \alpha_5 \ln df_i x Latin + \varepsilon_i$. See Doucouliagos, Laroche and Stanley (2005) for details on this testing procedure.
12. Thus, for Asia the test restriction is that $\alpha_1 + \alpha_4 = 0$.
13. This conclusion is supported also by Funnel Asymmetry Tests which suggests the presence of selection effects in this literature and an absence of a genuine empirical effect (Stanley 2005).
14. That is, some studies contribute more than one estimate to our dataset, and these estimates are conceptual replications (see Hunter and Schmidt 2004).
15 A Wald test validates the removal of the redundant variables (Chi-square values of 0.19 and 0.17, with prob-values of 0.98 and 0.98, for the OLS and the bootstrap results, respectively).

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.[16]

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	-0.17	(-0.81)	-0.13	(-0.79)	-0.17	(-0.77)	-0.13	(-0.77)
Institutions	0.09	(0.33)	-		0.09	(0.31)	-	
Endogeneity	0.41	(2.72)***	0.39	(3.17)***	0.41	(2.60)***	0.39	(3.11)***
Panel Data	0.02	(0.12)	-		0.02	(0.11)	-	
Growth	0.24	(1.56)	0.24	(1.89)*	0.24	(1.52)	0.24	(1.84)*
Fiscal Response	0.44	(1.77)*	0.42	(1.98)*	0.44	(1.68)*	0.42	(1.94)*
Barro Type	-0.53	(-2.39)**	-0.49	(-2.97)***	-0.53	(-2.31)**	-0.49	(-2.93)***
Sample Size	0.002	(2.71)***	0.002	(3.50)***	0.002	(2.45)**	0.002	(3.13)***
Gross	0.19	(0.88)	0.17	(1.24)	0.19	(0.82)	0.17	(1.15)
Private	0.05	(0.27)	-		0.05	(0.26)	-	
Asia	-0.30	(-1.33)	-0.31	(-1.43)	-0.30	(-1.25)	-0.31	(-1.37)
Latin	0.38	(1.41)	0.36	(1.51)	0.38	(1.33)	0.36	(1.45)
Adjusted R^2	0.19		0.20		0.19		0.22	
Sample Size	133		133		133		133	

Note: *, **, *** statistically significant at the 10%, 5% and 1% levels, respectively. Results are similar if outliers are removed. t-statistics derived from robust standard errors.

The high variation of results presented make it difficult to conclude. On the one hand stands the nicely positive weighted and unweighted average coefficients of table 8, which suggest that an increase in aid may lead to an increase in investment of about 25% of the aid. On the other hand, the detailed tests suggest that this result is so unstable that it can not be trusted.

16. Note the difference 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 0.

IV. EFFECTS ON SAVINGS

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

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 then 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); 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). From these 16 studies we derive a best-set of 23 observations (a couple of studies offer more than one statistically independent estimate). From the 24 studies we derive an all-set of 89 observations (including the 28 estimates from the 8 proxy studies).

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.

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 decreases in the larger samples, so the two averages are almost the same.

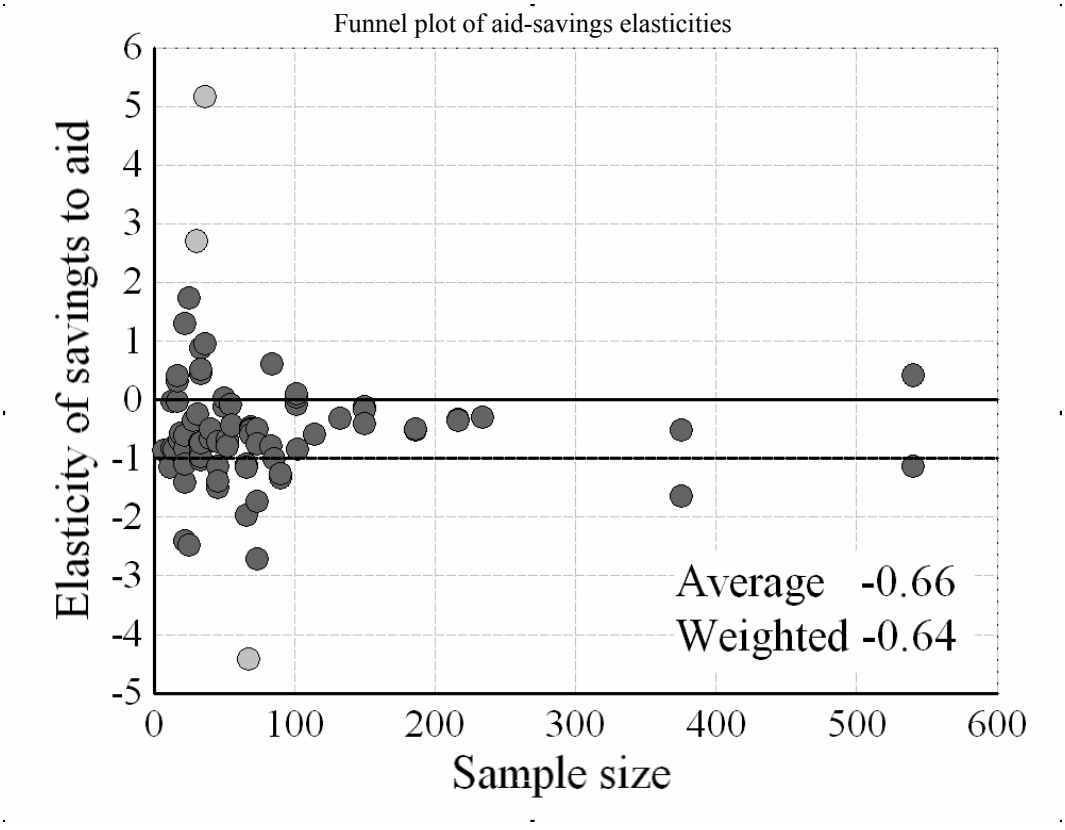
Table 11.

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)	2 (9%)	3 (13%)	6 (26%)	10 (43%)	2 (9%)
All-set of estimates (n = 89)	7 (8%)	24 (27%)	34 (38%)	21 (24%)	3 (3%)

Note: The gray shading points to the less common results.

Figure 4.



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

Seen from the point of view of bookkeeping the investment-aid elasticity of $\eta(i,h)$ and the savings-aid elasticity of $\eta(s,h)$ should add to the BOP-elasticity. Hence, if $\eta(i,h) \approx 0.46$ and $\eta(s,h) \approx -0.62$, the BOP deteriorates due the aid, as more than half of the investments are crowded out by falling savings. However, we know that the BOPs of the high aid recipients in, for example, Africa are improved a little by the aid received. It is more in line with stylized facts to accept that $\eta(i,h) \approx 0.25$, as this means that aid of 1% of GDP gives an improvement in the BOP of about 0.1% of GDP.

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 and significance tests, aid-savings elasticities

Group	(1) N	(2) Unweighted Average	(3) Median	(4) Weighted Average	(5) MST [a] Coeff	(t-test)	(6) MSTMRA [a] Coef	(t-test)
Best-set	23	-0.90	-0.79	-0.85	0.02	(0.20)	-0.02	(-0.08)
All-set	61	-0.66	-0.72	-0.64	0.23	(2.34)**	0.38	(1.82)*
Best-set, with proxies	31	-0.72	-0.61	-0.75	-0.05	(-0.41)	-0.18	(-0.41)
All-set, with proxies	89	-0.53	-0.59	-0.57	0.16	(1.73)*	0.27	(1.56)
With Latin samples	36	-0.80	-0.78	-0.81	0.52	(1.64)	0.84	(1.75)*
With Asian samples	21	-0.66	-0.67	-0.65	0.08	(0.38)	0.09	(0.09)
With Africa samples	32	-0.40	-0.51	-0.42	0.12	(1.33)	0.21	(1.13)
Regional dummies [b]	57							
Asia		-	-	-	1.03	(0.31)†	0.04	(0.84)†
Latin		-	-	-	5.15	(0.02)†*	4.89	(0.04)†*

Note a) MST are Meta-Significance Testing, and MRA is Meta-Regression Analysis, see appendix 1. Dependent variable is $\ln|t_i|$. Reported coefficients to ln(df). * denotes statistically significant at least at the 10% level. All regressions involving the All-Set and sub-groups use the bootstrap to derive robust standard errors. Full regression results are available from the authors. b) country composition not reported for some estimates. † refers to prob-value of 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. The large variation also means that we can not reject that the elasticity is -1. We conclude that the literature provides evidence that aid has a negative effect on domestic savings.[17] The MST indicates that there is an aid-savings association among Latin American economies, with an aid-savings effect of -0.81.

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 smaller (negative) aid-savings elasticities. Relative to non-Asian and non-Latin American economies, the negative effect of aid on savings is larger when Latin American data is used. To test the sensitivity of our results, we followed Higgins and Thompson (2004) and conducted permutation tests by *randomly* reallocating the aid-investment and aid-savings elasticities to sets of covariates. The MRA was then reestimated. The reallocation and

17. This is confirmed also through Funnel Asymmetry Tests (Stanley 2005) which suggest a genuine negative aid-savings effect.

reestimation was repeated 1,000 times. The permutation tests confirm the statistical significance of the variables listed in Tables 10 and 13.

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	-0.66	(-1.11)	-0.73	(-1.59)	-0.66	(-1.05)	-0.73	(-1.63)
Panel Data	0.73	(2.21)**	0.68	(1.80)*	0.73	(1.26)	0.68	(1.82)*
Endogeneity	0.11	(0.43)	-		0.11	(0.22)	-	
Growth	0.21	(0.45)	-		0.21	(0.36)	-	
FDI	-0.35	(-1.10)	-		-0.35	(-0.57)	-	
Sample Size	-0.002	(-0.76)	-		-0.002	(-0.47)	-	
Asia	0.70	(1.41)	0.49	(1.50)	0.70	(1.16)	0.49	(1.44)
Latin	-0.91	(-1.63)	-0.72	(-2.02)**	-0.91	(-1.48)	-0.72	(-1.93)*
Adjusted R^2	0.03		0.07		0.03		0.07	
Sample Size	57		57		57		57	

Notes: *, **, *** statistically significant at the 10%, 5% and 1% levels, respectively. t-statistics derived from robust standard errors.

The result from the 24 savings studies is thus a net accumulation effect of dubious significance. The challenge of Griffin and Enos 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 are reduced correspondingly. We thus interpret the Enos-Griffin-Boone challenge as a strong crowding out effect: Aid causes domestic savings to fall, and this will crowd out investments, but there need not be a full crowding out.[18]

Like in the investment section, the results show considerable variation, but we think that the best rule of thumb we can derive from the studies is that increase in aid leads to a decrease in domestic savings of about 60%. There is probably a small balance of payment improvement, so that the amount of foreign savings the country uses decreases a little. In total the

18. In addition to the crowding out effect, there might be an additional mechanism that aid increases an activity that is harmful to development. In the Barro-type growth empirics discussed in section 6 it is a common (though not fully robust) finding that an increase in public consumption reduces growth. The reason given by Barro and Sala-i-Martin (2004; 525-26) is not very sharp, but it appears to be an additional mechanism.

absorption of domestic and foreign savings probably adds up to 75% of the aid. It is dubious if this is significantly less than the 100% claimed by the Enos-Griffin-Boone challenge.

V. 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.

Most of the literature deals with countries from all regions, and we have concentrated on the aggregate results. However, it appears that the aid-savings effect is larger in Latin America.

The aggregate results have considerable variation, but if we demand that the two results are consistent so that the investment effect minus the savings effect adds to 1, then the best we can say probably is that about 25% of the aid is invested, while 75% is crowded out by a fall in the domestic absorption of savings, mainly caused by increasing public consumption crowding out public savings. However, also the foreign savings used seem to fall a little. As increasing public consumption is detrimental to growth it is thus unclear if aid increases economic growth. These results are consistent with the results of our two meta-studies of the other parts of the aid effectiveness literature. They show an effect on growth that is positive, but small and insignificant.

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 that a large gulf separates the promises and the accomplishments of development aid. It appears that there is a prominent phenomenon of *aid hype*, where the politicians of aid keep adding both new goals and promises to the various aid programs. This may pay off in the short run – in the sense of halting the erosion of the aid budgets – but it generates cynicism and aid fatigue in the longer run, and we believe that it is counterproductive. We suggest that more realism and a simplification of aid goals toward *development* could increase 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.

REFERENCES (NOTE ALSO APPENDIX 2 COVERING THE AEL)

Agénor, P.-R. and P.J. Montiel (1999). *Development macroeconomics (2nd ed)*. Princeton UP, Princeton NJ

Barro, R.J. and X. Sala-i-Martin (1998, 2004). *Economic growth*. MIT Press, Boston

Bauer, P.T. (1971). *Dissent on development: Studies and debates in development economics*. Weidenfeld and Nicolson, London.

Card, D., and A.B. Krueger (1995). Time-Series Minimum-Wage Studies: a meta-analysis. *American Economic Review* 85, 238-43

Chenery, H.B., and A.M. Strout (1966). Foreign assistance and economic development. *American Economic Review* 56, 679-733

Chenery, H.B., and M. Syrquin (1975). *Patterns of development: 1950-1970*. Oxford University Press, Oxford

Clemens, M.A., Radelet, S.A. and R. Bhavnani (2004). Counting chicken when they hatch: The short term effect of aid on growth. WP 44, center for Global Development (September)

Doucouliagos, C. (H.) (2005). Publication Bias In The Economic Freedom And Economic Growth Literature. *Journal of Economic Surveys* 19, 367-89

Doucouliagos, C. (H), P. Laroche and T.D. Stanley (2005). Publication Bias in Union-Productivity Research? *Relations Industrielles/Industrial Relations* 60, 320-46.

Doucouliagos, H. and M. Paldam (2005a). Aid effectiveness on growth. A meta study. Working Paper[19]

Doucouliagos, H. and M. Paldam (2005b). Conditional aid effectiveness. A meta study. Working Paper[19]

Easterly, W. (2001). *The elusive quest for growth. Economists' adventures and misadventures in the tropics*. MIT Press, Cambridge, MA

Efron, B. and R.J. Tibshirani (1993). *An Introduction to the Bootstrap*. Chapman and Hall, San Francisco.

Friedman, M. (1958). Foreign economic aid: Means and Objectives. *Yale Review* 47, 500-516

Herbertsson, T.T., and M. Paldam (2005). Does development aid help poor countries catch up? An analysis of the basic relations. For O. Morrissey, ed., *New Directions in Research on Foreign Aid*. Routledge, forth-coming[19]

Haavelmo, T., 1965. Comment to W. Leontieff. The rates of long-run economic growth and capital transfers from developed to underdeveloped areas. Section 13, 1039-1068 in *The Econonometric Approach to Development Planning*. Pontificia Academiae Scintiarum Scripta Aaria 28. North-Holland Publishing, Amsterdam

Higgins, J.P.T. and S.G. Thompson. 2004. Controlling the risk of spurious findings from meta-regression. *Statistics in Medicine* 23, 2663-82.

Huges, H., 2003. Trade or aid? Which benefits developing countries more? Economic Papers – Economic Society of Australia, 22 pp, Sept

Hunter, J., and F. Schmidt (2004). *Methods of Meta-Analysis: correcting error and bias in research findings*. Sage, London

Jarrell, S., and T.D. Stanley (2004). Declining Bias and Gender Wage Discrimination? A Meta-regression analysis. *Journal of Human Resources*, 39, 828-38.

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

Levine, R., and D.D. Renelt (1992). A Sensitivity Analysis of Cross-Country Growth Regressions. *American Economic Review* 82, 942-63

Paldam, M. (1997). Rent Seeking and Dutch Disease. An Essay on Greenland. *European Journal of Political Economy* 13, 591-614

Rajan, R.G., and A. Subramanian (2005). Aid and Growth: What Does the Cross-Country Evidence Really Show? IMF WP No. 05/127. June (see also WP No 05/126)

Stanley, T.D. (2001). Wheat From Chaff: meta-analysis as quantitative literature review. *The Journal of Economic Perspectives* 15, 131-150

Stanley, T.D. (2005). Beyond Publication Bias. *Journal of Economic Surveys* 19, 309-45

Stanley, T.D. and S.B. Jarrell. 1989. Meta-Regression Analysis: A quantitative method of literature surveys. Journal of Economic Surveys 3, 54-67.

Weisskopf, T.E. (1972a). An econometric test of alternative constraints on the growth of underdeveloped countries. *Review of Economics and Statistics* 54, 67-78

Weisskopf, T.E. (1972b). The impact of foreign capital inflow on domestic savings in underdeveloped countries. *Journal of International Economics* 2, 25-38

Note: Some papers, such as Weisskopf and Clemens *et al* have influenced the AEL, but do not contain model estimates which we have managed to include in our data.

APPENDIX 1: INTRODUCTION TO META TECHNIQUES, ESPECIALLY THE TESTS USED

Meta-analysis uses both descriptive statistics and significance tests. 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 i^{th} 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 accumulation, 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:

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

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 (2A) 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 and accumulation, since t-statistics rise as sample size increases.

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:

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

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 ith study,
$\boldsymbol{X}_i$ is a vector of dummy variables *j* representing characteristics associated with the ith study,
$\boldsymbol{K}_i$ is a vector of continuous variables *j* associated with the ith study, and
v_i is the disturbance term, with usual Gaussian error properties (see Stanley and Jarrell 1989).

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:

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

APPENDIX 2: THE AEL. THE PAPERS COVER 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., and D. Dollar (2000). Aid, policies and growth. *American Economic Review* 90, 847-68 (Working paper available fro World bank since 1996)
9	*gc*	Burnside, C., and D. Dollar (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., and P. Guillaumont (2004). Aid and growth revisited: Policy, economic vulnerability and political instability. Pp 95-109 in Tungodden, B., Stern, N., and I. Kolstad, eds. *Toward Pro-Poor Policies - Aid, Institutions and Globalization*. World Bank/Oxford UP
12	*gc*	Collier, P., and J. Dehn (2001). Aid, shocks, and growth. WP 2688 World Bank Policy Research
13	*gc*	Collier, P., and D. Dollar (2002). Aid allocation and poverty reduction. *European Economic Review* 46, 1475-1500
16	*i*	Collier, P., and D. Dollar (2004). Development effectiveness: What have we learnt? *Economic Journal* 114, 244-71
15	*gc*	Collier, P., and A. Hoeffler (2004). Aid, policy and growth in post-conflict societies. *European Economic Review* 48, 1125-45
16	*gc*	Dalgaard, C.-J., and H. Hansen (2001). On aid, growth and good policies. *Journal of Development Studies* 37, 17-41
17	*gc*	Dalgaard, C.-J., Hansen, H., and F. Tarp (2004). On the empirics of foreign aid and growth. *Economic Journal* 114, 191-216

18 *gc* Dayton-Johnson, J., and J. Hoddinott (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)

20 *i* Dollar, D., and W. Easterly (1999). The search for the key: Aid, investment and policies in Africa. *Journal of African Economies* 8, 546-77

21 *g* Dowling, J.M., and U. Hiemenz (1983). Aid, savings, and growth in the Asian region. *The Developing Economies* 21, 4-13

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

23 *g* Easterly, W. (2003). Can foreign aid buy growth? *Journal of Economic Perspectives* 17, 23-48

24 *gc* Easterly, W., Levine, R., and D. Roodman (2004). Aid, policies, and growth: Comment. *American Economic Review* 94, 774-80 (Comment to Burnside and Dollar, 2001)

25 *g* Economides, G., Kalyvitis, S., and A. Philippopoulos (2004). Does foreign aid distort incentives and hurt growth? Theory and evidence from 75 aid-recipient countries. WP Athens Univ. of Econ. and Business

26 *g* Fayissa, B., and M. El-Kaissy (1999). Foreign aid and the economic growth of developing countries (LDCs): Further evidence. *Studies in Comparative International Development* Fall, 37-50

27 *i* Feyzioglu, T., Swaroop, V., and M. Zhu (1998). A panel data analysis of the fungibility of foreign aid. *World Bank Economic Review* 12, 29-58

28 *i* Franco-Rodriguez, S. (2000). Recent developments in fiscal response with an application to Costa Rica. *Journal of International Development* 12, 429-41

29 *i* Franco-Rodriguez, S., Morrissey, O., and M. McGillivray (1998). Aid and the public sector in Pakistan: Evidence with endogenous aid. *World Development* 26, 1241-50

30 *sp* Fry, M.J. (1978). Money and capital or financial deepening in economic development? *Journal of Money, Credit, and Banking* 10, 464-75

31 *i* Gang, I.N., and H.A. Khan (1991). Foreign aid, taxes and public investment. *Journal of Development Economics* 34, 355-69

32 *g* Giles, J.A. (1994). Another look at the evidence on foreign aid led economic growth. *Applied Economics Letters* 1, 194-99

33 *sp* Giovannini, A. (1983). The interest elasticity of savings in developing countries: The existing evidence. *World Development* 11, 601-07

34 *igc* Gomanee, K., Girma, S., and O. Morrissey (2002). Aid and growth: Accounting for the transmission mechanisms in Sub-Sahara Africa. Credit WP Univ. of Nottingham

35 *g* Gounder, R. (2001). Aid-growth nexus: Empirical evidence from Fiji. *Applied Economics* 33, 1009-19

36 *sp* Griffin, K.B. (1970). Foreign capital, domestic savings and economic development. *Bulletin of the Oxford University Institute of Economics and Statistics* 32, 99-112

37 *spg* Griffin, K.B., and J.L. Enos (1970). Foreign assistance: Objectives and consequences. *Economic Development and Cultural Change* 18, 313-27

38 *gc* Guillaumont, P., and L. Chauvet 2001. Aid and performance: A reassessment. *Journal of*

Development Studies 37, 66-92

39 *g* Gulati, U.C. (1976). Foreign aid, savings and growth: Some further evidence. *Indian Economic Journal* 24, 152-60

40 *g* Gulati, U.C. (1978). Effects of capital imports on savings and growth in less developed countries. *Economic Inquiry* 16, 563-69

41 *sp* Gupta, K.L. (1970). Foreign capital and domestic savings: A test of Haavelmo's hypothesis with cross-country data: A comment. *Review of Economics and Statistics* 52, 214-16

42 *sg* Gupta, K.L. (1975). Foreign capital inflows, dependency burden, and saving rates in developing countries: A simultaneous equation model. *Kyklos* 28, 358-74

43 *sg* Gupta, K.L., and M.A. Islam (1983). *Foreign Capital, Savings and Growth – an International Cross-Section Study*. Dordrecht, Reidel Publishing Company

44 *sig* Gyimah-Brempong, K. (1992). Aid and economic growth in LDCs: Evidence from Sub-Saharan Africa. *Review of Black Political Economy* 20, 31-52

45 *sigc* Hadjimichael, M.T., Ghura, D., Mühleisen, M., Nord, R., and E.M. Ucer (1995). Sub-Saharan Africa: Growth, savings, and investment, 1986-93. IMF Occasional Paper, No. 118

46 *i* Halevi, N. (1976). The effects on investment and consumption of import surpluses of developing countries. *Economic Journal* 86, 853-58

47 *gc* Hansen, H., and F. Tarp (2000). Aid effectiveness disputed. *Journal of International Development* 12, 375-398. Also pp 103-128 in Tarp, F. and P. Hjertholm, P., eds. *Foreign aid and development. Lessons learnt and directions for the future*. Routledge, London

48 *igc* Hansen, H., and F. Tarp (2001). Aid and growth regressions. *Journal of Development Economics* 64, 547-70

49 *i* Heller, P.S. (1975). A model of public fiscal behavior in developing countries: Aid, investment, and taxation. *American Economic Review* 65, 429-45

50 *sgc* Hudson, J., and P. Mosley (2001). Aid policies and growth: In search of the Holy Grail. *Journal of International Development* 13, 1023-38

51 *g* Islam, M.A. (1992). Foreign aid and economic growth: An econometric study of Bangladesh. *Applied Economics* 24, 541-44

52 *gc* Jensen, P.S., and M. Paldam (2004). Can the two new aid-growth models be replicated? *Public Choice* forthcoming

53 *g* Kellman, M. (1971). Foreign assistance: Objectives and consequences: Comments (to Griffin and Enos, 1970). *Economic Development and Cultural Change* 20, 142-54

54 *i* Khan, H.A., and E. Hoshino (1992). Impact of foreign aid on the fiscal behaviour of LDC governments. *World Development* 20, 1481-88

55 *i* Khilji, N.M., and E.M. Zampelli (1994). The fungibility of U.S. military and non-military assistance and the impacts on expenditures of major aid recipients. *Journal of Development Economics* 43, 345-62

56 *gc* Kosack, S. (2003). Effective aid: How democracy allows development aid to improve the quality of life. *World development* 31, 1-22

57 *g* Landau, D. (1986). Government and Economic Growth in the less Developed Countries: An empirical

study for 1960-1980. *Economic Development and Cultural Change* 35, 35-75

58 *g* Landau, D. (1990). Public choice and economic aid. *Economic Development and Cultural Change* 38, 559-75

59 *sig* Larson, J.-D. (2001). An updated analysis of Weisskopf's savings-dependency theory. *Review of Development Economics* 5, 157-67

60 *sg* Lensink, R. (1993). Recipient government behavior and the effectiveness of development aid. *De Economist* 141, 543-62.

61 *ig* Lensink, R., and O. Morrissey (2000). Aid instability as a measure of uncertainty and the positive impact of aid on growth. *Journal of Development Studies* 36, 30-48

62 *gc* Lensink, R., and H. White (2001). Are there negative returns to aid? *Journal of Development Studies* 37, 42-65

63 *i* Levy, V. (1987). Does concessionary aid lead to higher investment rates in low-income countries? *Review of Economics and Statistics* 69, 152-56

64 *ig* Levy, V. (1988). Aid and growth in Sub-Saharan Africa: The recent experience. *European Economic Review* 32, 1777-95

65 *gc* Lu, S., and R. Ram (2001). Foreign Aid, government policies, and economic growth: Further evidence from cross-country panel data for 1970-1993. *Economia Internazionale/International Economics* 54, 15-29

66 *ig* Mahdavi, S. (1990). The effects of foreign resource inflows on composition of aggregate expenditure in developing countries: A seemingly unrelated model. *Kyklos* 43, 111-37

67 *i* Mavrotas, G. (2002). Foreign aid and fiscal response: Does aid disaggregation matter? *Weltwirtschaftliches Archiv* 138, 534-59

68 *g* Mbaku, J.M. (1993). Foreign aid and economic growth in Cameroon. *Applied Economics* 25, 1309-14

69 *i* McGillivray, M. (2000). Aid and public sector behavior in developing countries. *Review of Development Economics* 4, 156-63

70 *i* McGowan, P.J., and D.L. Smith (1978). Economic dependency in black Africa: An analysis of competing theories. *International Organization* 32, 179-235

71 *i* McGuire, M.C. (1987). Foreign assistance, investments, and defense: A methodological study with an application to Israel, 1960-1979. *Economic Development and Cultural Change* 35, 847-73

72 *gc* Moreira, S.B. (2003). Evaluating the impact of foreign aid on economic growth: A cross-country study (1970-1998). WP for 15th Annual Meeting on Socio-Economics, Aix-en-Provence, France

73 *g* Mosley, P. (1980). Aid, savings and growth revisited. *Bulletin of the Oxford University Institute of Economics and Statistics* 42, 79-95

74 *ig* Mosley, P., Hudson, J., and S. Horrell (1987). Aid, the public sector and the market in less developed countries. *Economic Journal* 97, 616-41

75 *g* Mosley, P., Hudson, J. and S. Horrell (1992). Aid, the public sector and the market in less developed countries: A return to the scene of the crime. *Journal of International Development* 4, 139-50

76 *g* Most, S.J., and H.v.d. Berg (1996). Growth in Africa: Does the source of investment financing matter? *Applied Economics* 28, 1427-33

77 *g* Murthy, V.N.R., Ukpolo, V., and J.M. Mbaku (1994). Foreign aid and economic growth in Cameroon: Evidence from cointegration tests. *Applied Economics Letters* 1, 161-63

78 *i* Otim, S. (1996). Foreign aid and government fiscal behaviour in low-income South Asian countries. *Applied Economics* 28, 927-33

79 *s* Ouattara, B. (2004). The impact of project aid and programme aid inflows on domestic savings: A case study of Côte d'Ivoire. WP Univ. of Manchester

80 *gc* Ovaska, T. (2003). The failure of development aid. *Cato Journal* 23, 175-88

81 *sp* Over, A.M. (1975). An example of the simultaneous-equation problem: A note on "foreign assistance: Objectives and consequences". *Economic Development and Cultural Change* 23, 751-56

82 *sg* Papanek, G.F. (1973). Aid, foreign private investment, savings, and growth in less developed countries. *Journal of Political Economy* 81, 120-30

83 *i* Quazi, R.M. (2004). Foreign aid and capital flight. A case study of Bangladesh. *Journal of the Asia Pacific Economy* 9, 370-93

84 *sp* Rahman, A. (1968). Foreign capital and domestic savings: A test of Haavelmo's hypothesis with cross-country data. *Review of Economics and Statistics* 50, 137-38

85 *g* Ram, R. (2003). Roles of bilateral and multilateral aid in economic growth of developing countries. *Kyklos* 56, 95-110

86 *gc* Ram, R. (2004). Recipient country's "policies" and the effect of foreign aid on economic growth in developing countries: Additional evidence. *Journal of International Development* 16, 201-11

87 *sg* Rana, P.B., and J.M. Dowling (1988). The impact of foreign capital on growth: Evidences from Asian developing countries. *The Developing Economies* 26, 3-11

88 *sg* Reichel, R. (1995). Development aid, savings and growth in the 1980s: A cross-section analysis. *Savings and Development* 19, 279-96.

89 *gc* Roodman, D. (2004). The anarchy of numbers: Aid, development and cross-country empirics. WP 32 Center for Global Development

90 *gc* Shukralla, E.K. (2004). Aid, incentives, polices, and growth: Theory and a new look at the empirics. WP Western Michigan Univ.

91 *sg* Singh, R.D. (1985). State intervention, foreign economic aid, savings and growth in LDCs: Some recent evidence. *Kyklos* 38, 216-32

92 *s* Snyder, D.W. (1990). Foreign aid and domestic savings: A spurious correlation? *Economic Development and Cultural Change* 39, 175-81

93 *g* Snyder, D.W. (1993). Donor bias towards small countries: An overlooked factor in the analysis of foreign aid and economic growth. *Applied Economics* 25, 481-88

94 *i* Snyder, D.W. (1996). Foreign aid and private investment in developing economies. *Journal of International Development* 8, 735-45

95 *g* Stoneman, C. (1975). Foreign capital and economic growth. *World Development* 3, 11-26

96 *gc* Svensson, J. (1999). Aid, growth and democracy. *Economics and Politics* 11, 275-97

97 *gc* Tebouel, R., and E. Moustier (2001). Foreign aid and economic growth: The case of the countries south of the Mediterranean. *Applied Economics Letters* 8, 187-90