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Does Foreign Aid Increase Foreign Direct Investment?

PABLO SELAYA
University of Copenhagen, Denmark
Copenhagen Business School, Denmark

and

EVA RYTTER SUNESEN *
Copenhagen Economics A/S, Denmark

Summary. — We examine the idea that aid and foreign direct investment (FDI) are complementary sources of foreign capital. We argue that the relationship between aid and FDI is theoretically ambiguous: aid raises the marginal productivity of capital when used to finance complementary inputs (like public infrastructure and human capital investments), but aid may crowd out private investments when it comes in the shape of pure physical capital transfers. Empirically, we find that aid invested in complementary inputs draws in FDI, while aid invested in physical capital crowds it out. The paper shows that *the composition of aid matters* for its overall level of efficiency.

Key words — development aid, foreign direct investment (FDI), foreign capital for development, aid effectiveness

1. INTRODUCTION

The notion that foreign aid and foreign direct investment (FDI) are complementary sources of capital is conventional among governments and international cooperation agencies. For instance, the UN's 2002 Monterrey Consensus on International Financing for Development affirms that "ODA [Official Development Aid] plays an essential role as a complement to other sources of financing for development, especially in those countries with the least capacity to attract private direct investment. A central challenge, therefore, is to create the necessary domestic and international conditions to facilitate direct investment flows, conducive to achieving national development priorities, to developing countries, particularly Africa, least developed countries, small island developing States, and landlocked developing countries, and also to countries with economies in transition." (United Nations, 2002, p. 9). [1]

However, the implicit presumption in the consensus that ODA has a "catalyzing" effect on FDI, or that aid and FDI are complements, is by no means evident. For example, Kosack and Tobin (2006) argue that aid and FDI are essentially unrelated, because aid is basically oriented to support the government budget and finance investments in human capital, while FDI is a private sector decision relatively more connected to physical capital. In a more general study, Caselli and Feyrer (2007) estimate the marginal product of capital (*MPK*) across countries and find that, accounting for the contribution of land and other natural resources to income generation, "[...] the return from investing in capital is no higher in poor countries than in rich countries." (Caselli & Feyrer, 2007, p. 537). One of the implications of their study is that increasing aid inflows to developing countries will lower the *MPK* in these economies and will tend to be fully offset by outflows of other types of capital investments (Caselli & Feyrer, 2007, p. 540). If this is the case, aid and FDI are clearly closer to being substitutes rather than being complements.

This paper presents a unified framework for assessing the relative merit of these different claims. We analyze the relationship between aid and FDI in a theoretical framework that distinguishes between aid directed toward complementary factors of production and aid invested in physical capital. This distinction serves to illustrate, on the one hand, that aid invested in complementary factors increases *MPK* in the recipient country, which tends to draw in additional foreign resources and helps to sustain a higher level of capital over time. For example, aid can ease important bottlenecks in poor countries by financing public infrastructure and human capital investments that would not have been undertaken by private actors (due to the free-riding problem in financing public goods for instance), nor by public agents (for example because of the budgetary constraints that prevent aid-recipient governments from undertaking this type of investments). On the other hand, the distinction also helps to illustrate that foreign aid invested in physical capital competes directly with other types of capital, and thus replaces investments that private actors would have undertaken anyway. In this case, capital mobility and rate-of-return equalization across countries will give rise to a flight of other types of capital after an aid flow has been received.

This framework provides a number of testable predictions. First, for a given level of domestic saving, aid invested in physical capital crowds out other types of foreign investments in physical capital, one for one. Second, aid invested in complementary factors of production has an ambiguous net effect on FDI. The logic of the ambiguity is that, while an increase in complementary factors increases *MPK* and attracts additional foreign investments, the productivity increase also raises in-

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come, domestic savings, and domestic investments, which tends to lower *MPK* and thus crowds out foreign investments. These two findings suggest that the overall impact of aid on FDI is in theory indeterminate, and that *the composition of aid matters*.

We take the implications of our theoretical analysis to the data utilizing a panel of 99 countries over the period 1970–2001 for which we have disaggregated data. We find a large and positive effect of aid invested in complementary factors, while aid invested in physical capital has a negative impact on FDI. The combined impact of these two types of aid on FDI remains positive, so our results imply that more aid should be directed toward inputs complementary to physical capital to optimize the return on aid. The results are robust to (1) a broader definition of complementary aid than that adopted in the benchmark estimations, (2) allowing for imperfect capital mobility, and (3) controlling for traditional FDI correlates and regional fixed effects.

The paper is structured as follows. Section 2 reviews the scarce theoretical and empirical literature on aid and FDI. Section 3 describes our theoretical framework. Section 4 presents our empirical strategy, describes the data and discusses relevant econometric. Section 5 shows the results, and Section 6 tests their robustness. Section 7 sums up and discusses policy implications.

2. THE LITERATURE ON AID AND FDI

The relationship between aid and FDI is controversial and research results on it remain inconclusive. To our knowledge, only six papers analyze the question empirically. Harms and Lutz (2006) and Karakaplan, Neyapti, and Sayek (2005) analyze the relationship between aid and FDI for a broad sample of developing countries. Karakaplan *et al*. (2005) find that aid has a negative direct effect on FDI and that both good governance and financial market development significantly improve the impact of aid on subsequent flows of FDI. Harms and Lutz (2006), on the other hand, find that once they control for the regulatory burden in the host country, aid works as a complement to FDI and, surprisingly, that the catalyzing effect of foreign aid is stronger in countries that are characterized by an unfavorable institutional environment.

Kimura and Todo (2010) and Blaise (2005) present case studies on Japanese FDI and aid flows, and report incongruent results. While Blaise (2005) finds positive effects from aid to infrastructure projects, Kimura and Todo (2010) find no positive infrastructure effect, no negative rent-seeking effect but a positive vanguard effect (arising when foreign aid from a particular donor country promotes FDI from the same country but not from other countries). Two other case studies, Bhavan, Xu, and Zhong (2011) and Carro and Larrú (2010), find that aid attracts FDI in Bangladesh, Sri Lanka, Pakistan, and India; and that the evidence is inconclusive in the cases of Argentina and Brazil, respectively.

We believe that this type of mixed results can be explained to a large extent by the high level of aggregation used for the aid variable. Karakaplan *et al*. (2005) and Bhavan *et al*. (2011) include only overall ODA. Harms and Lutz (2006) distinguish between grants, technical cooperation grants, as well as bilateral and multilateral aid, but it remains unclear why one would expect foreign investors to react differently to these types of aid. Kimura and Todo (2010) apply the idea of different types of aid but do not implement an effective disaggregation: they rely on a proxy for aid for infrastructure that takes the bulk of total aid (namely aid for economic and social infrastructure, production and multisector activities), and a proxy for aid for non-infrastructure that contains the most volatile part of aid (food and humanitarian aid, and aid related to debt).

A general shortcoming in this literature is also the lack of consensus on the specification of the FDI relation (Blonigen & Piger, 2011). None of the cited empirical papers are supported by a theoretical model.[2] One reason might be that the only paper analyzing theoretically the relationship between aid and FDI is Beladi and Oladi (2007, Ch. 4)—who set up a general equilibrium model where all foreign aid is used to finance public goods, but where they unfortunately do not consider any further disaggregation for the aid flows nor make an empirical analysis.

This paper closes this gap by proposing a simple theoretical model for the relationship between different types of aid and FDI in a small open economy, which constitutes the base for our empirical analysis. We describe the main elements and mechanisms in the next section (a formal presentation is given in the appendix).

3. A THEORETICAL ANALYSIS OF AID AND FDI

Assume a Solow setup for a small open economy, where output per capita, y, grows with (a) the accumulation of physical capital per capita, k (financed by domestic and foreign investments), and (b) improvements in total factor productivity, A (which includes any factor complementary to the accumulation of physical capital per capita, like new technologies and better institutions); such that $y = Ak$.

Assume that foreign aid is composed of two types of flows, which contribute to the described process of growth in two different ways: one part of aid helps to increase the amount of physical capital k, and the other helps to increase the amount of complementary factors or total factor productivity A. (As an example of two types of aid imagine, for instance, aid projects to modernize agriculture or other specific productive sector, and aid projects to improve the quality of public institutions.)[3]

If international mobility of capital is unrestricted, the return to investments in physical capital (the *MPK*) should be the same across countries. If this is the case, as Caselli and Feyrer (2007) estimate in their paper, any inflow of foreign capital should tend to reduce the *MPK* in the recipient country and will tend to crowd out other sources of capital. Assuming that one part of foreign aid is effectively used to finance projects that could have been financed by private (foreign or domestic) investors, a direct implication is that, controlling for domestic sources of capital (domestic savings), an increase in the flow of aid used to make investments in physical capital will tend to crowd out FDI.[4]

In turn, the effect of aid directed to increase complementary factors is in principle positive: foreign aid that is used to finance reforms, better institutions or better producing technologies, will increase the *MPK* and will tend to attract additional FDI. But interestingly, given that an increase in complementary factors also increases the aggregate level of income, in the context of a Solow economy (where domestic savings are determined by the country's level of income), we should also observe an increase in the level of domestic savings and domestic investments, which will tend to lower the *MPK* in the country and thereby reduce the amount of additional FDI attracted to the country. Therefore, the net effect of aid to complementary factors on FDI is in theory ambiguous: it will be the result of combining the positive effects via higher total factor productivity, with the negative effects via larger availability of domestic sources of capital.

The two counterbalancing effects from aid to complementary factors are both of first order, so the final effect of this

type of aid will depend on its existing level. In contrast, the effect of aid for physical capital investments will not operate with this type of scale effects, because its relationship with FDI is pinned down by the assumption of unrestricted capital mobility, through equalization of the level of *MPK* across countries. (We relax the assumption of unrestricted capital mobility as a robustness check later, and consider the case where the *MPK* differs across countries in a measure that reflects each country's idiosyncratic risks.)

A key implication of the analysis is that the effect of total aid on FDI is in theory ambiguous, because it is the combined effect of aid for physical capital investments and aid to complementary factors. This is an important result because it offers a simple explanation for why empirical studies that do not disaggregate aid flows tend to find insignificant or ambiguous effects, and provides a clear theoretical basis for the idea that *the composition of aid matters* for its overall level of efficiency.

A simple model formalizing this analysis and showing in more detail the mechanisms at work is presented in the appendix.

Based on these implications and the basic mechanisms described, we present in the next section our empirical examination of the relationship between aid and FDI.

4. EMPIRICAL STRATEGY

Within the framework described in the Section 3, the relationship between aid and FDI should have the following reduced form structure:

$$fdi = f(aid_K, aid_A, \mathbf{X}), \tag{1}$$

to reflect that the basic correlates of the level of FDI per capita in a country, *fdi*, are the amount of aid invested in physical capital per capita, aid_K; the amount of aid to complementary factors per capita, aid_A; determinants of the level of physical capital in the country and other correlates of *fdi* (all collected in **X**), like the level of domestic savings per capita, S, the depreciation rate of the existing stock of k (given by the physical rate of capital depreciation and the rate of population growth, n), the rate of return to physical capital investments in a world with unrestricted capital mobility (which will be a given level for a small country), and some measure of initial economic conditions (like the initial overall productivity level in the economy, A_0).[5]

In a panel setting, the econometric interpretation of this aid–FDI relationship is

$$fdi_{it} = \beta_0 + \beta_1 A_{0,it} + \beta_2 n_{it} + \beta_3 S_{it} + \beta_4 aid^K_{it} + \beta_5 aid^A_{it} + \beta_6 (aid^A_{it})^2 + u_{it}, \tag{2}$$

where fdi_{it} is the net flow of FDI per capita to country i during period t, $A_{0,it}$ is the overall productivity level at the beginning of period t, n_{it} is population growth, S_{it} is domestic savings per capita, aid^K_{it} is aid invested in physical capital, aid^A_{it} is aid invested in complementary factors, and β_0 is a constant term capturing all time-invariant factors. The square of aid^A_{it} is included in the regression to reflect that total effect of aid_A is conditional on its own level—feature that arises from the two counterbalancing first-order effects of complementary aid on FDI, namely that aid_A increases the marginal productivity of capital and attracts additional foreign investments; but it also raises income, domestic savings, and domestic investments, which lowers the *MPK* and tends to crowd out foreign investments. The square of aid_K is not included in the regression because, as explained in Section 3, without restrictions to capital mobility, aid directed to investments in physical capital substitutes *fdi* independently of its own level, due to cross-country equalization of *MPK*.

We expect β_1 to be positive in this specification since higher productivity raises the steady state level of capital and the demand for FDI. We also expect β_2 to be positive since a fast growing population dilutes the stock of k and thus allows for an increase in FDI per capita. β_3 should be negative since a high level of domestic savings lowers the need for foreign capital. From the theoretical analysis, aid_K is expected to crowd out foreign investments, and therefore the sign of β_4 should be negative. If capital mobility is unrestricted (an assumption that we relax in Section 6), aid to physical capital should crowd out FDI one by one, and we should in fact expect $\beta_4 = -1$. Finally, as explained in Section 3, the net effect of aid_A is theoretically indeterminate, so we do not have prior expectations for the signs of β_5 and β_6.

Interesting hypotheses that we can test with linear combinations of the estimated parameters are whether the effect of aid_K is negative (and equal to -1), whether the effect of aid_A is positive, and if the combined effect (or the effect of total aid) is significantly larger than zero.

(a) *Regression specification*

Precise data for the initial level of productivity ($A_{0,it}$) are unavailable, so we need to find valid proxies for it before running regressions. We start by assuming that the initial level of productivity is the same for all countries, β_0, and that it grows at a constant rate per period, so that $A_{0,it} = \beta_0 + \alpha_t$. If we make this assumption and pool the data, we can estimate

$$fdi_{it} = \beta_0 + \alpha_t + \beta_2 n_{it} + \beta_3 S_{it} + \beta_4 aid^K_{it} + \beta_5 aid^A_{it} + \beta_6 (aid^A_{it})^2 + u_{it}, \tag{3}$$

where α_t is a time-specific constant (that captures common productivity shocks at time t).

However, not all countries start out with the same initial conditions, and therefore we allow also for cross sectional differences in productivity by including time-invariant country-specific fixed effects, α_i:

$$fdi_{it} = \beta_0 + \alpha_t + \alpha_i + \beta_2 n_{it} + \beta_3 S_{it} + \beta_4 aid^K_{it} + \beta_5 aid^A_{it} + \beta_6 (aid^A_{it})^2 + u_{it}. \tag{4}$$

This equation can be consistently estimated with a fixed effects model (FE). But then again, if productivity evolves unequally across countries over time, regression (4) leaves out important information. We thus extend the list of regressors to include a lagged dependent variable, which captures time-moving country-specific factors and agglomeration effects, and basically reflects the persistent nature of FDI:

$$fdi_{it} = \beta_0 + \alpha_t + \alpha_i + \beta_1 fdi_{it-1} + \beta_2 n_{it} + \beta_3 S_{it} + \beta_4 aid^K_{it} + \beta_5 aid^A_{it} + \beta_6 (aid^A_{it})^2 + u_{it}. \tag{5}$$

Eqn. (5) is a dynamic specification for panel data, which can be estimated consistently and efficiently using the Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998) Generalized Method of Moments (GMM) estimators, and therefore constitutes our preferred econometric specification. To keep the empirical analysis as close as possible to our theoretical setup, the only additional control we add to this regression is the initial level of GDP per capita, y_{i0}, which is a strong proxy for time-varying initial conditions in each country.

Summing up, in our empirical analysis we run regressions of the type

$$fdi_{it} = \beta_0 + \beta_2 n_{it} + \beta_3 S_{it} + \beta_4 aid_{it}^K + \beta_5 aid_{it}^A + \beta_6 (aid_{it}^A)^2 + \gamma \mathbf{X} + u_{it} \quad (6)$$

where $\mathbf{X} = \{\alpha_t, \alpha_i, fdi_{it-1}, y_{i0}\}$. We do not add further controls here because we believe that the omitted variables bias is substantially reduced by including a full set of time dummies, individual country effects, the initial level of GDP per capita, and the lagged level of the dependent variable. [6]

(b) *Data*

The dependent variable in all our regressions, fdi_{it}, is net FDI inflows in constant US dollars divided by population to control for country size. The FDI data are taken from UNCTAD's Foreign Direct Investment database. [7]

The main control variables are the income per capita level, population growth rate, and savings per capita, which are taken from the World Bank's World Development Indicators. [8]

The aid variables are total net flows of official aid disbursements reported in the OECD aid statistics database. Since data on sectoral disbursements are available only after 1990, our measure of aid to a given sector is constructed using sectoral commitments as a proxy for sectoral disbursements. [9] More precisely, we follow the approach in Clemens, Radelet, Bhavnani, and Bazzi (in press) and Thiele, Nunnenkamp, and Dreher (2006) and assume that the proportion of aid actually disbursed to sector x during a given period, aid_x, is equal to the proportion of aid committed to sector x during this period, and hence that

$$aid_x \approx \frac{commit_x}{\sum_x commit_x} \sum_x aid_x \quad (7)$$

where $commit_x$ is the amount of ODA commitments to sector x, and $\sum_x commit_x$ and $\sum_x aid_x$ are the total amounts of aid commitments and disbursements received during each period, respectively.

Approximating sectoral disbursements with sectoral commitments may cause some concerns due to differences in definitions and statistical record (see Clemens *et al.* (in press) for more details). However, according to Odedokun (2003) and Clemens *et al.* (in press) this problem is likely to be small since disbursements and commitments (both on the aggregate and sectoral levels) are highly correlated.

Aid is decomposed into two broad categories, relying on the sectoral disaggregation from OECD's Aid Activity database [10]:

- *Aid invested in complementary inputs*, aid_A: aid oriented to social infrastructure (such as education, health, and water supply projects) and economic infrastructure (such as energy, transportation, and communications projects).
- *Aid invested in physical capital*, aid_K: contributions to directly productive sectors (such as agriculture, manufacturing, trade, banking, and tourism projects).

These two aid categories capture the main characteristics of aid_A and aid_K: aid invested in complementary factors is intended to generate positive spillover effects (public goods, inputs complementary to physical capital) whereas aid invested in physical capital has a more narrow purpose and could more easily have been undertaken by private investors (projects of agriculture, forestry, fishing, industry, mining, construction, trade, banking, and tourism). Other sectoral aid categories (like multisector support, program assistance, debt reorganization, emergency assistance, and unallocated types of aid) are excluded from the analysis since they are primarily oriented to provide fiscal budget support in the recipient country. [11]

Tables 6 and 7 in the appendix show statistics of aid_A and aid_K across time and countries. The statistics show that aid_K has been on average 22% of total aid during the period 1970–2001, and aid_A has been on average 50%.

All the data used in the estimations are averaged over five-year intervals to reduce the noise caused by sudden annual changes and possible discrepancies (Tables 5 and 8 in the appendix show summary statistics and describe the main sample, respectively).

(c) *Endogeneity*

We need to consider the possible endogeneity of the aid variables (and all other variables in the right hand side) in our regressions, since the estimated coefficients are consistent only if all explanatory variables are exogenous. Aid would be endogenous if, for example, donors systematically disburse more resources to those countries that are neglected by private foreign investors (Harms & Lutz, 2006).

We start by estimating regressions (3) and (4) with an instrumentation strategy that follows cross-country studies on aid effectiveness (e.g., Dalgaard, Hansen, & Tarp, 2004; Hansen & Tarp, 2001), and use lags of the own aid variables, (log) GDP per capita levels and squared levels, (log) population levels, and a dummy for countries in the CFA franc zone.

As shown in the tables below, these instruments are strong for the model estimated in levels (Eqn. (3)), but not for the model estimated including country fixed effects (Eqn. (4)), and they unfortunately do not pass standard tests of validity. [12] We therefore opt for an identification strategy based on predetermined instruments, and take Arellano and Bond's (1991) first-difference GMM (GMM-DIFF) estimator, which relies on lagged levels as instruments for regressions in first differences, and later on Arellano and Bover (1995) and Blundell and Bond's (1998) system GMM (GMM-SYS) estimator, which supplements the GMM-DIFF set with a system of regressions in levels, with lagged first differences used as instruments. Validity of this instrumentation strategy can be assessed with tests of overidentification and autocorrelation of the residuals, which are described in the tables in the next section.

5. EMPIRICAL RESULTS

Table 1 reports the results of estimating Eqns. (3)–(6) for a (non-balanced) sample of 99 countries for which we have disaggregated data, using data averaged over five-year intervals during 1970–2001. The standard errors reported are robust to arbitrary heteroskedasticity and intra-group correlation (clustering within countries), and in columns 3–5 they also include the two-step correction for small samples suggested by Windmeijer (2005).

Independently of the chosen estimator, our results strongly support the notions that aid to complementary factors has a positive effect on FDI, that aid invested in physical capital tends in turn to crowd out FDI, and that the net effect is small but always positive.

In terms of specification, a Hausman test between columns 1 and 2 confirms the relevance of including fixed effects (p-value = 0.81). The lagged dependent variable is highly significant, which suggests that a dynamic model is a correct specification, and that we should then rely on consistent and efficient methods for estimating it, like Arellano and Bond's

Table 1. *Foreign aid and FDI*

	1 2SLS	2 2SLS + FE	3 GMM-DIF	4 GMM-SYS	5 GMM-SYS
aid_K	−0.85	−1.36***	−0.62	−0.84**	−0.84***
	[0.65]	[0.22]	[0.46]	[0.33]	[0.29]
aid_A	1.74***	1.67***	1.33***	1.13***	1.09***
	[0.44]	[0.22]	[0.32]	[0.38]	[0.32]
aid_A, squared	−0.0027***	−0.0013**	−0.0015***	−0.0013***	−0.0013***
	[0.00069]	[0.00063]	[0.00023]	[0.00037]	[0.00031]
Savings per capita, S	13.9	53.1*	53.9***	−0.47	−17.0**
	[11.6]	[30.6]	[11.1]	[7.85]	[7.30]
Population growth, n	−8.97**	−1.58	4.59	−7.00	−2.39
	[4.19]	[1.89]	[30.3]	[6.99]	[5.93]
fdi, lagged			0.074	0.48***	0.48***
			[0.20]	[0.12]	[0.11]
GDP per capita, y					8.72***
					[2.99]
Observations	325	307	239	325	325
N countries (clusters)	99	81	85	99	99
N excluded instruments	6	5	24	54	64
1st stage F, Kleibergen–Paap	21.1	0.49			
Hansen overid., p-value	0.021	0.15	0.5	0.14	0.21
AR(1), p-value			0.12	0.012	0.013
AR(2), p-value			0.30	0.33	0.25
AR(3), p-value			0.52	0.26	0.24
AR(4), p-value			0.39	0.27	0.25
H_0: $aid_K = -1$	0.15	−0.36	0.38	0.16	0.16
	[0.65]	[0.22]	[0.46]	[0.33]	[0.29]
H_0: $aid > 0$	0.77	0.25	0.65	0.22	0.19
	[0.55]*	[0.31]	[0.41]*	[0.087]***	[0.058]***
H_0: $aid_A > 0$	1.62	1.61	1.26	1.07	1.03
	[0.42]***	[0.2]***	[0.31]***	[0.37]***	[0.31]***

Notes: The dependent variable is FDI per capita (*fdi*). All regressions include time dummies and a constant term. Aid variables are instrumented with own lags, (log) levels and square levels of GDP per capita, (log) population, and a FRZ dummy in columns 1 and 2. We use predetermined instruments in columns 3–5 (second lags in column 3; and second lags and lagged differences in columns 4 and 5). Robust standard errors in brackets, clustered at the country level, and including Windmeijer's (2005) small sample correction in columns 3–5.
* Denotes significance at 10% level.
** Denotes significance at 5% level.
*** Denotes significance at 1% level.

(1991) GMM-DIFF. Results in column 3 report the results of estimating our preferred specification (Eqn. (6)) with this method. The coefficients have the same signs as in previous regressions, and the linear parameter tests show that we cannot reject the hypotheses that (a) aid_A operates with scale effects, (b) $aid_K = -1$, (c) $aid_A > 0$, and (d) total $aid > 0$, all of them supporting the main predictions of our theoretical analysis.

The Hansen test of overidentification does not reject the null hypothesis that the instruments as a group appear as exogenous. The tests of autocorrelation cannot reject the absence of autocorrelation in the second, third, and fourth differences (they cannot reject absence of AR(1) in column 3 either, but only marginally). This indicates that second and higher-order lags of the endogenous variables are valid instruments. Based on this, we limit the number of included lags to only the second, which helps us to conform to the "rule of thumb" of keeping the number of instruments below the number of cross sections (Roodman, 2006), and control the problem of overfitting the Hansen test of instruments joint validity that appears when the number of instruments approaches the number of observations (Roodman, 2009). [13]

Based on the indication that there might be AR(1) and that persistence in the FDI variable is important, we turn to GMM-SYS estimators. Column 4 presents the result of estimating Eqn. (5), and column 5 presents the results of estimating Eqn. (6), which is the richest (and our preferred) econometric specification.

Column 5 in Table 1 shows that one dollar of aid invested on physical capital crowds out on average 0.84 dollars of FDI in per capita terms. The table also shows that one aid dollar invested in complementary factors attracts on average 1.09 dollars of additional FDI. This type of aid works with scale effects, so, evaluated at the median (21.6 dollars per capita), our results indicate that one dollar of aid invested in complementary factors draws in total 1.03 ($1.09 - 2 \times 0.0013 \times 21.6$) dollars of FDI in per capita terms. The corresponding Wald test confirms this marginal effect to be significantly positive at the 1% level.

Having specified a dynamic model we can calculate long-run effects of aid_K and aid_A, by assuming that the level of FDI per capita is the same in every period. Evaluated at the median, we find that one additional aid dollar per capita invested in complementary factors draws in 1.98 dollars of FDI per capita in the

long run ($\frac{1.03}{1-0.48}$)—which indicates that aid_A generates important benefits for foreign investors both in the short and the long run.

The results also confirm the crowding out effect of aid invested in physical capital, which in the short run costs about 0.84 dollars of FDI per capita for each dollar of aid invested in physical capital, and that accumulates to a level of 1.61 dollars in the long run. Interestingly, the Wald tests reported at the bottom of the table show that the negative effect of aid_K on *fdi* is statistically not different from −1, which supports Caselli and Feyrer's (2007) estimate that the *MPK* tends to be equalized across countries.

The effect of other controls is either insignificant or goes according to the theoretical predictions: population growth enters insignificantly, domestic savings negatively (1 additional dollar of domestic savings per capita is associated with 17 dollars less of FDI per capita on average), and initial GDP per capita enters positively (1 additional dollar of GDP per capita at the beginning of each period tends to attract 8.72 dollars of FDI per capita on average).

A Wald test also shows that the combined effect of aid_A and aid_K is significantly positive and equal to 0.19 dollars (evaluated at the median), which implies that the substitution effect of aid_K is more than outweighed by the positive effects of aid_A on *fdi* in a typical case. [14]

6. ROBUSTNESS CHECKS

In light of the policy implications arising from the analysis, it is necessary to ensure that the results are robust to correcting for possible misspecifications. We carry out three basic checks for robustness of our empirical findings.

(a) *Technical assistance*

The grouping of our sectoral aid variables could be questioned. In particular, aid to complementary factors in this paper does not include Technical Cooperation Grants (TCGs), which aim to contribute to development primarily through education and training. Since TCGs consist of activities involving the supply of human resources or actions targeted on human resources (education, training, and advice) one could easily argue that TCGs would have the same impact as aid invested in complementary factors. [15] In Table 2 below we therefore replicate the specifications from Table 1 using an extended definition of aid_A that includes also TCGs from the OECD database.

Although there is a slight drop in the size of the main coefficients, the results from Table 1 carry completely over.

Table 2. *Foreign aid and FDI—Alternative definition of* aid_A

	1 2SLS	2 2SLS + FE	3 GMM-DIF	4 GMM-SYS	5 GMM-SYS
aid_K	−0.49	−1.40***	−0.68*	−0.69*	−0.74**
	[0.73]	[0.27]	[0.41]	[0.35]	[0.30]
aid_A*	0.99***	1.72***	1.44***	0.92**	0.94***
	[0.31]	[0.16]	[0.35]	[0.38]	[0.32]
aid_A*, squared	−0.0017***	−0.0013**	−0.0016***	−0.0011***	−0.0012***
	[0.00056]	[0.00059]	[0.00028]	[0.00036]	[0.00031]
Savings per capita, *S*	20.6	45.5*	47.4***	−0.44	−23.1***
	[13.7]	[27.0]	[10.6]	[9.83]	[6.69]
Population growth, *n*	−11.5**	−2.52	−0.50	−14.0*	−6.75
	[4.92]	[2.13]	[24.4]	[8.36]	[6.23]
fdi, lagged			0.09	0.46***	0.46***
			[0.20]	[0.14]	[0.13]
GDP per capita, *y*					12.1***
					[3.25]
Observations	323	307	237	323	323
N countries (clusters)	97	81	83	97	97
N excluded instruments	6	5	24	54	64
1st stage F, Kleibergen–Paap	71	0.44			
Hansen overid., *p*-value	0.015	0.073	0.47	0.21	0.17
AR(1), *p*-value			0.11	0.0095	0.012
AR(2), *p*-value			0.35	0.44	0.28
AR(3), *p*-value			0.42	0.20	0.17
AR(4), *p*-value			0.40	0.23	0.20
H_0: $aid_K = -1$	0.51	−0.40	0.32	0.31	0.26
	[0.73]	[0.27]	[0.41]	[0.35]	[0.3]
H_0: aid > 0	0.42	0.26	0.68	0.18	0.15
	[0.62]	[0.33]	[0.34]**	[0.1]**	[0.061]***
H_0: $aid_A > 0$	0.92	1.66	1.37	0.87	0.89
	[0.30]***	[0.15]***	[0.34]***	[0.36]***	[0.3]***

Notes: The dependent variable is FDI per capita (*fdi*). aid_A* is defined as aid_A + technical cooperation grants. All regressions include time dummies and a constant term. Aid variables are instrumented with own lags, (log) levels and square levels of GDP per capita, (log) population, and a FRZ dummy in columns 1 and 2. We use predetermined instruments in columns 3–5 (second lags in column 3; and second lags and lagged differences in columns 4 and 5). Robust standard errors in brackets, clustered at the country level, and including Windmeijer's (2005) small sample correction in columns 3–5.

* Denotes significance at 10% level.

** Denotes significance at 5% level.

*** Denotes significance at 1% level.

Table 3. *Foreign aid and FDI—Political risks*

Risk measure	Political risk						
	ICRG index	Govt. stability	Socio-ec. condit.	Investm. profile	Internal conflict	External conflict	Political corrupt.
	1	2	3	4	5	6	7
aid_K	−0.55	−0.52	−0.73***	−0.59**	−0.87***	−0.90***	−0.78**
	[0.36]	[0.43]	[0.25]	[0.29]	[0.27]	[0.30]	[0.30]
aid_A	−0.32	0.19	0.34	0.16	1.15***	1.24***	0.44
	[0.80]	[0.72]	[0.38]	[0.53]	[0.25]	[0.40]	[0.65]
aid_A, squared	−0.0014***	−0.0013***	−0.0014***	−0.0013***	−0.0013***	−0.0013***	−0.0011***
	[0.00030]	[0.00032]	[0.00029]	[0.00025]	[0.00035]	[0.00031]	[0.00037]
Risk measure	0.21	0.54	0.29	−0.99	0.18	2.5	0.063
	[0.66]	[6.12]	[3.18]	[3.44]	[3.20]	[2.69]	[7.48]
$aid_A \times$ Risk measure	0.021**	0.11**	0.12***	0.12***	−0.008	−0.017	0.23
	[0.0094]	[0.050]	[0.027]	[0.036]	[0.025]	[0.026]	[0.16]
Savings per capita, S	−32.7***	−21.5***	−23.9***	−22.5***	−22.5***	−22.5***	−15.2
	[8.78]	[6.13]	[6.98]	[6.88]	[6.04]	[8.39]	[14.5]
Population growth, n	−5	−6.88	−14.9**	−8.77	−10.1*	−11.2**	−14.6**
	[4.68]	[5.30]	[5.82]	[5.28]	[5.81]	[5.57]	[7.06]
fdi, lagged	0.43***	0.43***	0.44***	0.45***	0.46***	0.45***	0.38***
	[0.10]	[0.096]	[0.11]	[0.097]	[0.11]	[0.11]	[0.11]
GDP per capita, y	10.9***	9.01**	11.4***	10.6***	11.0***	11.2***	10.3**
	[3.62]	[3.67]	[3.53]	[3.54]	[3.72]	[3.54]	[5.05]
Observations	264	262	262	262	262	262	262
N countries (clusters)	82	82	82	82	82	82	82
N excluded instruments	71	71	71	71	71	71	71
AR(1), p-value	0.018	0.03	0.014	0.017	0.012	0.012	0.011
AR(2), p-value	0.17	0.098	0.089	0.13	0.067	0.077	0.069
AR(3), p-value	0.22	0.15	0.19	0.19	0.13	0.15	0.1
Hansen overid., p-value	0.5	0.25	0.35	0.44	0.46	0.23	0.42
H_0: $aid_K = -1$	0.45	0.48	0.27	0.41	0.13	0.10	0.22
	[0.36]	[0.43]	[0.25]	[0.29]	[0.27]	[0.30]	[0.3]
H_0: $aid > 0$	0.32	0.45	0.14	0.21	0.16	0.12	0.28
	[0.071]***	[0.12]***	[0.068]**	[0.046]***	[0.076]**	[0.098]	[0.09]***
H_0: $aid_A > 0$	0.87	0.97	0.87	0.80	1.03	1.02	1.07
	[0.34]***	[0.33]***	[0.3]***	[0.31]***	[0.31]***	[0.32]***	[0.3]***

(*continued on next page*)

Table 3. (*continued*)

Risk measure	Political risk					
	Military in politics	Religious tensions	Law and order	Ethnic tensions	Democratic accountab.	Bureauc. quality
	8	9	10	11	12	13
aid_K	−0.41	−0.86***	−0.83**	−0.85***	−0.73**	−0.71**
	[0.47]	[0.28]	[0.35]	[0.29]	[0.30]	[0.33]
aid_A	0.34	1.35***	0.96*	1.22***	0.87**	0.86**
	[0.69]	[0.33]	[0.50]	[0.41]	[0.37]	[0.40]
aid_A, squared	−0.0013***	−0.0013***	−0.0013***	−0.0013***	−0.0014***	−0.0013***
	[0.00033]	[0.00033]	[0.00031]	[0.00032]	[0.00028]	[0.00033]
Risk measure	−1.94	2.16	−7.99	−2.59	1.19	−8.68
	[4.70]	[4.67]	[5.37]	[5.20]	[6.42]	[5.69]
$aid_A \times$ Risk measure	0.17**	−0.066***	0.047	−0.036	0.052	0.10***
	[0.082]	[0.015]	[0.080]	[0.049]	[0.053]	[0.037]
Savings per capita, S	−33.7***	−20.1***	−24.4***	−24.3***	−24.4***	−24.0***
	[9.43]	[6.41]	[7.71]	[6.85]	[6.80]	[7.02]
Population growth, n	−7.27	−12.4*	−7.66	−13.8**	−7.58	−12.2*
	[5.87]	[6.71]	[5.30]	[6.04]	[5.12]	[6.70]
fdi, lagged	0.48***	0.44***	0.45***	0.44***	0.47***	0.44***
	[0.090]	[0.11]	[0.10]	[0.11]	[0.12]	[0.10]
GDP per capita, y	11.5***	11.6***	12.9***	13.5***	10.3***	11.9***
	[3.56]	[2.73]	[4.19]	[4.24]	[3.45]	[3.29]
Observations	262	262	262	262	262	262
N countries (clusters)	82	82	82	82	82	82
N excluded instruments	71	71	71	71	71	71
AR(1), p-value	0.012	0.012	0.013	0.013	0.014	0.015
AR(2), p-value	0.092	0.064	0.08	0.082	0.10	0.10
AR(3), p-value	0.13	0.13	0.13	0.14	0.12	0.15
Hansen overid., p-value	0.35	0.24	0.43	0.36	0.37	0.39
H_0: $aid_K = -1$	0.59	0.14	0.17	0.15	0.27	0.29
	[0.47]	[0.28]	[0.35]	[0.29]	[0.3]	[0.33]
H_0: $aid > 0$	0.37	0.1	0.21	0.18	0.25	0.29
	[0.079]***	[0.077]*	[0.084]***	[0.068]***	[0.064]***	[0.083]***
H_0: $aid_A > 0$	0.78	0.96	1.04	1.02	0.98	1.00
	[0.44]**	[0.34]***	[0.31]***	[0.32]***	[0.29]***	[0.34]***

Notes: The dependent variable is FDI per capita (*fdi*). Risk measures taken from the International Country Risk Guide (ICRG). All regressions are estimated by GMM-SYS, and include a full set of time dummies and a constant term. Aid variables are instrumented with their second lags and lagged differences. Robust standard errors in brackets, clustered at the country level, and including Windmeijer's (2005) small sample correction.

*Denotes significance at 10% levels.

**Denotes significance at 5% levels.

***Denotes significance at 1% levels.

(b) *Imperfect capital mobility*

In our theoretical analysis we assume unrestricted capital mobility and, therefore, *MPK* equalization across countries. If this is assumption unrealistic, we should allow in our theoretical analysis the return to capital investments to reflect idiosyncratic risk characteristics in each country.

Assuming each country has a given level of idiosyncratic risk, ρ, the capital stock in each country will conform then to a different risk-adjusted level of *MPK*. From there, the relationship between aid_K and FDI will essentially continue as before: for given levels of initial domestic savings and idiosyncratic risks, an increase in aid_K will tend to decrease the overall *MPK* and thereby crowd out *fdi*. This means that in our preferred econometric specification (6) we will have to add some measure of ρ to still be able to identify the effect of aid_K.

Including a measure of ρ in our regressions is necessary then to account for the effect of imperfect capital mobility on aid_K, but not sufficient, since it affects also aid_A: ρ determines basically a new level for the stock of capital in the economy (k^*), but this capital stock is also determined by the level of complementary factors in the economy (A), which is directly affected by aid_A. The interplay between ρ and aid_A has first order effects, and we therefore need to reflect this explicitly in the regression. (The model in the appendix shows formally the effects of allowing for imperfect capital mobility across countries and introducing country specific risks into consideration.)

Based on this, our regression specification should now look like

$$fdi_{it} = \beta_0 + \beta_1 n_{it} + \beta_2 S_{it} + \beta_3 aid_{it}^K + \beta_4 aid_{it}^A + \beta_5 (aid_{it}^A)^2 + \beta_6 \rho_{it} + \beta_7 (aid_{it}^A \times \rho_{it}) + \boldsymbol{\gamma}\mathbf{X} + u_{it} \quad (8)$$

where ρ_{it} is a measure of idiosyncratic risk that might affect investment decisions. The signs of β_6 and β_7 are expected to be negative or positive, depending on ρ_{it} increasing or reducing country i's attractiveness as an investment location.

We use the overall International Country Risk Guide rating and its 12 specific political risk components as different measures of ρ_{it}.[16]

In general, lower political risk is associated with higher levels of overall accountability, stability, and institutional quality in the political process. In particular, from the specific ICRG rankings, political risk is lower the higher the government stability, the better the socioeconomic conditions and the investment

Table 4. *Foreign aid and FDI—Regional effects*

	Benchmark definition of aid_A		Alternative definition of aid_A (aid_A^*)	
	GMM-SYS 1	GMM-SYS 2	GMM-SYS 3	GMM-SYS 4
aid_K	−0.84***	−0.89***	−0.74**	−0.80***
	[0.29]	[0.28]	[0.30]	[0.29]
aid_A (aid_A^*)	1.09***	1.10***	0.94***	0.97***
	[0.32]	[0.28]	[0.32]	[0.28]
aid_A (aid_A^*), squared	−0.0013***	−0.0013***	−0.0012***	−0.0012***
	[0.00031]	[0.00026]	[0.00031]	[0.00027]
Savings per capita, S	−17.0**	−2.53	−23.1***	−6.39
	[7.30]	[12.0]	[6.69]	[11.5]
Population growth, n	−2.39	5.1	−6.75	1.73
	[5.93]	[7.61]	[6.23]	[7.41]
fdi, lagged	0.48***	0.46***	0.46***	0.43***
	[0.11]	[0.094]	[0.13]	[0.11]
GDP per capita, y	8.72***	1.21	12.1***	3.43
	[2.99]	[6.43]	[3.25]	[6.08]
Observations	325	324	323	322
N countries (clusters)	99	98	97	96
N excluded instruments	64	59	64	59
Hansen overid., p-value	0.21	0.29	0.17	0.19
AR(1), p-value	0.013	0.011	0.012	0.011
AR(2), p-value	0.25	0.48	0.28	0.66
AR(3), p-value	0.24	0.25	0.17	0.18
AR(4), p-value	0.25	0.26	0.20	0.23
Continent dummies	No	Yes	No	Yes
H_0: Continent dummies (jointly) = 0 (p-value)	–	0.59	–	0.55
H_0: $aid_K = -1$	0.16	0.11	0.26	0.20
	[0.29]	[0.28]	[0.30]	[0.29]
H_0: aid > 0	0.19	0.15	0.15	0.12
	[0.058]***	[0.086]**	[0.061]***	[0.09]*
H_0: $aid_A > 0$	1.03	1.04	0.89	0.92
	[0.31]***	[0.27]***	[0.30]***	[0.27]***

Notes: The dependent variable is FDI per capita (*fdi*). aid_A^* is defined as aid_A + technical cooperation grants. All regressions are estimated by GMM-SYS, and include a full set of time dummies and a constant term. Aid variables are instrumented with their second lags and lagged differences. Robust standard errors in brackets, clustered at the country level, and including Windmeijer's (2005) small sample correction.

* Denotes significance at 10% level.

** Denotes significance at 5% level.

*** Denotes significance at 1% level.

profile, the lower the number of internal conflicts, external conflicts and political corruption, the lower the military is involved in politics, the lower the religious and the ethnic tensions, the higher the prevalence of law and order, and the larger the degrees of democratic accountability and bureaucratic quality.

Results from estimating regression (8) including these political risk measures are reported in Table 3.[17] We treat all risk variables as endogenous, and find that none of the political risk indices enter the regression significantly by themselves, but that some of them affect significantly through aid_A: a better ranking in the overall ICRG country risk indicator, government stability, better socioeconomic conditions, better investment profile, and higher bureaucratic quality. Although the results also show that the conditional effect of some of the indexes reduce significance of the effects of aid_K and aid_A, the marginal effect of aid on FDI remains positive and significant in practically all cases considered, and our most important findings appear more robustly: aid_K affects negatively *fdi* and we cannot reject that the effect is statistically equal to -1, aid_A affects positively and the impact is positive, and the marginal net effect is typically small but statistically positive and significant.[18] These results are reassuring, since we are now controlling for the facts that mobility across countries is probably neither perfect nor unrestricted, and that political risks are likely to be an important direct determinant of FDI allocation.

(c) *Omitted variables*

In general, our specification should also be guided by the extensive literature on FDI determinants. Blonigen and Piger (2011) present the most updated and comprehensive survey on this topic. They use statistical techniques to identify from a large set of candidates those variables that are most likely to be determinants of FDI. They find that traditional gravity variables (real GDP levels and distance between countries), cultural factors, relative labor endowments, and regional trade agreements are the variables with higher inclusion probabilities in an empirical FDI regression. Blonigen and Piger (2011) also report variables thought to be important determinants, but which according to their calculations have low inclusion probabilities and appear as non-robust in more comprehensive tests: multilateral trade openness, business costs, infrastructure (including credit markets), and institutions.

We estimated Eqn. (8) including proxies for all these categories, using growth rates of real GDP per capita; variables for socioeconomic, religious and ethnic conditions, geographic and climate characteristics, and a number of variables that proxy for the quality of political institutions. Our results remain remarkably stable and are similar to the ones reported in Table 3. (These results are reported in the supplementary material for this paper, available in a web appendix.)[19]

We believe that the omitted variables bias is substantially reduced by controlling for country fixed effects, time dummies, a lagged dependent variable, and other controls, and that we do a fair assessment of misspecification by checking the effect of other potential determinants of FDI and confounders in Table 3. However, one final check we could present is for the existence of regional effects—to control, for example, for the possibility that aid is more effective in attracting FDI in some continents and not in others.

In Table 4 we add a full set of continent dummies to our basic specification (regression 6), and test our results with the benchmark definition of aid_A, and the alternative definition of it including TCGs.[20]

Columns 1 and 3 in Table 4 reproduce our becnhamrk regressions (shown in column 5 in Tables 1 and 2, respectively), to facilitate comparison. Columns 2 and 4 in Table 4 show that inclusion of regional effects in our main regressions does not change the results. These columns also show that we cannot reject the hypothesis that the set of continent dummies are jointly statistically insignificant, which is an indication that aid is not more effective in attracting FDI in certain continents and not in others.

7. CONCLUSION

Due to its potential to transfer knowledge and technology, create jobs, boost overall productivity, and enhance competitiveness and entrepreneurship, attracting FDI to developing countries is essential to contribute to economic growth, development, and poverty reduction.[21] Given the emphasis on using ODA as a vehicle for creating a private sector enabling environment, the question of whether or not aid flows induce significantly more FDI inflows becomes an important and relevant question not only on its own right but also as an essential element in the aid effectiveness debate.

Our results strongly support the hypotheses that aid invested in inputs complementary to physical capital draws in foreign capital, while aid directly invested in physical capital crowds out private foreign investments. While the impact of the two types of aid together is positive, an important policy implication is that *the composition of foreign aid matters* for its overall level of efficiency. This is particularly important for debates where the discussion tends to center on the amount of aid to be donated to poorest countries.

Our analysis supports the recommendation of investing aid in complementary inputs. Such investments improve absorption capacity and increase *MPK* in the host countries, which allows them to accumulate more foreign capital without experiencing a drop in domestic private investments or a flight of foreign capital.

NOTES

1. See the 2007 Paris Declaration Aid Effectiveness, or the 2011 UNCTAD Policy Focus, available at www.unctad.org/en/docs/aldcafricapf2011d1_en.pdf, for more recent examples.

2. More generally, analyzing why development economics needs theory, Acemoglu (2010) argues that development economics essentially "investigates the causes of poverty and low incomes around the world and seeks to make progress in designing policies that could help individuals, regions, and countries to achieve greater economic prosperity", and that "[...] Economic theory plays a crucial role in this endeavor, not only because it helps us focus on the most important economic mechanisms, but also because it provides guidance on the external validity of econometric estimates, meaning that it clarifies how we can learn from specific empirical exercises about the effects of similar shocks and policies in different circumstances and when implemented on different scales." (Acemoglu, 2010, p. 17).

3. Aid has typically been thought to finance only public type of goods, but there is compelling evidence that aid also finances projects that could have been financed by foreign (or domestic) private investors, in areas with or without initial private investors' initiative or interest. One example of this is the Danish Development Agency's Business Development programs

("Private Sector Development", "Business to Business for Development", "Innovative Partnerships for Development"), which since 1993 have supported the establishment of commercial establishments and partnerships between Danish companies and companies in many developing countries in areas like organic farming and agriculture, IT and programing, clothing, and tourism, among others. A second, larger and more recent example is USAID's Private Sector Development program for Iraq, "Izdihar" ("prosperity" in Arabic), which encourages private sector institutions and reforms, the establishment of a stock exchange, and the support of a number of private banks and microfinance institutions. Visit for example www.danidadevforum.um.dk/en/menu/Topics/GrowthAndEmployment/BusinessDevelopment, and www.usaid.gov/iraq/accomplishments/privsec.html.

4. An interesting corollary is that the relationship between domestic savings and FDI has the same features as the one between this type of aid and FDI: controlling for other sources of capital, a larger amount of domestic savings tends to reduce the marginal returns to capital accumulation, and thereby the need of additional FDI flows. Our empirical results support this idea, and shows that the conditional correlation between savings and FDI is indeed negative.

5. Eqn. (1) is basically a simplified representation of the reduced form derived for the steady state equilibrium in the theoretical model presented in the appendix (Eqn. (A.6))

6. We can extend the set of controls **X** by including a measure of human capital (for example the level of primary schooling), and a measure of climate and geographical characteristics (for example the amount of tropical land in the country), but these factors do not add significant value to the benchmark regression we want to establish at this stage, and do not affect our results either, so we maintain our basic specification without including them. Regressions showing the results including these variables are available in the supplementary material for this paper, available at www.econ.ku.dk/pabloselaya/aidfdiWD2012/webappendix_april2012.pdf.

7. The data can be accessed at www.unctad.org/Templates/Page.asp?intItemID=4979.

8. Our data were extracted from the 2005 CD version. The data can also be accessed now at data.worldbank.org/data-catalog/world-development-indicators.

9. Data on total disbursements come from OECD's DAC database, and data on sectoral aid commitments from OECD's Credit Reporting System database. Both datasets can be accessed at www.oecd.org/dataoecd/50/17/5037721.htm.

10. OECD's sectoral classification for the purpose of aid is developed to facilitate tracking of aid flows and to permit measuring the share of each sector or other purpose category in total aid. For details on OECD's aid "purpose codes", and aid's disaggregation according to its purpose of investment, see www.oecd.org/dac/stats/crsguide.

11. In Section 6 we present a number of robustness checks for our results, and address specifically their sensitivity to our definition of different types of aid.

12. More precisely, column 1 in Table 1 shows that the first-stage F test for joint significance of the excluded instruments (Kleibergen–Paap statistic) is high and supports the hypothesis that the instruments are strong, but the Hansen test of overidentification rejects the hypothesis that the instruments are valid (uncorrelated with the error term and exogenous as a group). In column 2 we add country fixed effects, and the instruments gain marginally more validity, but lose completely their strength. In general, Roodman (2007) shows that the different instrumentation strategies in the traditional aid effectiveness literature are all fragile.

13. This choice helps us to observe the minimally arbitrary "rule of thumb" proposed by Roodman (2006) of keeping the number of instruments below the number of cross sections to make the regressions less susceptible to the problem of "too many instruments" (Roodman, 2009).

14. If the marginal effects are evaluated at the mean instead of the median, our conclusions remain the same.

15. TCGs were not initially included in the definition of aid_A, since they can in theory also contribute to an aid project in some productive sector of the economy.

16. In order to detect significant effects of aid on FDI, Karakaplan et al. (2005) and Harms and Lutz (2006) use aid interacted with the Kaufmann, Kraay, and Mastruzzi (2005) governance indicators to capture differences in government effectiveness.

17. For results in Table 3, a high value of the different political-risk measures is associated with a low overall political risk, and hence, a high value of the different risk measures should have a positive effect on *fdi*.

18. The only exception occurs with the number of external conflicts, where the positive effect of aid_A and the negative effect of aid_K are strongly significant and very close in magnitude, so that the combined effect remains positive but significant only at the 21% level.

19. Available at www.econ.ku.dk/pabloselaya/aidfdiWD2012/webappendix_april2012.pdf.

20. The inclusion of regional dummies makes a difference in a dynamic panel regression, because we estimate our main regressions with GMM-SYS, where country-specific and time-invariant regressors affect the part of the system estimated in levels.

21. An effective contribution of FDI to growth and development also depends on other factors, among them its contribution to environmental and social development in the host countries, and its support to their national development priorities. See Te Welde (2006) for a historical perspective on FDI and development, and Alfaro, Kalemli-Ozcan, Chanda, and Sayek (2010) for an assessment of FDI's impact on growth.

22. The argument of complementarity between public and private investment is generalized by Clarida (1993) and Chatterjee, Sakoulis, and Turnovsky (2003). Reinikka and Svensson (2002) find empirical support for the importance of complementary public capital for foreign investors.

23. We could assume that FDI (and domestic savings) also contributes to the accumulation of TFP in the economy. Our assumption that only one part of aid contributes to increasing TFP highlights the fact that there is one part of aid that explicitly aims to transfer technology, improve institutions, etc., whereas the effects that FDI (and domestic savings) have on TFP might be important as well but in practice are only indirect.

24. In line with Sørensen and Whitta-Jacobsen (2005, Ch. 4) and Turnovsky (2000).

25. The main reason for expecting significant scale effects only for aid_A is that it has two first-order effects on the level of FDI: it increases the marginal productivity and attracts additional foreign investments, but also

raises income, domestic savings, and domestic investments, which lowers MPK and tends to crowd out foreign investments. The total effect of complementary aid is then conditional on the existing amount of aid_A. aid_K does not operate with scale effects, because it has only one direct effect on the level of FDI: both are sources for investments in physical capital (along with domestic savings), and in a world where the MPK is pinned down by r^w (Caselli and Feyrer, 2007), the relationship between aid_K and FDI (and savings) is linear (they are substitutes to each other, independently of the size of aid_K in the economy).

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APPENDIX A. A THEORETICAL MODEL OF AID AND FDI

A.1.Basic *setup*

This section presents a Solow model for a small open economy, adapted to studying the relationship between different types of aid flows and FDI.

Assume a Cobb–Douglas production function where GDP per capita, y, is given by

$$y = Ak^{\alpha} \tag{A.1}$$

where k is the stock of physical capital per capita ($\frac{K}{L}$), A denotes total factor productivity, and α is a constant.

Assume that the total flow of foreign aid, AID, can be split into aid invested in complementary factors, AID_A, and aid invested in physical capital, AID_K, so that $AID = AID_K + AID_K$. The part invested in complementary factors, AID_A, raises the marginal productivity of all production factors that are complementary to physical capital. [22] Aid to complementary factors helps for example to finance infrastructure investments that lead to the interconnection of markets (Easterly & Levine, 1997), or investments in human capital improve technology adoption. On the other hand, aid invested in physical capital, AID_K, enters the production function only through its effect on physical capital accumulation and has no (augmenting) effect on total factor productivity.

To model the augmenting effect of complementary aid on all production factors that are complementary to physical capital,

we allow the flow of AID_A to increase the existing stock of A (A_0) in the economy:

$$A = A_0 + AID_A \tag{A.2}$$

Allowing complementary aid to have a direct impact on A is a shorthand for the idea that AID_A has an augmenting effect on any production factor other than k (e.g. human capital, public investments, new technology, *etc.*) and, thus, it is ultimately able to increase the MPK. [23]

We assume an open economy. [24] Accordingly, capital equipment (in per capita terms) is financed by (i) domestic savings ($S = sy$, where s is a given savings rate), and also by (ii) foreign direct investments (fdi), and (iii) the part of aid invested in physical capital (aid_A). Then, capital accumulation in per capita terms is given by

$$\dot{k} = sy + fdi + aid_K - (n + \delta)k \tag{A.3}$$

where n is the population growth rate and δ is a fixed depreciation rate.

With perfect capital mobility (following Caselli and Feyrer (2007)), the world real rate of return, r^w, pins down at any point in time the net return to capital (MPK-δ), and thus

$$r^w = MPK - \delta = A\alpha k^{\alpha-1} - \delta \tag{A.4}$$

According to (A.4), the steady state level of k at any point in time is given by

$$k^* = \left[\frac{A\alpha}{r}\right]^{\frac{1}{1-\alpha}} \tag{A.5}$$

where r is defined as a gross world real rate of return, $r^w + \delta$.

Rewriting (A.3) taking (A.5) as given, the flow of FDI per capita is determined as the residual

$$fdi = -aid_K - sy^* + (n + \delta)k^* \tag{A.6}$$

where $y^* = Ak^{*\alpha}$.

At a first glance, (A.6) seems to support the Caselli and Feyrer (2007) conjecture that aid and FDI are substitutes: for a given level of domestic savings, equalization between MPK and r requires an increase in foreign aid to be accommodated by a proportional reduction in FDI:

$$\frac{\partial fdi}{\partial aid_K} = -1 \tag{A.7}$$

However, this type of relationship only holds for aid invested in physical capital. The effect of complementary aid has two components:

$$\frac{\partial fdi}{\partial aid_A} = -s\frac{\partial y^*}{\partial aid_A} + (n + \delta)\frac{\partial k^*}{\partial aid_A} \tag{A.8}$$

First, since

$$\frac{\partial k^*}{\partial aid_A} = \frac{\partial}{\partial aid_A}\left(\left[\frac{A\alpha}{r}\right]^{\frac{1}{1-\alpha}}\right) = \frac{\alpha}{1-\alpha}\left[\frac{A\alpha}{r}\right]^{\frac{\alpha}{1-\alpha}}\frac{L}{r} > 0, \tag{A.9}$$

we see that complementary aid has a positive effect on the steady state capital stock. This finding is based on the augmenting effect of aid_A on TFP (A), which rises the MPK and allows the recipient country to increase its capital stock without experiencing a counterbalancing capital flight. More precisely, for a given level of s, aid-financed investments in complementary factors allow a sustainable increase in FDI equal to $(n + \delta)\frac{\partial k^*}{\partial aid_A}$.

Second, since

$$s\frac{\partial y^*}{\partial aid_A} = s\frac{\partial (Ak^{*\alpha})}{\partial aid_A} = s\left[Lk^{*\alpha} + A\alpha k^{*\alpha-1}\frac{\partial k^*}{\partial aid_A}\right] > 0 \tag{A.10}$$

complementary aid has a positive effect on domestic savings and thus on domestically financed capital investments. This comes from the fact that aid_A shifts the production function and thereby raises the steady state levels of income and domestic savings. Given the assumption of MPK equalization in (A.4), the corresponding increase in domestically financed investments causes a proportional reduction of size $-s\frac{\partial y^*}{\partial aid_A}$ in the need for FDI.

This model holds several implications that should be taken into account when assessing the empirical relationship between aid and FDI. First, the effect of total aid on FDI is ambiguous:

$$\begin{aligned}\frac{\partial fdi}{\partial aid} &= \frac{\partial fdi}{\partial aid_K} + \frac{\partial fdi}{\partial aid_A} \\ &= -1 - s\frac{\partial y^*}{\partial aid_A} + (n + \delta)\frac{\partial k^*}{\partial aid_A} \gtrless 0\end{aligned} \tag{A.11}$$

because we expect aid to production sectors to have a negative effect on FDI, but the effect of complementary aid is indeterminate. Second, from equations (second component) and (savings effect), since the marginal effect of complementary aid on FDI includes the level of complementary aid itself, the relationship between complementary aid and FDI is not linear, and there are scale effects from complementary aid that should be taken into account. [25] Since $-s\frac{\partial y^*}{\partial aid_A}$ and $(n + \delta)\frac{\partial k^*}{\partial aid_A}$ work in opposite directions, the sign of the second order effects will also be indeterminate and will need to be assessed empirically. Third, the model stresses the need to take all sources of capital into account, and it is therefore essential to include domestic savings as an additional explanatory variable in any empirical analysis of FDI. To our knowledge, this has not been done before.

A.2. *Imperfect capital mobility*

If mobility of capital is imperfect, MPK should be allowed to deviate from the gross world interest rate by a risk-premium, ρ, that reflects idiosyncratic country characteristics. In this case, the first-order condition in (A.4) should read

$$r + \rho = MPK, \tag{A.12}$$

and the capital stock in (A.5) should be redefined accordingly:

$$k^* = \left[\frac{A\alpha}{r + \rho}\right]^{\frac{1}{1-\alpha}}. \tag{A.13}$$

While this renders the effect of aid invested in physical capital unchanged, the effect of complementary aid becomes somewhat more complicated. The risk premium impacts FDI directly through (A.13) but, given that

$$\frac{\partial k^*}{\partial aid_A} = \frac{\partial}{\partial aid_A}\left(\left[\frac{A\alpha}{r + \rho}\right]^{\frac{1}{1-\alpha}}\right) = \frac{1}{1-\alpha}\left[\frac{A\alpha}{r + \rho}\right]^{\frac{\alpha}{1-\alpha}}\frac{L\alpha}{r + \rho}, \tag{A.14}$$

the marginal effect of aid_A will also depend on the risk premium and thus on country-specific characteristics.

APPENDIX B. ADDITIONAL TABLES

Table 5. *Summary statistics*

	Observations	Median	Mean	Standard deviation	Minimum	Maximum
Main variables						
fdi	325	9.8	27.4	65.9	−384.9	547.0
aid_K	325	6.5	15.5	40.5	−18.7	442.1
aid_A (alternative definition of aid_A)	325	21.6	39.6	76.5	−12.2	914.4
aid_A^*	323	32.2	50.3	79.8	−7.0	926.0
Population growth, n	325	2.3	2.2	1.0	−5.1	7.0
Savings per capita, S	325	130.4	337.9	559.2	−679.2	4827.0
GDP per capita, y	325	747.6	1468.7	1706.5	85.8	9127.1
Political risks						
ICRG index	264	60.1	59.7	10.4	27.6	80.6
Govt. stability	263	8.0	7.7	2.2	2.3	12
Socio-economic conditions	263	5.0	4.9	1.5	1	9
Investment profile	263	6.0	6.2	1.9	1	11
Internal conflict	263	8.1	7.8	2.3	0.4	12
External conflict	263	9.7	9.3	2.0	2.3	12
Political corruption	263	3.0	2.7	0.9	0	5
Military in politics	263	3.0	3.0	1.6	0	6
Religion in politics	263	5.0	4.3	1.4	0	6
Law and order	263	3.0	3.1	1.1	1	6
Ethnic tensions	263	4.0	3.8	1.4	0	6
Democratic accountability	263	3.2	3.2	1.2	0	6
Bureaucratic quality	263	2.0	1.7	0.9	0	3.5

Table 6. *aid_A and aid_K across time (as % of total aid), and total aid receipts (in USD per capita)*

	Social infrastructure	Economic infrastructure	aid_A	Agriculture, forestry, fishing	Industry, mining, construction	Trade, banking, tourism	aid_K	Total *aid* per capita
	(1)	(2)	(1) + (2)	(a)	(b)	(c)	(a) + (b) + (c)	(USD)
1970–74	29.9	32.7	50.4	16.2	17.8	1.8	22.8	372.1
1975–79	25.1	36.4	50.9	21.2	18.8	5.9	29.0	368.8
1980–84	22.3	28.8	41.8	19.6	14.4	5.1	28.4	279.5
1985–89	23.7	26.8	41.6	19.2	14.9	7.4	29.1	369.6
1990–94	33.8	20.4	51.3	12.2	6.9	2.7	19.5	388.9
1995–99	42.0	16.5	57.1	9.2	3.5	1.0	12.9	372.0
2000–01	46.5	13.0	59.4	9.3	3.0	0.8	12.2	112.6
All countries (186 countries, 1970–2001)								
Median	29.9	26.8	50.9	16.2	14.4	2.7	22.8	369.6
Average	31.9	24.9	50.4	15.3	11.3	3.5	22.0	323.4
Std. dev.	9.4	8.6	6.8	5.0	6.7	2.6	7.4	99.6
Minimum	22.3	13.0	41.6	9.2	3.0	0.8	12.2	112.6
Maximum	46.5	36.4	59.4	21.2	18.8	7.4	29.1	388.9
Main sample (99 countries, 1975–2001)								
Median	22.3	22.5	45.1	13.6	6.3	1.1	19.9	88.1
Average	25.7	22.7	47.6	12.9	6.9	1.7	18.8	91.7
Std. dev.	12.8	6.2	7.8	3.9	3.8	1.3	5.6	27.3
Minimum	12.8	14.5	40.1	8.1	3.2	0.6	12.3	51.6
Maximum	43.5	30.5	58.0	17.5	13.2	3.8	24.7	130.3

Notes: Estimated amount of aid_A and aid_K, as percentages of total aid commitments. aid_A is aid financing complementary inputs (projects in social infrastructure, such as education, health, and water supply projects; and economic infrastructure, such as energy, transportation, and communications projects). aid_K are aid contributions to directly productive sectors (such as agriculture, manufacturing, trade, banking, and tourism projects). Total aid disbursements per capita expressed in constant 2000 US dollars. Estimates based on data from the OECD's Credit Reporting System and Aid Activity database. Data available for 186 developing countries, of which 99 are included in the main sample, due to limitations in the availability of other variables.

Table 7. *aid_A and aid_K across countries (as % of total aid), and total aid receipts (in USD per capita, 1970–2001)*

			Social infrastructure	Economic infrastructure	aid_A	Agriculture, forestry, fishing	Industry, mining, construction	Trade, banking, tourism	aid_K	Total *aid* per capita
			(1)	(2)	(1) + (2)	(a)	(b)	(c)	(a) + (b) + (c)	(USD)
	ABW	Aruba	25.4	6.0	31.4	0.5	8.1	10.2	17.3	
×	AFG	Afghanistan	23.9	7.7	28.1	12.0	2.5	6.1	13.6	9.4
×	AGO	Angola	22.7	20.2	42.2	9.8	5.2	0.7	13.7	37.2
	AIA	Anguilla	42.1	37.7	75.2	4.2	3.2	15.2	9.1	
×	ALB	Albania	37.8	10.1	47.9	5.1	2.7	0.1	7.8	43.5
	ANT	Netherlands Antilles	56.5	17.3	48.8	0.8	4.5	1.5	5.9	4219.4
	ARE	United Arab Emirates	55.0	55.0	65.0	64.5	21.7		73.3	209.4
×	ARG	Argentina	21.2	34.8	53.8	35.4	29.1	1.5	43.7	138.1
×	ARM	Armenia	32.2	34.9	67.0	3.2	2.0	4.3	9.6	60.7
	ATG	Antigua and Barbuda	30.8	30.4	58.4	18.1	21.0	17.7	29.6	544.7
	AZE	Azerbaijan	40.7	32.6	62.9	5.6	3.0	1.6	8.2	10.6
×	BDI	Burundi	26.3	20.5	41.4	10.3	6.2	3.0	14.8	36.8
×	BEN	Benin	26.9	24.5	51.4	8.8	10.6	1.2	13.7	50.2
×	BFA	Burkina Faso	21.3	15.9	37.1	14.1	3.8	2.1	17.7	41.8
×	BGD	Bangladesh	15.1	15.8	30.9	10.0	5.0	1.3	15.2	17.1
×	BGR	Bulgaria	49.8	14.6	64.3	2.8	3.0	1.1	6.9	
	BHR	Bahrain	47.3	10.0	57.3	13.7	35.3	6.7	50.8	755.2
	BHS	Bahamas, The	68.0	4.2	52.8	0.0	33.3		33.3	2307.7
	BIH	Bosnia and Herzegovina	34.7	13.0	54.3	1.4	0.4	0.1	1.9	236.6
	BLR	Belarus	44.7	14.2	58.9	3.5	0.8	0.0	2.5	
	BLZ	Belize	29.0	19.3	48.0	15.4	5.6	2.5	19.6	233.1
×	BOL	Bolivia	22.8	18.4	41.6	12.5	4.8	1.2	17.8	85.6
×	BRA	Brazil	24.3	30.7	51.3	13.4	14.0	0.5	26.7	62.8
	BRB	Barbados	36.4	21.7	40.4	9.4	33.0	6.9	34.4	534.6
	BRN	Brunei Darussalam	93.1	1.8	84.7	15.5	0.0	6.3	18.6	124.2
	BTN	Bhutan	21.5	21.4	45.3	39.8	10.7	0.3	44.7	61.6
×	BWA	Botswana	42.0	24.1	66.0	5.2	3.7	1.3	8.1	148.1
×	CAF	Central African Republic	27.6	41.7	53.5	15.0	8.2	6.8	18.6	56.0
×	CHL	Chile	22.6	8.0	32.3	16.9	5.1	0.6	19.6	93.4
×	CHN	China	30.9	53.2	68.7	5.8	9.8	2.1	16.5	4.4
×	CIV	Cote d'Ivoire	18.9	14.4	29.7	22.6	5.9	0.2	27.2	73.8
×	CMR	Cameroon	18.8	29.6	48.4	15.6	1.8	0.3	17.3	55.0
×	COG	Congo, Rep.	18.7	27.1	45.8	10.0	9.3	6.9	19.9	118.3
	COK	Cook Islands	39.6	36.6	63.0	23.7	0.5	2.5	24.7	
×	COL	Colombia	50.1	17.4	65.4	12.4	5.5	1.5	15.0	32.4
	COM	Comoros	38.9	31.8	58.7	13.7	5.6	9.6	16.5	132.5
	CPV	Cape Verde	17.1	10.4	27.5	15.2	1.5	2.4	17.5	281.7
×	CRI	Costa Rica	30.5	31.1	46.6	11.1	3.1	1.6	12.6	94.4
	CUB	Cuba	45.0	9.5	54.8	6.6	23.4	0.5	21.6	8.8
	CYM	Cayman Islands	47.7	74.4	91.9		55.0		55.0	

	CYP	Cyprus	51.8	14.6	61.7	10.9	4.7	0.7	11.3	295.7
	CZE	Czech Republic	58.1	14.3	72.4	2.1	18.8	0.6	21.1	
	DJI	Djibouti	44.5	35.2	74.9	4.5	0.8	0.1	5.2	304.0
	DMA	Dominica	25.8	19.4	47.4	26.4	2.1	4.3	26.0	383.0
×	DOM	Dominican Republic	24.1	22.9	49.0	28.7	7.4	1.5	34.3	39.6
×	DZA	Algeria	20.8	31.2	53.9	7.9	14.0	0.1	17.8	76.3
×	ECU	Ecuador	22.2	33.6	60.3	19.7	4.3	0.8	20.3	48.9
×	EGY	Egypt, Arab Rep.	19.7	19.9	38.5	5.4	9.0	0.7	13.7	81.4
×	ERI	Eritrea	32.5	4.9	36.2	8.8	4.3	0.2	13.1	43.5
	EST	Estonia	43.9	26.9	54.1	5.5	3.5	0.7	9.4	
×	ETH	Ethiopia	22.2	9.7	30.8	15.8	2.9	0.2	18.0	14.6
	FJI	Fiji	50.3	13.7	60.9	16.1	10.7	1.2	24.7	97.5
	FLK	Falkland Islands (Malvinas)	69.2	93.6	100.0					
	FSM	Micronesia, Fed. Sts.	16.6	21.0	37.5	28.0	1.3	0.4	29.4	737.1
×	GAB	Gabon	29.5	22.0	50.0	19.4	7.6	3.0	23.3	338.2
×	GEO	Georgia	23.8	24.3	48.1	3.7	1.5	4.6	7.1	37.0
×	GHA	Ghana	26.6	22.2	53.7	8.6	3.3	1.0	10.8	35.9
	GIB	Gibraltar	56.0	31.1	37.7	2.8		1.5	2.1	
×	GIN	Guinea	18.9	21.5	46.1	13.9	3.2	2.0	17.2	45.1
×	GMB	Gambia, The	24.7	21.0	38.9	22.8	3.1	3.0	24.4	91.4
×	GNB	Guinea-Bissau	29.9	9.5	38.1	10.7	5.9	1.4	16.9	96.7
	GNQ	Equatorial Guinea	40.8	18.4	61.5	17.8	3.0	0.0	18.6	90.3
	GRD	Grenada	43.6	22.2	74.5	40.8	4.6	29.8	42.5	161.1
×	GTM	Guatemala	33.9	16.3	48.6	14.2	7.4	0.2	17.3	33.0
	GUY	Guyana	14.3	29.5	44.0	22.6	2.6	4.7	26.5	124.7
	HKG	Hong Kong, China	74.4	13.8	91.7	0.0	32.4	2.5	33.4	369.7
×	HND	Honduras	24.4	21.7	42.6	20.3	2.1	1.6	22.5	74.6
×	HRV	Croatia	38.2	13.9	63.7	2.4	14.2	2.5	17.4	149.7
×	HTI	Haiti	30.0	21.1	49.0	15.4	0.9	0.5	16.1	34.0
	HUN	Hungary	60.3	37.6	66.7	1.2	2.7	3.5	7.4	
×	IDN	Indonesia	15.9	32.0	47.9	8.4	9.3	0.4	18.0	27.9
×	IND	India	17.5	25.2	42.7	10.5	11.3	0.4	22.0	4.6
×	IRN	Iran, Islamic Rep.	57.1	24.4	83.3	10.3	45.5	0.4	41.6	16.8
	IRQ	Iraq	46.7	50.0	5.5	17.6	80.3		37.8	19.2
	ISR	Israel	13.3	7.6	24.1	1.2	5.7	0.1	5.1	618.6
×	JAM	Jamaica	27.0	11.2	38.5	10.9	3.6	0.7	14.1	142.4
×	JOR	Jordan	22.7	20.8	43.6	9.2	8.4	1.9	15.5	385.2
×	KAZ	Kazakhstan	41.8	47.2	76.1	2.5	5.5	9.2	17.1	33.2
×	KEN	Kenya	31.9	20.6	52.5	13.3	4.4	0.5	18.0	42.0
×	KGZ	Kyrgyz Republic	25.9	16.3	42.2	5.4	3.6	1.1	10.1	38.8
×	KHM	Cambodia	24.8	11.8	36.4	5.1	0.5	0.3	5.5	25.9
	KIR	Kiribati	40.7	15.9	55.0	24.1	13.4	2.2	28.2	281.4
	KNA	St. Kitts and Nevis	33.6	24.0	48.5	24.9	20.2	1.1	29.1	128.9
	KOR	Korea, Rep.	51.6	6.4	63.1	7.5	7.2	0.6	12.5	75.4
	KWT	Kuwait	93.6	0.0	80.8		0.0		0.0	119.4
×	LAO	Lao PDR	19.3	30.1	45.4	21.7	4.7	0.2	21.9	46.7
×	LBN	Lebanon	35.4	11.4	62.9	3.5	9.8	0.5	8.5	75.1
	LBR	Liberia	21.5	20.2	43.9	11.6	2.4	2.4	10.0	208.5
	LBY	Libya	48.3	0.0	67.9	0.0			0.0	89.8
	LCA	St. Lucia	38.3	28.8	49.1	27.5	18.9	0.0	34.8	162.2

(*continued on next page*)

Table 7. (*continued*)

			Social infrastructure	Economic infrastructure	aid_A	Agriculture, forestry, fishing	Industry, mining, construction	Trade, banking, tourism	aid_K	Total *aid* per capita
			(1)	(2)	(1) + (2)	(a)	(b)	(c)	(a) + (b) + (c)	(USD)
×	LKA	Sri Lanka	17.3	30.5	47.6	10.4	7.0	0.4	15.9	36.9
	LSO	Lesotho	33.7	19.1	47.7	14.0	3.1	0.3	16.2	85.0
	LTU	Lithuania	26.9	33.3	60.2	5.3	7.4	0.9	13.7	
	LVA	Latvia	41.4	42.2	65.2	3.9	3.8	1.8	7.3	
	MAC	Macao, China	83.3							26.9
×	MAR	Morocco	20.0	19.4	40.4	14.7	19.5	0.7	23.4	59.2
	MDA	Moldova	19.5	28.2	47.8	1.5	2.6	14.2	18.0	14.0
×	MDG	Madagascar	13.9	28.9	42.9	16.8	4.0	2.1	21.1	36.5
	MDV	Maldives	34.8	25.7	59.4	24.8	13.4	0.0	24.6	109.7
×	MEX	Mexico	44.2	37.1	61.2	12.6	15.2	8.7	25.6	68.7
	MHL	Marshall Islands	23.1	9.4	32.3	28.1	8.8		33.7	2663.5
×	MKD	Macedonia, FYR	35.6	10.4	46.0	8.9	1.8	0.5	9.9	77.4
×	MLI	Mali	24.8	15.9	40.6	16.0	3.4	1.0	19.1	51.5
	MLT	Malta	32.8	28.5	58.1	15.7	12.2	0.4	16.1	591.9
	MMR	Myanmar	12.4	16.0	28.4	9.0	17.7	0.5	25.2	8.4
×	MNG	Mongolia	37.7	33.9	59.0	6.0	21.6	0.5	25.9	40.3
	MNP	Northern Mariana Islands	68.7	16.6	44.3	49.6	18.2		52.0	
×	MOZ	Mozambique	17.7	15.3	31.5	9.9	3.0	0.2	12.7	48.1
×	MRT	Mauritania	20.9	9.6	28.8	19.4	8.1	1.1	26.3	150.4
	MSR	Montserrat	38.2	33.2	55.5	7.4	12.5	2.7	14.4	
×	MUS	Mauritius	42.0	28.4	65.8	14.9	3.9	4.9	16.0	144.6
×	MWI	Malawi	23.4	31.6	56.3	10.8	2.4	0.7	12.0	47.6
×	MYS	Malaysia	23.2	54.8	71.5	5.0	17.7	0.7	22.0	80.2
	MYT	Mayotte	91.9	25.8	93.8	5.7			5.7	
×	NAM	Namibia	53.0	37.6	69.4	8.4	3.6	0.3	11.4	37.5
	NCL	New Caledonia	51.9	49.1	92.4	6.6	19.9	2.0	16.3	1778.1
×	NER	Niger	24.8	13.0	35.8	16.7	4.6	0.7	20.7	52.2
×	NGA	Nigeria	34.1	22.2	59.7	17.6	4.7	0.8	20.7	10.9
×	NIC	Nicaragua	26.1	19.5	44.4	10.2	9.8	0.2	17.6	98.4
	NIU	Niue	33.6	36.5	71.6	12.3		5.1	9.2	
×	NPL	Nepal	21.9	35.4	57.3	15.6	6.8	0.4	20.4	19.4
	NRU	Nauru	22.8	2.5	59.0	25.0	3.3	0.0	25.0	
×	OMN	Oman	42.9	15.7	31.1	37.2	32.4	1.2	60.4	170.6
×	PAK	Pakistan	11.9	24.7	36.5	10.9	3.3	0.2	14.3	18.1
×	PAN	Panama	41.0	18.3	52.6	27.1	3.7	7.6	30.1	875.9
×	PER	Peru	21.5	13.1	36.5	14.8	6.5	0.3	19.8	54.7
×	PHL	Philippines	14.5	40.2	54.5	10.3	6.2	1.0	16.6	37.3
	PLW	Palau	7.0	48.7	55.7	18.4	0.3	1.6	19.7	
×	PNG	Papua New Guinea	27.4	21.8	42.5	3.4	3.4	0.1	4.7	187.3
	POL	Poland	33.2	28.0	39.5	3.6	10.9	5.8	16.7	
	PRK	Korea, Dem. Rep.	39.1	3.5	11.8	2.3	0.5	0.1	2.4	2.6
×	PRY	Paraguay	24.5	46.0	64.2	28.9	10.2	0.1	34.5	44.1
	PYF	French Polynesia	60.7	35.5	81.8	7.4	2.1	7.1	8.2	1760.7
	QAT	Qatar	70.4	2.3	72.8	19.5	10.8	0.0	40.4	337.0
×	ROM	Romania	46.0	21.5	53.7	4.3	1.1	6.5	8.8	
×	RUS	Russian Federation	33.2	34.9	53.1	0.8	1.8	5.4	7.5	0.2

×	RWA	Rwanda	24.2	19.8	41.6	14.6	2.1	2.6	17.2	51.3
×	SAU	Saudi Arabia	60.1	29.1	61.7	3.3	64.4	2.3	66.5	29.8
×	SDN	Sudan	13.1	15.0	27.5	9.5	1.0	0.1	9.0	38.6
×	SEN	Senegal	24.4	11.1	35.6	17.5	4.2	0.4	21.6	91.0
	SGP	Singapore	40.4	30.9	62.2	3.7	45.0	10.4	53.1	399.7
	SHN	Saint Helena, Ascension and Tristan da Cunha	43.7	28.3	62.4	11.3	7.3	1.0	14.3	
	SLB	Solomon Islands	36.7	12.7	47.6	24.9	13.2	6.2	31.4	196.9
×	SLE	Sierra Leone	17.8	19.7	36.3	6.8	3.9	0.5	8.5	34.1
×	SLV	El Salvador	31.6	21.6	53.8	20.9	8.3	0.7	24.9	70.2
	SOM	Somalia	18.8	11.9	29.9	9.8	18.2	0.1	15.7	66.7
	STP	Sao Tome and Principe	28.3	11.5	42.8	34.6	0.9	0.7	35.2	274.4
	SUR	Suriname	55.8	20.2	58.9	4.3	0.4	0.1	4.5	239.5
	SVK	Slovak Republic	52.4	15.4	67.8	1.8	3.1	5.6	10.4	
	SVN	Slovenia	46.5	22.5	72.6	0.3	23.6	1.1	24.6	171.9
	SWZ	Swaziland	41.3	20.3	61.2	15.8	10.5	1.9	24.2	94.5
	SYC	Seychelles	34.0	13.1	42.8	24.9	4.3	9.5	29.5	623.0
×	SYR	Syrian Arab Republic	24.3	43.3	64.4	30.8	3.1	0.3	27.7	103.7
	TCA	Turks and Caicos Islands	36.3	26.5	64.5	8.6	3.9	67.4	24.5	
×	TCD	Chad	23.4	14.4	40.7	16.9	4.0	2.2	19.6	36.1
×	TGO	Togo	24.6	23.0	46.5	12.6	5.8	0.1	16.7	59.1
×	THA	Thailand	15.9	54.6	70.2	14.0	9.1	1.1	22.2	46.4
×	TJK	Tajikistan	24.0	10.5	34.4	1.1	4.0	10.2	14.9	18.6
	TKL	Tokelau	73.7	44.6	80.4	100.0	0.0		50.0	
	TKM	Turkmenistan	31.9	9.8	41.7		6.6	0.0	6.6	29.7
	TMP	Timor-Leste	50.5	0.8	43.9	7.1	25.2	4.9	22.3	11
	TON	Tonga	44.4	25.2	61.6	18.6	13.2	1.0	24.0	194.7
×	TTO	Trinidad and Tobago	32.8	46.7	48.8	49.7	19.0	1.0	51.0	77.4
×	TUN	Tunisia	18.6	23.4	42.0	11.7	14.6	1.6	26.0	98.2
×	TUR	Turkey	24.8	30.3	51.9	4.5	6.9	0.1	11.3	54.3
	TUV	Tuvalu	35.0	23.3	60.4	21.4	2.5	2.9	22.2	
	TWN	Taiwan	89.6	0.4	86.4	1.1	27.9	0.3	28.3	
×	TZA	Tanzania	25.8	19.7	45.5	9.5	7.6	0.4	17.5	44.4
×	UGA	Uganda	36.4	15.8	40.2	8.2	22.5	2.8	30.0	24.9
×	UKR	Ukraine	44.9	34.2	62.4	4.0	17.8	0.6	21.7	
×	URY	Uruguay	44.2	17.3	47.0	24.6	14.8	1.7	35.6	74.4
×	UZB	Uzbekistan	48.9	24.0	72.9	5.2	5.4	3.7	15.5	10.2
	VCT	St. Vincent and the Grenadines	41.5	29.1	51.0	34.6	7.0	4.3	31.4	168.5
×	VEN	Venezuela, RB	56.3	40.7	71.1	11.7	14.2	0.7	21.1	64.1
	VIR	Virgin Islands (United States)	51.6	30.5	72.4	10.4	9.1	8.3	13.4	5079.0
×	VNM	Vietnam	27.0	21.1	44.7	6.5	29.3	0.4	35.3	16.3
	VUT	Vanuatu	34.1	16.3	50.0	14.5	1.8	9.0	16.9	362.0
	WLF	Wallis and Futuna	67.1	2.6	96.1	35.3			35.3	
	WSM	Samoa	41.4	39.6	69.1	16.9	2.2	1.2	18.7	243.9

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Table 7. (*continued*)

			Social infrastructure	Economic infrastructure	aid_A	Agriculture, forestry, fishing	Industry, mining, construction	Trade, banking, tourism	aid_K	Total *aid* per capita
			(1)	(2)	(1) + (2)	(a)	(b)	(c)	(a) + (b) + (c)	(USD)
	XPA	Palestinian Adm. Areas	73.2	13.0	74.4	2.8	4.3	0.4	5.6	
×	YEM	Yemen, Rep.	28.3	27.7	50.9	14.5	7.9	0.0	17.2	54.0
	YUG	Serbia and Montenegro	58.0	12.9	52.7	0.8	0.5	0.1	1.3	45.4
×	ZAF	South Africa	77.1	10.1	78.5	2.5	2.9	0.7	5.8	29.1
×	ZAR	Congo, Dem. Rep.	18.0	25.3	43.4	5.8	2.6	0.1	8.1	27.0
	ZMB	Zambia	21.7	18.2	39.9	12.4	4.9	0.8	16.9	94.2
×	ZWE	Zimbabwe	38.9	15.6	54.6	8.0	4.3	1.0	12.3	42.1
All countries (186 countries, 1970–2001)										
Number of countries			186	185	185	181	179	173	184	167
Median			33.0	21.4	51.9	10.9	5.5	1.0	17.8	62.8
Average			36.0	23.3	53.3	13.6	9.5	2.8	20.3	219.6
Standard deviation			17.1	13.5	16.0	12.2	11.5	6.2	12.5	602.7
Minimum			7.0	0.0	5.5	0.0	0.0	0.0	0.0	0.0
Maximum			93.6	93.6	100.0	100.0	80.3	67.4	73.3	5079.0
Main sample (99 countries, 1975–2001)										
Number of countries			99	99	99	99	99	98	99	99
Median			32.0	14.7	52.2	9.5	3.0	0.5	13.5	47.6
Average			34.9	18.8	53.3	10.3	4.8	1.0	15.2	72.2
Standard deviation			13.0	12.2	15.3	6.7	5.8	1.5	9.5	112.6
Minimum			13.2	0.3	22.1	0.4	0.0	0.0	2.1	0.0
Maximum			70.0	51.6	86.1	38.0	42.4	8.7	62.3	998.7

Notes: × = included in the final sample. Estimated amount of aid_A and aid_K, as percentages of total aid commitments. aid_A is aid financing complementary inputs (projects in social infrastructure, such as education, health, and water supply projects; and economic infrastructure, such as energy, transportation and communications projects). aid_K are aid contributions to directly productive sectors (such as agriculture, manufacturing, trade, banking, and tourism projects). Total aid disbursements per capita expressed in constant 2000 US dollars. Estimates based on data from the OECD's Credit Reporting System and Aid Activity database. Data available for 186 developing countries, of which 99 are included in the main sample, due to limitations in the availability of other variables.

Table 8. *Main sample (99 countries, 1975–2001)*

		1975–79	1980–84	1985–89	1990–94	1995–99	2000–01
AFG	Afghanistan	×					
ALB	Albania						×
DZA	Algeria	×	×	×	×	×	×
AGO	Angola					×	×
ARG	Argentina		×	×	×	×	×
ARM	Armenia						×
BGD	Bangladesh					×	×
BEN	Benin		×	×	×	×	×
BOL	Bolivia			×	×	×	×
BWA	Botswana		×	×	×	×	×
BRA	Brazil	×	×	×	×	×	×
BGR	Bulgaria						×
BFA	Burkina Faso	×	×	×	×	×	×
BDI	Burundi				×	×	×
KHM	Cambodia						×
CMR	Cameroon	×	×	×	×	×	×
CAF	Central African Republic		×	×	×	×	×
TCD	Chad		×	×	×	×	×
CHL	Chile		×	×	×	×	×
CHN	China			×	×	×	×
COL	Colombia	×	×	×	×	×	×
ZAR	Congo, Dem. Rep.					×	×
COG	Congo, Rep.				×	×	×
CRI	Costa Rica		×	×	×	×	×
CIV	Cote d'Ivoire				×	×	×
HRV	Croatia						×
DOM	Dominican Republic					×	×
ECU	Ecuador			×	×	×	
EGY	Egypt, Arab Rep.		×	×	×	×	×
SLV	El Salvador					×	×
ERI	Eritrea						×
ETH	Ethiopia		×	×	×	×	×
GAB	Gabon		×	×	×	×	×
GMB	Gambia, The					×	×
GEO	Georgia						×
GHA	Ghana					×	×
GTM	Guatemala			×	×	×	×
GIN	Guinea				×	×	×
GNB	Guinea-Bissau						×
HTI	Haiti			×	×	×	×
HND	Honduras			×	×	×	×
IND	India	×	×	×	×	×	×
IDN	Indonesia			×	×	×	×
IRN	Iran, Islamic Rep.					×	×
JAM	Jamaica					×	×
JOR	Jordan	×	×	×	×	×	×
KAZ	Kazakhstan					×	×
KEN	Kenya		×	×	×	×	×
KGZ	Kyrgyz Republic						×
LAO	Lao PDR					×	×
LBN	Lebanon				×	×	×
MKD	Macedonia, FYR						×
MDG	Madagascar				×	×	
MWI	Malawi						×
MYS	Malaysia			×	×	×	×
MLI	Mali				×	×	×
MRT	Mauritania				×	×	×
MUS	Mauritius				×	×	×
MEX	Mexico		×	×	×	×	×
MNG	Mongolia					×	×
MAR	Morocco				×	×	×
MOZ	Mozambique				×	×	×
NAM	Namibia					×	×
NPL	Nepal	×	×	×	×	×	×

(*continued on next page*)

Table 8. *(Continued)*

		1975–79	1980–84	1985–89	1990–94	1995–99	2000–01
NIC	Nicaragua			×	×	×	×
NER	Niger	×	×	×	×	×	×
NGA	Nigeria		×			×	×
OMN	Oman					×	×
PAK	Pakistan	×	×	×	×	×	×
PAN	Panama			×	×	×	×
PNG	Papua New Guinea		×	×	×	×	
PRY	Paraguay		×	×	×	×	×
PER	Peru			×	×	×	×
PHL	Philippines		×	×	×	×	×
ROM	Romania					×	
RUS	Russian Federation					×	
RWA	Rwanda		×	×	×	×	×
SAU	Saudi Arabia					×	×
SEN	Senegal	×	×	×	×	×	×
SLE	Sierra Leone				×	×	
ZAF	South Africa					×	×
LKA	Sri Lanka				×	×	×
SDN	Sudan	×	×	×		×	×
SYR	Syrian Arab Republic				×	×	×
TJK	Tajikistan					×	
TZA	Tanzania				×	×	×
THA	Thailand		×	×	×	×	×
TGO	Togo				×	×	×
TTO	Trinidad and Tobago						×
TUN	Tunisia	×	×	×	×	×	×
TUR	Turkey			×	×	×	×
UGA	Uganda					×	×
UKR	Ukraine						×
URY	Uruguay						×
UZB	Uzbekistan					×	×
VEN	Venezuela, RB				×	×	×
VNM	Vietnam			×	×	×	×
YEM	Yemen, Rep.				×	×	×
ZWE	Zimbabwe			×	×	×	×

Notes: Aid data available for 186 developing countries from the OECD Credit Reporting System and Aid Activity databases, of which 99 are included in the main sample, due to limitations in the availability of other variables.