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An Index of Donor Performance

By David Roodman

Abstract

The Commitment to Development Index of the Center for Global Development rates wealthy countries on the "development-friendliness" of their policies. It is revised and updated annually. The component on foreign assistance combines quantitative and qualitative measures of official aid, and of fiscal policies that support private charitable giving. The quantitative measure uses a net transfers concept, as distinct from the net flows concept in the net Official Development Assistance measure of the Development Assistance Committee. The qualitative factors are: a penalty for tying aid; a discounting system that favors aid to poorer, better-governed recipients; and a penalty for "project proliferation." The charitable giving measure is based on an estimate of the share of observed private giving to developing countries that is attributable to a) lower overall taxes or b) specific tax incentives for giving. Despite the adjustments, overall results are dominated by differences in quantity of official aid given. This is because while there is a seven-fold range in net concessional transfers/GDP among the scored countries, variation in overall aid quality across donors appears far lower, and private giving is generally small. Denmark, the Netherlands, Norway, and Sweden score highest while the largest donors in absolute terms, the United States and Japan, rank at or near the bottom. Standings by the current methodology have been relatively stable since 1995.

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Rich nations are often compared on how much they share their wealth with poorer countries. The Nordics and the Netherlands, it is noted, are the most generous with foreign assistance, while the United States gives among the least aid per unit of gross domestic product. Two major international consensus documents issued in 2002, the reports of the International Conference on Financing for Development, in Monterrey, Mexico, and the World Summit on Sustainable Development, in Johannesburg, call on donors to move toward giving at least 0.7 percent of their national income in aid, as few now do. (UN 2002a, p. 9; UN 2002b, p. 52)

The measure of aid implicitly or explicitly referenced in all these comparisons and benchmarks is "net overseas development assistance" (Net ODA), which is a measure of aid quantity defined by the donor-funded Development Assistance Committee (DAC) in Paris. DAC counts total grants and concessional (low-interest) development loans given to developing countries, and subtracts principle repayments received on such loans (thus the "net").[2]

Yet it is widely recognized that some dollars and euros of foreign aid do more good than others. While some aid has funded vaccinations whose effectiveness can be measured in pennies per life saved, other aid has handsomely paid donor-country consultants to write policy reports that collect dust on shelves, or merely helped recipients make interest payments on old aid loans. As a result, a simple quantity metric is hardly the last word on donor performance.

This paper describes an index of donor performance that takes the standard quantity measure as a starting point. It is motivated by the desire to incorporate determinants of aid impact other quantity into the Commitment to Development Index (CDI) (Roodman 2012). The aid index was introduced in 2003 and has been updated annually. At its heart, it is an attempt to quantify aspects of aid quality. But it also introduces a novel variant on the definition of aid *quantity*, and factors in tax policies that support private giving.

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[2] DAC considers a loan concessional if it has a grant element of at least 25 percent of the loan value, using a 10 percent discount rate.

In the last four decades, researchers have taken three main approaches to cross-country quantitative assessment of aid quality. Since at least the early 1970s, econometric studies have been done of the determinants of donors' aid allocations, factors such as recipient's poverty rate and level of oil exports (citations are below). Though often not evaluative in character, the approach offers a way to measure one aspect of aid quality, selectivity, by looking at how responsive aid allocation is to recipient need and development potential. How best to integrate such results with aid quantity into a single performance index is less obvious, however. Attempts to create a single index began with Mark McGillivray (1989, 1994), who essentially computed the weighted sum of each donor's aid disbursements to all recipients, basing weights on recipient GDP/capita as an indicator of need.

The third approach is the most straightforward and flexible in its overall structure, if most atheoretical. Various indicators of aid quality are assembled, transformed onto a standardized scale, then averaged. Usually, aid quantity is not considered. Easterly (2002b) appears to have begun this school, measuring several aspects of aid quality as well as aid quantity; and Easterly and Pfutze (2008) go on to incorporate additional aspects of aid quality and drop aid quantity. And a new, even more ambitious wave of such studies has arrived: Knack, Rogers, and Eubank (2010) and Birdsall and Kharas (2010). The principal contrast is in mathematical structure. Easterly's style is to use mathematical constructs that are relatively intuitive. Easterly (2002b), for instance, ranks donors on each indicator, whether of quantity or quality, then average ranks.

Driven in part by the need to weigh both quality and quantity, the index described here uses more conceptually sound—though still of course debatable—structures to construct and integrate various measures. Quality and quantity, for instance, are combined multiplicatively in the index since they do so in reality. That way, a donor that gives a total of one penny of high-quality aid, by ranking low on quantity and high on quality, would not end up ranked as average. Likewise, the penalty for tying aid is applied as a discount to aid quantity at level influenced by past studies of the cost of tying, rather than being introduced as a stand-alone indicator that is averaged with other indicators. The approach does have a disadvantage, though, which is that the computations tend to be more complex, even if they are more conceptually defensible. In fact, Easterly (2002b) constitutes CGD's initial attempt at a design for the CDI aid component, and is an important source of inspiration for the current design.

The donor performance measure described here factors quality of recipient governance as well as poverty into the selectivity scoring system, penalizes tying of aid, handles reverse flows (debt service) in a consistent way, penalizes project proliferation (overloading recipient governments with the administrative burden of many small aid projects), and rewards tax policies that encourage private charitable giving to developing countries.

Because this aid measure is designed to draw entirely from available statistics, primarily the DAC databases, many important aspects of aid quality are not reflected in the index—factors such as the realism of project designs and the effectiveness of structural adjustment conditionality. Moreover, most variation in aid quality may occur *within* donor's aid portfolios rather than across donors. As a result, while there is a sevenfold range in net aid transfers/GDP among the 27 rich countries scored here, the calculations in this paper reveal nothing like that sort of variation in aid quality across donors. Moreover, including private giving does not change this picture because it appears to be much smaller than official giving in most countries. Thus the sheer quantity of official aid is still the dominant determinant of donors' scores on this index.

Still, the measure does highlight some interesting differences among donors, and does somewhat rearrange the usual standings. Japan is especially hurt by the netting out of its large amounts of interest received (ODA is not net of interest received). Donors such as Australia and Italy are pulled low by the apparent tendency to spread their aid budgets thinly, over many projects.

This paper details the calculations and illustrates them with primarily 2008 data, which are the latest available and the basis for the current edition. The first six sections describe the computations involved in rating official aid programs: their final output is "quality-adjusted aid quantity" in dollars, or simply "quality-adjusted aid." They treat multilateral and bilateral donors in parallel, so that the World Bank's main concessional aid program, for instance, can be compared for selectivity to Denmark's aid program. The penultimate section describes how the quality-adjusted aid of multilaterals is allocated back to the bilaterals that fund them, in order to give national governments scores on official aid that reflect both their bilateral aid programs and their contributions to multilaterals. The last section describes how the aid index factors in tax policies that favor private charitable giving.

1. The first step: gross aid transfers

The starting point for the calculation of quality-adjusted official aid is gross disbursements of ODA and Official Aid (OA), disaggregated by donor *and* recipient. DAC reports both commitments and disbursements of ODA, but its press releases normally focus on disbursements. Similarly, I use disbursements. Dudley and Montmarquette (1976) argue that commitments better indicate donor policies, on the idea that recipient absorptive capacity limits largely explain any shortfalls in disbursements. But commitment-disbursement divergences could reflect bottlenecks or unrealism on either side of the donor-recipient relationship. Large and persistent gaps between commitments and disbursements may reflect a tendency of certain donors to promise more than they can realistically deliver, or a failure to learn from history that certain recipients cannot absorb aid as fast as donors hope. On balance, it seems best to stick with disbursements and avoid the risk of rewarding donors for overpromising aid or systematically underestimating the capacity to absorb it.

The definition of gross disbursements used here differs in one respect from DAC's. In recent years, donors have formally cancelled billions of dollars in non-ODA loans to countries such as Nigeria, Iraq, Pakistan, Cameroon, and the Democratic Republic of Congo (DRC). These OOF or "Other Official Finance" loans are ones with too small a concessional element to qualify as ODA, or that are meant for military, export financing, or other non-development purposes. The DRC, for example, was the world's top ODA recipient in 2003, at just over $5 billion. It turns out that under a Paris Club agreement, donors cancelled $4.5 billion in outstanding OOF loans to the DRC that year. Actual transfers of money were an order of magnitude lower.

When OOF loans are cancelled, they are, in effect, retroactively recognized by the DAC accounting system as ODA grants. This is a reasonable choice *if* the original purpose of the loan was for development and it was merely disqualified as ODA because it was not concessional enough. The DAC system books the transfer at the time it is officially recognized. It would be more accurate to recognize the gradual transfer that occurs year by year as the loans become uncollectible over time. The U.S. government does something like this, regularly assessing the likely collectibility of its outstanding sovereign loans and taking on budget any drop in their apparent value.[3] DAC does not do this, perhaps in part because of the complexity, in part because past years' data would be constantly revised, and in part because accounting rules and appropriations processes within some of the donor agencies, which govern DAC, create strong disincentives for recognizing such losses.

Unfortunately, some of the resulting ODA numbers have seemed quite unrealistic in the last few years. The true, current financial value of debt cancellation for countries such as the DRC in 2003 is far less than the face value. Even Pakistan, which received $1 billion in OOF debt relief in 2003, was a Highly Indebted Poor Country going by its debt/exports ratio and GDP/capita (Roodman 2001). Much of its cancelled debt may therefore have been uncollectible anyway, suggesting that the true value of the cancellation per se was far lower.

The definition of gross disbursements used here therefore excludes forgiveness of non-ODA loans. The reasoning is that the net transfers that do occur are not primarily a credit to current policy. If a Carter Administration export credit to Zaire went bad in the early 1980s, and was finally written off in 2003, the transfer that occurred does not for the most part reflect 2003 development policy.

Purging OOF loan forgiveness from ODA turns out to be complicated. The starting point is the formula for DAC's standard gross ODA[4]:

$$\text{Gross ODA} = \text{grants} + \text{ODA loans extended}$$

The term "grants" on the right contains a subtlety relating to debt relief. When DAC accounts for cancellation of ODA loans (not the OOF ones just discussed), it does so with two opposite transactions. The first is a "debt forgiveness grant," which is included under "grants." The second is an "offsetting entry for debt relief," which

[3] The process occurs within the U.S. government's Interagency Country Risk Assessment System.
[4] "Grants" here includes capital subscriptions to multilateral organizations.

represents the immediate return of that grant in the form of amortization and is considered an ODA loan repayment. This mechanism prevents double-counting of forgiven ODA loans, which were already fully counted as aid at disbursement. Since the offsetting entry is considered a reflow, it does not enter gross ODA, but will surface in Net ODA in the next section. So canceling any loan, ODA or OOF, increases gross ODA. In fact, when donors and recipients *reschedule* debt, as under Paris Club agreements, the capitalization of interest arrears is treated as a new aid flow, and is included in "ODA loans extended", under the subheading, "rescheduled debt."

Since the purpose here is to count only transactions that reflect current, actual transfers, we exclude all debt forgiveness grants and capitalized interest, none of which involves actual movement of money. The result is called "gross aid transfers" or simply "gross aid" to distinguish it from gross ODA. Thus:

Gross aid = (grants – debt forgiveness grants) + (ODA loans extended – rescheduled debt)

This removes all debt forgiveness grants, for both ODA and non-ODA loans, from the definition of gross aid. Now, the DAC definition of Net ODA, discussed in the next section, does itself remove grants for ODA loan forgiveness, by counting those offsetting entries for debt relief in ODA reflows. So in order to highlight the real departure of gross aid transfers from DAC accounting, I compare gross aid to DAC's Gross ODA net of offsetting entries for ODA loan forgiveness. Table 1 shows the 10 recipients most affected by changing the definition this way for 2005, a year in which much debt was cancelled. In all, cancellation of non-ODA loans accounted for an extraordinary $23.9 billion of reported gross ODA. It may be a long time before that figure is surpassed since it is clearly driven by unusual developments in Iraq and Nigeria.

Table 1. Gross ODA net of offsetting entries for ODA loan forgiveness vs. gross aid transfers, selected recipients, 2005 (million $)

Recipient	Gross ODA net of offsetting entries for ODA loan forgiveness	Gross aid	Difference
Iraq	21,654	7,726	13,927
Nigeria	6,490	854	5,635
Congo, Rep.	1,565	167	1,397
Congo, Dem. Rep.	1,864	1,355	509
Indonesia	2,835	2,332	503
Zambia	1,233	892	340
Madagascar	975	681	293
Serbia & Montenegro	1,142	937	205
Cameroon	603	404	199
Egypt	1,491	1,309	182
All Part I countries	119,142	95,204	23,938

Table 2 shows the implications from the donor perspective for the latest year. Among bilaterals, the United States gave the most gross aid to non-DAC governments and Japan came in second. Among multilaterals, the European Commission disbursed the most, with the World Bank's International Development Association (IDA) not far behind. Most of the calculations in the aid index are done for each donor-recipient pair. The

donor-level totals in Table 2, are *not* used in the calculations, but are summaries for illustration. The final row of the table is an exception: it shows the figures for one donor-recipient pair, Japan and Sierra Leone. I will continue the Japan-Sierra Leone example in order to illustrate the actual calculations at the level of the donor-recipient pair.

Table 2. Gross ODA net of offsetting entries for ODA loan forgiveness vs. gross aid transfers aid by donor

Donor	Gross ODA net of offsetting entries for ODA loan forgiveness	Gross aid transfers	% reduction from gross ODA to gross aid transfers
Australia	3,241	3,241	0
Austria	617	470	24
Belgium	2,095	1,544	26
Bill & Melinda Gates Foundation	1,552	1,552	0
Canada	3,963	3,938	1
Cyprus	30	30	0
Czech Republic	79	79	0
Denmark	2,186	2,140	2
Estonia	5	5	0
Finland	839	839	0
France	8,923	7,446	17
Germany	9,353	9,220	1
Greece	212	212	0
Hungary	28	28	0
Iceland	21	21	0
Ireland	585	585	0
Israel	128	128	0
Italy	923	694	25
Japan	15,131	14,948	1
Kuwait	617	617	0
Latvia	2	2	0
Liechtenstein	22	22	0
Lithuania	16	16	0
Luxembourg	262	262	0
Malta	8	8	0
Netherlands	4,755	4,291	10
New Zealand	271	271	0
Norway	3,561	3,561	0
Poland	102	102	0
Portugal	428	428	0
Romania	27	27	0
Russia	302	302	0
Saudi Arabia	2,884	2,884	0
Slovak Republic	20	20	0
Slovenia	22	22	0
South Korea	933	931	0
Spain	4,272	3,995	6
Sweden	2,923	2,923	0
Switzerland	1,728	1,698	2
Taiwan	326	326	0
Thailand	31	31	0
Turkey	920	920	0
United Arab Emirates	539	539	0
United Kingdom	8,364	8,364	0
United States	27,226	27,234	0
AfDF	1,842	2,345	-27
Arab Fund (AFESD)	1,028	1,028	0
AsDF	1,929	1,929	0
BADEA	125	125	0
CarDB	75	75	0
EC	12,570	12,570	0

GAVI	772	772	0
GEF	530	530	0
GFATM	3,031	3,031	0
IAEA	88	88	0
IDA	10,126	10,121	0
IDB Sp.Fund	722	720	0
IFAD	463	463	0
Islamic Develop-ment Bank	384	384	0
Montreal Protocol	20	20	0
Nordic Dev.Fund	61	60	2
OPEC Fund for International De-velopment	314	327	-4
SAF+ESAF(IMF)	1,872	1,346	28
UNAIDS	246	246	0
UNDP	613	613	0
UNECE	12	12	0
UNFPA	815	815	0
UNHCR	393	393	0
UNICEF	1,050	1,050	0
UNPBF	51	51	0
UNRWA	545	545	0
WFP	244	244	0
WHO	366	366	0
Japan-Sierra Leone	12	12	0

2. Subtracting debt service

The next step is to net debt service received out of gross aid transfers, in the belief that net transfers are a better measure than gross of the cost to the donor's treasury and benefit to the recipient. This departs somewhat from the approach of the DAC, whose Net ODA statistic is net of payments of principal, not interest. The rationale for the DAC approach is an analogy with the capital flow concept of net foreign direct investment. Only return of capital is netted out of net FDI, not repatriation of earnings. Similarly, only amortization is netted out of Net ODA, not interest, which can be seen as the donors' "earnings" on aid investment. So the formula for Net ODA is simply:

Net ODA = Gross ODA – (ODA loans received + Offsetting entries for ODA loan forgiveness)

(As mentioned in the previous section, Net ODA does subtract out the offsetting entries for forgiveness of ODA loans since those loans were counted in full as aid at disbursement.)

But for the purposes of evaluating aid policy, the FDI metaphor seems inapt. When the government of Ghana sends a check to the government of Japan for $1 million, it hardly matters to citizens in either country whether the check has "interest" or "principal" in the memo field, that is, whether the transaction enters the capital or current account. It seems unlikely that interest and principal payments have different effects on Japan's treasury or Ghana's development.

Moreover, studies have found evidence of defensive lending on the part of bilateral and multilateral lenders, whereby new loans go to servicing old ones (Ratha 2001; Birdsall, Claessens, and Diwan 2002). To the extent that donors are lending to cover interest payments they receive on concessional loans, Net ODA makes the circulation of money on paper look like an aid increase. Much the same can be said for treating capitalization of interest arrears as new aid. For these reasons, the CDI aid index treats debt service uniformly. "Net aid transfers" is defined as "gross aid transfers" less debt service actually received on ODA loans. (See Table 3.)

However, computing actual transfers from DAC data is surprisingly difficult. In DAC accounting, "interested received" includes interest on ODA loans that has been forgiven, not actually paid. Forgiving interest generates two opposite transactions: a debt forgiveness grant and a (forgiven) interest received transaction, which is included in total interest received. Since the definition of gross aid used here excludes the debt forgiveness grant, it must also exclude the return transaction for consistency. Thus:

Net aid transfers = gross aid transfers – ODA loans received
– (interest received – interest forgiven)

Note that "ODA loans received," unlike "interest received," only counts payments that result in actual transfers. Amortization payments made as the result of debt cancellation agreements are recorded separately, as offsetting entries for debt relief, described earlier. Surprisingly, it is impossible in general using DAC data to determine exactly how much interest a given aid recipient actually paid a given donor in a given year. DAC Table 2a, the table with disbursements data by donor and recipient only, reports total interest received, amalgamating interest actually paid and interest forgiven. DAC Table 1, however, which contains donor-level aggregates, does make the distinction, and provides a good basis for estimating the shares at the donor-recipient level, via prorating. The portion of "interest received" for each donor-recipient pair that is actually forgiven is assumed to be the same for each of a donor's recipients. Table 3 shows the donor-level amounts that are the basis for the prorating. For most donors, the potential error at the donor-recipient level is small because they a) receive no little or no interest or b) almost all of the interest they report receiving is actually received rather than forgiven.

The final column of Table 3 shows net aid transfers by donor. For multilaterals lenders, only concessional (low-interest) lending programs such as the World Bank's International Development Association are counted since only they generate ODA. Again, the calculations displayed do not in fact enter the aid index directly and are only illustrative summaries, except for the Japan-Sierra Leone example at the bottom. Among bilaterals, this adjustment to gross aid particularly affects Japan, which received $9.3 billion in debt service on concessional loans, equal to a striking 72% of its gross aid transfers and sufficient to put Japan's bilateral aid program well behind those of France, Germany, the Netherlands, Spain, the United Kingdom, and the United States in size. Among bilaterals, France and Germany were also major recipients of debt service for their size. Multilateral institutions of course are too.

Table 3. Subtracting Debt Service

Donor	A. Gross aid transfers	B. Amortization	C. DAC interest received	D. Estimated interest actually paid	Net Aid Transfers (A – B – D)
Australia	3,241	0	0	0	3,241
Austria	470	3	0	0	467
Belgium	1,544	37	0	0	1,507
Bill & Melinda Gates Foundation	1,552	0	0	0	1,552
Canada	3,938	40	2	2	3,896
Cyprus	30	0	0	0	30
Czech Republic	79	0	0	0	79
Denmark	2,140	23	0	0	2,118
Estonia	5	0	0	0	5
Finland	839	0	0	0	839
France	7,446	1,136	408	427	5,883
Germany	9,220	1,318	292	338	7,565
Greece	212	0	0	0	212
Hungary	28	0	0	0	28
Iceland	21	0	0	0	21
Ireland	585	0	0	0	585
Israel	128	0	0	0	128
Italy	694	164	0	0	530
Japan	14,948	7,800	2,121	2,121	5,027
Kuwait	617	406	132	132	78
Latvia	2	0	0	0	2
Liechtenstein	22	0	0	0	22
Lithuania	16	0	0	0	16
Luxembourg	262	0	0	0	262
Malta	8	0	0	0	8
Netherlands	4,291	62	0	0	4,229
New Zealand	271	0	0	0	271
Norway	3,561	0	0	0	3,561
Poland	102	6	0	0	96
Portugal	428	32	13	13	383
Romania	27	0	0	0	27
Russia	302	0	0	0	302
Saudi Arabia	2,884	14	0	0	2,870
Slovak Republic	20	0	0	0	20
Slovenia	22	0	0	0	22
South Korea	931	33	28	28	870
Spain	3,995	259	59	59	3,677
Sweden	2,923	0	0	0	2,923
Switzerland	1,698	16	0	0	1,682
Taiwan	326	0	0	0	326
Thailand	31	36	0	0	-4
Turkey	920	0	0	0	920
United Arab Emirates	539	159	0	0	380
United Kingdom	8,364	304	0	0	8,060
United States	27,234	639	237	237	26,358
AfDF	2,345	82	147		
Arab Fund (AFESD)	1,028	551	0	0	478
AsDF	1,929	906	286		
BADEA	125	49	18		
CarDB	75	20	0	0	55
EC	12,570	0	363	363	12,208
GAVI	772	0	0	0	772
GEF	530	0	0	0	530
GFATM	3,031	0	0	0	3,031
IAEA	88	0	0	0	88

IDA	10,121	2,347	833		
IDB Sp.Fund	720	220	2		
IFAD	463	179	0	0	284
Islamic Development Bank	384	104	0	0	280
Montreal Protocol	20	0	0	0	20
Nordic Dev.Fund	60	12	1		
OPEC Fund for International Development	327	154	0	0	174
SAF+ESAF(IMF)	1,346	642	1		
UNAIDS	246	0	0	0	246
UNDP	613	0	0	0	613
UNECE	12	0	0	0	12
UNFPA	815	0	0	0	815
UNHCR	393	0	0	0	393
UNICEF	1,050	0	0	0	1,050
UNPBF	51	0	0	0	51
UNRWA	545	0	0	0	545
WFP	244	0	0	0	244
WHO	366	0	0	0	366

[1]From previous table.

3. Discounting tied aid

Most bilateral donors tie some of their aid, requiring recipients to spend it on goods and services from the donor's home country, which reduces recipient governments' freedom to shop for the best deals. Catrinus Jepma's literature review (1991, p. 58) finds that tying raises the cost of aid projects a typical 15–30%. This suggests that tying reduces the *value* of aid by 13–23 percent. (Consider that a 15-percent cost increase lowers the purchasing power of aid by 1–1/1.15 = 13 percent. Similarly, a 30-percent cost increase cuts the value of aid 23 percent.)

The DAC tying statistics split aid commitments—tying data are unavailable for disbursements—into three categories: untied, tied, and partially untied. "Partially untied aid" comes with restrictions, but ones that are looser than those of "tied aid." To be precise, partially untied aid is subject to the restriction that it must be spent on goods and services from the donor nation *or* developing countries, or else to the restriction that it be spent on goods and services from developing countries only. In principle, the approach taken to penalizing tying is simple. Tied aid is discounted by 20% (a round number in the 13–23% range) and partially untied aid by 10%. No attempt is made to account for unreported, informal, de facto tying that may occur.

Implementation is more complex. The tying figures come primarily from the detailed commitment-level data in DAC's Creditor Reporting System (CRS) database, and are aggregated to the level of the donor-recipient pair. Since the data are for commitments, not disbursements, it is assumed that the same shares of disbursements and commitments are tied, untied, or partially untied. The discount applies to gross aid; returns

flows are not discounted since they are assumed to have an opportunity cost equivalent to untied aid. The selectivity discount described in the next section exempts emergency aid, so the tying discount step also splits gross aid into emergency and non-emergency aid and discounts them separately for tying.[5] Table 4 shows the results of this step, "net tying-discounted aid" by emergency status.[6]

[5] For commitments that missing tying status information, the index calculation algorithm uses two backstops to estimate the tied fraction. If the donor is multilateral, it assumes the aid is untied. Otherwise, it takes the average tied share of all of a donor's commitments, excluding debt forgiveness, from DAC Table 7b, for the most recently available year.

[6] For simplicity, aid to recipients missing tying information, such as to "Far East Asia unallocated," is assumed untied. Therefore the donor-level totals involve no extrapolations and are simple sums of the feasible estimates at the donor-recipient level.

Table 4. Penalizing tied aid

Donor	Non-emergency					Emergency				
	A. Gross transfers	B. Tied	C. Partially untied	D. Tying penalty (20%×B + 10%×C)	Tying-discounted gross transfers (A – D)	E. Gross transfers	F. Tied	G. Partially untied	H. Tying penalty (20%×F + 10%×G)	Tying-discounted gross transfers (E – H)
Australia	2,913	58	0	12	2,902	328	6	0	1	327
Austria	446	185	0	37	409	24	5	0	1	23
Belgium	1,404	80	0	16	1,388	140	1	0	0	139
Bill & Melinda Gates Foundation	1,552	1,552	0	310	1,242	0	0	0	0	0
Canada	3,455	169	0	34	3,421	483	0	0	0	483
Cyprus	30	30	0	6	24	0	0	0	0	0
Czech Republic	72	72	0	14	58	7	7	0	1	6
Denmark	1,987	197	0	39	1,948	153	2	0	0	153
Estonia	5	5	0	1	4	0	0	0	0	0
Finland	718	76	0	15	703	121	3	0	1	121
France	7,358	368	0	74	7,285	88	0	0	0	88
Germany	8,897	1,943	0	389	8,509	323	59	0	12	311
Greece	206	96	1	19	187	6	1	0	0	5
Hungary	28	28	0	6	23	0	0	0	0	0
Iceland	21	21	0	4	17	0	0	0	0	0
Ireland	505	0	0	0	505	80	0	0	0	80
Israel	128	128	0	26	102	0	0	0	0	0
Italy	623	287	13	59	564	71	18	2	4	67
Japan	14,348	511	881	190	14,158	600	2	2	1	599
Kuwait	617	617	0	123	493	0	0	0	0	0
Latvia	2	2	0	0	1	0	0	0	0	0
Liechtenstein	22	22	0	4	17	0	0	0	0	0
Lithuania	16	16	0	3	13	0	0	0	0	0
Luxembourg	225	0	0	0	225	37	0	0	0	37
Malta	8	8	0	2	7	0	0	0	0	0
Netherlands	4,082	507	0	101	3,980	209	17	0	3	206
New Zealand	247	39	2	8	239	24	1	0	0	24
Norway	3,256	0	0	0	3,256	305	0	0	0	305
Poland	102	102	0	20	81	0	0	0	0	0
Portugal	428	263	0	53	376	0	0	0	0	0
Romania	27	27	0	5	21	0	0	0	0	0
Russia	302	302	0	60	242	0	0	0	0	0
Saudi Arabia	2,884	2,884	0	577	2,308	0	0	0	0	0
Slovak Republic	20	20	0	4	16	0	0	0	0	0
Slovenia	22	22	0	4	18	0	0	0	0	0
South Korea	913	585	0	117	796	18	11	0	2	16
Spain	3,705	422	587	143	3,562	290	32	12	8	282
Sweden	2,540	8	0	2	2,538	383	0	0	0	383
Switzerland	1,515	264	0	53	1,462	183	34	0	7	176
Taiwan	326	326	0	65	261	0	0	0	0	0
Thailand	31	31	0	6	25	0	0	0	0	0
Turkey	772	772	0	154	617	148	148	0	30	119
United Arab Emirates	450	450	0	90	360	89	89	0	18	71
United Kingdom	7,794	0	0	0	7,794	570	0	0	0	570
United States	22,374	4,135	0	827	21,547	4,861	2,086	0	417	4,443
AfDF	2,345	0	0	0	2,345	0	0	0	0	0
Arab Fund (AFESD)	1,023	0	0	0	1,023	5	0	0	0	5
AsDF	1,923	0	0	0	1,923	6	0	0	0	6
BADEA	125	0	0	0	125	0	0	0	0	0

CarDB	75	0	0	0	75	0	0	0	0	0
EC	12,570	0	0	0	12,570	0	0	0	0	0
GAVI	772	0	0	0	772	0	0	0	0	0
GEF	530	0	0	0	530	0	0	0	0	0
GFATM	3,030.7	0.0	0.0	0.0	3,030.7	0.0	0.0	0.0	0.0	0.0
IAEA	88	0	0	0	88	0	0	0	0	0
IDA	10,121	0	0	0	10,121	0	0	0	0	0
IDB Sp.Fund	714	0	0	0	714	7	0	0	0	7
IFAD	463	0	0	0	463	0	0	0	0	0
Islamic Development Bank	384	0	0	0	384	0	0	0	0	0
Montreal Protocol	20	0	0	0	20	0	0	0	0	0
Nordic Dev.Fund	60	0	0	0	60	0	0	0	0	0
OPEC Fund for International Development	324	0	0	0	324	3	0	0	0	3
SAF+ESAF(IMF)	1,346	0	0	0	1,346	0	0	0	0	0
UNAIDS	246	0	0	0	246	0	0	0	0	0
UNDP	553	0	0	0	553	61	0	0	0	61
UNECE	12	0	0	0	12	0	0	0	0	0
UNFPA	815	0	0	0	815	0	0	0	0	0
UNICEF	1,022	0	0	0	1,022	28	0	0	0	28
UNPBF	47	0	0	0	47	4	0	0	0	4
UNRWA	522	0	0	0	522	23	0	0	0	23
WFP	116	0	0	0	116	127	0	0	0	127
WHO	357	0	0	0	357	9	0	0	0	9
Japan-Sierra Leone	9	0	0	0	9	3	0	0	0	3

4. Adjusting for selectivity

It has long been argued that which country aid goes to is an important determinant of its effectiveness (Burnside and Dollar 2000; Easterly 2002a, p. 35). Some countries need aid more than others. Some countries can use it better than others. There is little empirically grounded consensus, however, on what precisely donors should select for.[7]

For anyone measuring selectivity, two main challenges arise: choosing a mathematical *structure* to distill numbers on recipient attributes and donor aid allocations into a metric; and choosing the *attributes* that donors are expected to select for, such as low income, good policies, or good governance. This section discusses the choices made here at the level of principle, then descends to the details of implementation.

Principles

The oldest approach to measuring selectivity—even if not thought of as such—is the use of cross-country regressions to explain donors' aid allocations as a function of recipient characteristics. Historically, these characteristics have included indicators of geopolitical importance (e.g, oil exports or military expenditure), commercial links (trade with donors), and development need and potential (income, governance) (Kaplan 1975; Dudley and Montmarquette 1976; McKinley and Little 1979; Mosley 1981, 1985; Maizels and Nissanke 1984; Frey and

[7] And as Radelet (2004) points out, aid allocation rules should probably vary by aid type.

Schneider 1986; Gang and Lehman 1990; Schraeder, Hook, and Taylor 1998; Trumbull and Wall 1994; Alesina and Dollar 1998; Burnside and Dollar 2000; Collier and Dollar 2002; Birdsall, Claessens, and Diwan 2002). In general, bilateral donors appear to be less sensitive to recipient need and potential than to strategic and commercial interests. More limited evidence suggests that multilaterals act oppositely. Almost all the studies that check find a bias in favor of small countries, in the sense that the elasticity of aid receipts with respect to population or GDP is less than 1.

The cross-country regression approach to measuring selectivity is conceptually consistent, but if used to evaluate donors, it invites methodological challenges that it seems better to avoid. This is because it embodies an attempt to model donor decision-making and predict the effects on allocations of marginal changes in recipient characteristics, all else equal. (That is the meaning of regression coefficient estimates.) With modeling comes the risk of misspecification. If a donor's aid allocations fail to relate to the chosen variables via the chosen functional form, the results may not be meaningful. For example, if a donor specializes in a region, such as France does in francophone Africa, its aid allocations will be highly nonlinear with respect to most indicators of recipient appropriateness, and a linear regression may produce strange results. Similarly if a donor specializes in the poorest nations. Results may also be sensitive to the choice of regressors. The United States gives large amounts of aid to countries such as Russia and Pakistan that appear too poorly governed to make good use of aid for development but have obvious geopolitical value. As a result, regressions that control for geopolitical value may yield a different coefficient on governance for the United States than regressions that do not. This then raises the question of whether evaluations of selectivity should abstract from donors' responsiveness to non-development concerns. Controlling for non-development concerns gives a better picture of the effects of a hypothetical marginal change in an indicator of recipient development potential. Not controlling for it gives a better picture of the general importance of development potential in allocation. It is a question, in other words, of what is meant by "selectivity."

The work of David Dollar and Victoria Levin (2006) stands in the regression tradition and faces these questions. The authors estimate the elasticity of a donor's aid disbursements with respect to recipient's income and governance. They posit a log-linear (elasticity-type) relationship between aid disbursements and recipient population, GDP/capita, and "institutions/policies" as indicated by the World Bank's Country Policy and Institutional Assessment (CPIA). They do not control for commercial or geopolitical interests but in controlling for population they abstract from small-country bias, even though Collier and Dollar (2002) find that global aid could reduce poverty twice as fast if most of it were reallocated to India.

The second major approach to evaluating selectivity was initiated by McGillivray (1989, 1992). It is more radically empirical, eschewing any attempt to model allocation procedures or estimate marginal effects, and lends itself more naturally to creating an index that combines aid quantity and selectivity. His index is essentially the weighted sum of a donor's aid disbursements to all recipients, where the weights are mathematical-

ly related to a recipient characteristic such as GDP/capita. If the weights lie between 0 and 1, they can be thought of as discounts that penalize or reward selection for desired characteristics. The ratio of the weighted sum to the unweighted sum measures overall selectivity.[8]

Rao (1994, 1997) points out that donors can maximize their scores on McGillivray's index by concentrating all their aid in the single poorest country. He argues that the source of this perverse result is the failure of McGillivray's index to consider recipients' *post-aid* GDP/capita. On the assumption that aid leads directly to GDP gains, if all aid went to the poorest country, that country's GDP/capita would rise rapidly and make it a less deserving recipient. He revises McGillivray's index to factor in both pre- and post-aid GDP. This introduces a notion of diminishing returns to aid: not diminishing returns to the effectiveness of aid in raising GDP/capita, but diminishing returns to the value of doing so.

The third approach to assessing selectivity is the newest and most sophisticated. Drawing on the cross-country literature on determinants of aid allocation, McGillivray, Leavy, and White (2002), formally model aid allocation. They endow donors with utility functions that depend on their allocation of aid among recipients that are characterized by various commercial and geopolitical interest factors as well as levels of development need and potential. The authors incorporate diminishing returns to aid, compute optimal allocations, and penalize donors to the extent they deviate from their optima. The approach has several disadvantages from the point of view of the CDI. It is conceptually complex. It is vulnerable to challenges analogous to those that apply to the first approach, regarding proper specification. It rewards donors for pursuing geopolitical and commercial interests (though this could be easily changed, to focus purely on recipient need, as appropriate for the CDI). And it penalizes donors for aid allocations that are rather different from the ideal ones even if they do not generate much lower utility. For example, if a donor at the optimal allocation shifts aid between two identical recipients, the marginal utility loss is zero, but the marginal decline in the donor's score would be non-zero.

The approach taken here is closest to McGillivray's original. For the purposes of the CDI, it has the advantages of conceptual simplicity. It combines quantity and quality (selectivity) in a natural way that minimizes questions about proper modeling specification. Since it does not model with smooth functional forms, it does not inherently penalize sharp specialization in a certain region or income bracket. It can be combined with other discount factors, such as for tying and project proliferation. It lends itself to a distinction between subflows of aid (emergency and non-emergency). And it can handle negative net aid flows, which do occur and which some of the common functional forms cannot. (Reverse flows, like zero flows, would bedevil the elasticity approach of Dollar and Levin, for example.)

[8] McGillivray's original (1989) index sums aid/recipient population rather than total aid to each recipient. White (1992) questions the implicit notion of donors allocating aid/recipient population: shifting $1 million in aid from small, poor Mali to large, poor India would reduce a donor's score in McGillivray's system because the aid would be lower *per capita* in India. In reply, McGillivray (1992) proposes using absolute aid rather than aid/capita, within the same basic framework.

Here is a simple example of how the chosen system works. The selectivity formula introduced here, it will emerge, assigns Uganda a weight of 0.75 for non-emergency aid and Uzbekistan a 0.25 for the 2006 data year. A donor whose aid program consisted of giving $1 million to each of these countries would have selectivity-weighted aid of $1 million (0.75 × $1 million = $0.75 million for Uganda plus 0.25 × $1 million = $0.25 million for Uzbekistan). The donor's overall "selectivity" is then the ratio of its selectivity-weighted aid to its unweighted aid—in this case, $1 million / $2 million = 0.5. This is also the average selectivity weight of the donor's recipients, where the average is weighted by how much aid the donor gives each recipient.

One potentially counterintuitive result of this approach is that a donor that is constitutionally confined to a clientele with low selectivity weights comes off poorly even if it is in some sense selective within that pool. The best example is the European Bank for Reconstruction and Development (EBRD), which lends to nations of the former Eastern bloc, which are relatively rich. Once again we are faced with the question of what we mean by "selectivity." But for the present purpose of comparing *bilateral* donors to each other, the potentially counterintuitive outcome makes sense. As will be described below, the "quality-adjusted aid quantities" of multilaterals are ultimately allocated back as credits to the bilaterals. If Germany is to be more rewarded for giving aid to Mali than Slovenia, it should be more rewarded for doing the same indirectly—giving more to the African Development Fund than the EBRD.

Having settled the question of mathematical form for measuring selectivity, there remains the question of what donors are supposed to select for. The aid index uses two indicators. The first is GDP/capita, converted to dollars on the basis of exchange rates.[9] The second indicator is the composite governance variable of Daniel Kaufman and Aart Kraay (Kaufmann, Kraay, and Mastruzzi 2008), which is the most comprehensive governance indicator available. The KK composite is an average of indicators on up to six dimensions, available data permitting: democracy, political instability, rule of law, bureaucratic regulation, government effectiveness, and corruption. The six variables are themselves synthesized from several hundred primary variables from more than a score of datasets. These two indicators of recipient need and appropriateness, GDP/capita and the KK composite, have several strengths for measuring selectivity. They have wide coverage. They are updated annually and made freely available. And they reflect consensus views that a) the richer a country is, the less it needs aid; and b) that institutional quality is a key determinant of development and, most likely, aid effectiveness.

Before descending to the particulars of the selectivity discounting, it is worth reiterating that two concepts are defined here relating to selectivity. The first, selectivity-weighted aid, is a measure of aid allocations that blends quantity and quality, and is of primary interest for grading performance. It possesses the desirable properties of linearity: If a country doubles its aid to every recipient, its selectivity-adjusted aid score will dou-

[9] PPP-based GDP might seem more meaningful, but it is highly correlated with exchange-rate GDP in logs, so that it gives nearly the same results as used here, and is available for slightly fewer countries.

ble. If it runs two parallel aid programs, the selectivity-adjusted aid total of the combination is the sum of those for the individual programs.

The second concept is the weighted-average selectivity score of a donor's recipients—the donor's "selectivity." This measure, it should be noted, behaves strangely when applied to donors with net transfers much smaller than gross transfers. Consider this example. Donor X is a development bank. It disburses nothing to Recipient Y, which has selectivity weight 0.6, but *receives* $1 million from Y in debt service, which is treated as negative aid. It disburses the $1 million to Recipient Z, which has weight 0.8. Donor X's selectivity-weighted aid is thus:

$$0.6 \times (-\$1 \text{ million}) + 0.8 \times (\$1 \text{ million}) = \$0.2 \text{ million}.$$

Its score is small but positive because it has transferred funds from a less appropriate to a more appropriate aid "recipient"—perhaps an odd result, but meaningful. Now, what is the "selectivity" of Donor X?

$$\text{selectivity-weighted net transfers} / \text{total net transfers} = \$0.2 \text{ million} / 0 = \infty.$$

The donor has done some good for the developing world on net, according to the measure, with zero net disbursal of funds. It is infinitely efficient.

This extreme example illustrates a counterintuitive result for donors whose net transfers are much smaller than gross transfers (because of debt service). In these cases, the donor's reported "selectivity" can lie outside the range of most of its recipients' selectivity weights. For example, the IDB's Fund for Special Operations disbursed $593 million in 2003. It received $434 million in debt service, for net aid of only $159 million. Yet it generally transferred funds from countries deemed less appropriate for aid to those deemed more appropriate and so achieves a selectivity score of 0.88 in 2003, which is higher than the selectivity weight of any of its recipients. Mathematically, the 0.88 is a weighted average of selectivity factors between 0 and 1, where some of those weights (net transfers) are negative.

One can avoid such results by measuring selectivity of gross disbursements only, which I call "gross selectivity." In the abstract example above, Donor X has gross selectivity of $0.2 million/$1 million = 0.2. This result seems more meaningful than infinity, but comes at the expense of ignoring the debt service received from Recipient Y.

The sometimes-strange behavior of the version that includes reflows, "net selectivity," does not mean it is inherently flawed. Rather, it points up yet another subtlety in the question of what is meant by selectivity. The picture conjured by the word "selectivity" is of a donor that only sends funds outward. In fact, donors not only distribute their own money but redistribute that of recipients. What does selectivity mean in such a context? Is a donor that bestows all its net transfers on Mali almost perfectly selective? Or is it falling far short of the ideal by failing to transfer billions of dollars from Kuwait to Mali?

The aid index set forth here does incorporate reflows into its measure of selectivity. To avoid infinities, it makes a compromise between principle and simplicity. It segregates (tying-discounted) disbursements from

reflows. It then applies the gross selectivity factor to disbursements, yielding selectivity-weighted disbursements, and applies the same factor to reflows, implicitly assuming that the distribution of a donor's disbursements and reflows across recipients are same. It would be more accurate to separately compute the "selectivity" of the donor's reflows, but would also be more complicated, and tends to generate extreme results in some cases.

Implementation

The flow to which selectivity weights are applied is the output of the previous steps in the construction of the aid performance measure, namely "gross tying-discounted aid" and debt service. These quantities are multiplied by two discount factors. The first is linearly related to a country's KK governance score. The linear relationship is such that in the benchmark year of 2001, the data year for the first edition of the CDI, the governance weight ranges exactly between 0 (for the worst-governed country, Afghanistan) and 1 (for Singapore). The second factor is a linear function of a country's log GDP/capita. In 2001, Singapore (GDP/capita of $21,869 in year-2000 dollars) gets a 0 and the DRC (GDP/capita of $81), defines the upper end for the GDP/capita weights. This upper end is not 1.0, as one might expect, but 2.21, a number chosen so that the highest *combined* selectivity weight (the product of the governance and income factors) *is* 1.0 in the benchmark year of 2001 (for Ghana). Table 5 summarizes the weight computations for the latest year.[10] Since the scalings just described are based on 2001 data and remain fixed thereafter for the sake of valid comparisons over time, it is possible for selectivity weights in later years to stray outside the 0–1 range.

There are two exceptions to this weighting. First, emergency aid is exempted from the selectivity discounting since it is often effective even in the poorest-governed countries. Second is an exemption from the governance discount—the first discount factor—for aid that is meant to *improve* governance, broadly defined. This sort of aid receives a uniform governance-based discount of 50%—compared to, say, the 75% discount it would otherwise get in Haiti. It seems perverse to penalize donors for trying to improve governance where it is low. On the other hand, poor governance may indeed undermine the effectiveness of aid meant to improve it. The choice of a uniform 50% discount seems like a minimally arbitrary, middle-of-the-road response to the problem. Governance aid is defined as that assigned a code in the 15000's in DAC's Creditor Reporting System database. The headings for these 16 codes are: Government and civil society, general; Economic & development policy/planning; Public sector financial management; Legal and judicial development; Government administration; Strengthening civil society; Elections; Human rights; Free flow of information; Womens equality organisations and institutions; Security system management and reform; Civilian peace-building; Conflict pre-

[10] The KK governance variables are available on a biannual basis for 1996–2004 and annual since. For years missing KK data, the aid index uses the previous year's values.

vention and resolution; Post-conflict peace-building (UN); Demobilisation; Land mine clearance; and Child soldiers (prevention and demobilisation).[11,12]

This system implies several valuations, which are meant to be minimally arbitrary but should be made explicit. For one, non-emergency program aid to the highest-weighted recipient in 2001, Ghana, is precisely as meritorious as emergency aid to any country any year, since the latter is not discounted. All other aid is valued less. And because of the multiplicative weighting structure, non-emergency aid to the richest country is valueless no matter how well-governed the country: by virtue of being the richest its income weight is zero. Similarly, non-emergency, non-governance aid to the worst-governed country is also treated as valueless regardless of how poor the country is. In general, governance quality and income level are each seen as conditioning the other's relevance for aid effectiveness.

Table 6 summarizes the calculations by donor, which, recall, actually take place at the donor-recipient level.

[11] The full CRS purpose classification is at http://www.oecd.org/dataoecd/40/23/34384375.doc.
[12] I think Ian Anderson and Terry O'Brien for comments that led to this change.

Table 5. Computation of selectivity weights

Country name	A. Exchange rate GDP/capita, 2010 ($)	B. Log exchange rate GDP/capita	C. GDP selectivity multiplier	D. Kaufmann-Kraay composite governance score, 2010	E. Governance selectivity multiplier	F. Combined selectivity multiplier[1]
Formula:		Log A	(linear map of B onto standard scale)		(linear map of B onto standard scale)	C × E
Ghana	359	5.88	1.53	0.11	0.62	0.94
Malawi	184	5.22	1.72	–0.27	0.52	0.89
Burkina Faso	276	5.62	1.60	–0.27	0.52	0.82
Rwanda	338	5.82	1.54	–0.25	0.52	0.80
Lesotho	496	6.21	1.43	–0.13	0.55	0.79
Mozambique	390	5.97	1.50	–0.25	0.52	0.78
Kiribati	760	6.63	1.31	0.01	0.59	0.78
Benin	377	5.93	1.51	–0.29	0.51	0.77
Mali	270	5.60	1.61	–0.43	0.47	0.76
Cape Verde	1,960	7.58	1.04	0.46	0.72	0.75
Vanuatu	1,544	7.34	1.11	0.24	0.66	0.73
Tanzania	456	6.12	1.46	–0.34	0.50	0.72
Zambia	432	6.07	1.47	–0.36	0.49	0.72
Bhutan	1,324	7.19	1.15	0.10	0.62	0.71
Tuvalu	1,715	7.45	1.08	0.23	0.65	0.71
Niger	180	5.19	1.72	–0.69	0.40	0.69
Mongolia	773	6.65	1.31	–0.25	0.52	0.68
Gambia	355	5.87	1.53	–0.53	0.44	0.68
Liberia	155	5.04	1.77	–0.75	0.38	0.68
Georgia	1,259	7.14	1.17	–0.06	0.57	0.67
Moldova	596	6.39	1.38	–0.39	0.48	0.66
Senegal	562	6.33	1.40	–0.43	0.47	0.66
India	787	6.67	1.30	–0.31	0.50	0.66
Sierra Leone	268	5.59	1.61	–0.66	0.41	0.65
Chile	6,334	8.75	0.71	1.18	0.92	0.65
St. Vincent and the Grenadines	4,885	8.49	0.78	0.86	0.83	0.65
Namibia	2,667	7.89	0.96	0.30	0.67	0.64
Uganda	377	5.93	1.51	–0.59	0.43	0.64
Botswana	4,189	8.34	0.83	0.66	0.77	0.64
St. Lucia	5,249	8.57	0.76	0.89	0.84	0.64
Madagascar	243	5.49	1.64	–0.74	0.38	0.63
Bulgaria	2,550	7.84	0.97	0.20	0.65	0.63
Micronesia, Fed. Sts.	2,146	7.67	1.02	0.05	0.61	0.62
Tonga	2,025	7.61	1.03	–0.01	0.59	0.61
Mauritius	5,182	8.55	0.77	0.73	0.79	0.61
Latvia	5,011	8.52	0.78	0.66	0.77	0.60
Lithuania	5,332	8.58	0.76	0.72	0.79	0.60
Hungary	5,634	8.64	0.74	0.75	0.80	0.59
Kenya	469	6.15	1.45	–0.67	0.40	0.59
Vietnam	723	6.58	1.33	–0.54	0.44	0.58
Armenia	1,327	7.19	1.15	–0.31	0.51	0.58
Costa Rica	5,189	8.55	0.77	0.61	0.76	0.58
Guyana	1,201	7.09	1.18	–0.36	0.49	0.58
Dominica	6,148	8.72	0.72	0.76	0.80	0.57
Albania	1,915	7.56	1.05	–0.17	0.54	0.57
Poland	6,576	8.79	0.70	0.81	0.81	0.57
Sri Lanka	1,296	7.17	1.16	–0.37	0.49	0.57
Macedonia, FYR	2,221	7.71	1.01	–0.11	0.56	0.57
South Africa	3,746	8.23	0.86	0.24	0.66	0.56
Czech Republic	7,381	8.91	0.67	0.92	0.84	0.56
Solomon Islands	1,144	7.04	1.20	–0.46	0.46	0.56
Timor-Leste	370	5.91	1.52	–0.82	0.36	0.55
Marshall Islands	2,437	7.80	0.98	–0.10	0.56	0.55
Jordan	2,534	7.84	0.97	–0.09	0.57	0.55
Togo	285	5.65	1.59	–0.89	0.34	0.55
Indonesia	1,144	7.04	1.20	–0.48	0.46	0.55
Nepal	268	5.59	1.61	–0.91	0.34	0.55
El Salvador	2,557	7.85	0.97	–0.10	0.56	0.54

Ethiopia	221	5.40	1.66	–0.95	0.33	0.54
Grenada	5,330	8.58	0.76	0.42	0.71	0.54
Guinea-Bissau	161	5.08	1.75	–1.03	0.30	0.53
Kyrgyz Republic	373	5.92	1.52	–0.86	0.35	0.53
Ukraine	1,037	6.94	1.22	–0.56	0.44	0.53
Morocco	1,844	7.52	1.06	–0.32	0.50	0.53
Papua New Guinea	744	6.61	1.32	–0.69	0.40	0.53
Malaysia	5,185	8.55	0.77	0.32	0.68	0.52
Bolivia	1,233	7.12	1.18	–0.55	0.44	0.51
Slovakia	8,446	9.04	0.63	0.78	0.81	0.51
Nicaragua	948	6.85	1.25	–0.67	0.40	0.51
Brazil	4,699	8.46	0.79	0.14	0.63	0.50
Uruguay	9,106	9.12	0.61	0.85	0.82	0.50
Croatia	6,338	8.75	0.71	0.41	0.70	0.50
St. Kitts and Nevis	9,176	9.12	0.60	0.85	0.83	0.50
Cambodia	558	6.32	1.40	–0.85	0.36	0.50
Jamaica	3,665	8.21	0.87	–0.06	0.57	0.50
Philippines	1,383	7.23	1.14	–0.56	0.43	0.50
Burundi	115	4.75	1.85	–1.16	0.27	0.50
Bangladesh	558	6.32	1.40	–0.86	0.35	0.49
Comoros	336	5.82	1.54	–0.99	0.32	0.49
Bosnia and Herzegovina	2,183	7.69	1.01	–0.38	0.48	0.49
Tunisia	3,165	8.06	0.91	–0.18	0.54	0.49
Belize	3,546	8.17	0.87	–0.11	0.56	0.49
Honduras	1,392	7.24	1.14	–0.60	0.42	0.48
Peru	3,180	8.06	0.91	–0.24	0.52	0.47
Swaziland	1,810	7.50	1.07	–0.53	0.44	0.47
Thailand	2,713	7.91	0.95	–0.34	0.50	0.47
Mauritania	609	6.41	1.38	–0.91	0.34	0.47
Cameroon	714	6.57	1.33	–0.88	0.35	0.46
Palau	6,244	8.74	0.71	0.21	0.65	0.46
Tajikistan	279	5.63	1.60	–1.10	0.29	0.46
Laos	555	6.32	1.40	–0.97	0.32	0.45
Egypt, Arab Rep.	1,976	7.59	1.04	–0.56	0.43	0.45
Colombia	3,233	8.08	0.90	–0.33	0.50	0.45
Panama	5,901	8.68	0.73	0.09	0.62	0.45
Guatemala	1,861	7.53	1.06	–0.60	0.42	0.45
Paraguay	1,621	7.39	1.10	–0.66	0.41	0.45
Kazakhstan	2,482	7.82	0.98	–0.48	0.46	0.45
Turkey	5,349	8.58	0.76	–0.05	0.58	0.44
Antigua and Barbuda	11,894	9.38	0.53	0.81	0.81	0.43
Slovenia	12,729	9.45	0.51	0.91	0.84	0.43
Maldives	4,039	8.30	0.84	–0.29	0.51	0.43
China	2,425	7.79	0.98	–0.58	0.43	0.42
Haiti	371	5.92	1.52	–1.15	0.27	0.41
Cyprus	15,314	9.64	0.46	1.10	0.89	0.41
Dominican Republic	4,049	8.31	0.84	–0.40	0.48	0.40
Ecuador	1,728	7.45	1.08	–0.80	0.37	0.40
Seychelles	8,614	9.06	0.62	0.14	0.63	0.39
Fiji	2,231	7.71	1.01	–0.73	0.39	0.39
Mexico	6,105	8.72	0.72	–0.20	0.53	0.39
Pakistan	669	6.51	1.35	–1.13	0.28	0.37
Central African Republic	240	5.48	1.64	–1.31	0.23	0.37
Nigeria	545	6.30	1.41	–1.17	0.27	0.37
Syrian Arab Republic	1,526	7.33	1.11	–0.93	0.33	0.37
Eritrea	132	4.88	1.81	–1.40	0.20	0.37
Congo, Rep.	1,253	7.13	1.17	–1.01	0.31	0.36
Azerbaijan	2,345	7.76	0.99	–0.82	0.36	0.36
Cuba	4,495	8.41	0.81	–0.53	0.44	0.36
Gabon	4,181	8.34	0.83	–0.58	0.43	0.36
Guinea	412	6.02	1.49	–1.27	0.24	0.35
Angola	1,381	7.23	1.14	–1.02	0.31	0.35
Cote d'Ivoire	591	6.38	1.38	–1.21	0.25	0.35
Algeria	2,232	7.71	1.01	–0.87	0.35	0.35
Trinidad and Tobago	10,481	9.26	0.57	0.11	0.62	0.35
South Korea	16,373	9.70	0.44	0.72	0.79	0.35
Yemen	610	6.41	1.38	–1.22	0.25	0.35
Chad	276	5.62	1.60	–1.39	0.21	0.33

Bahamas, The	19,631	9.88	0.39	0.92	0.84	0.33
Belarus	2,738	7.91	0.95	–0.97	0.32	0.30
Lebanon	6,747	8.82	0.69	–0.61	0.42	0.29
Argentina	10,749	9.28	0.56	–0.27	0.52	0.29
Uzbekistan	953	6.86	1.25	–1.31	0.23	0.28
Iraq	736	6.60	1.32	–1.43	0.20	0.26
Congo, Dem. Rep.	104	4.64	1.88	–1.66	0.13	0.25
Singapore	32,536	10.39	0.24	1.46	0.99	0.24
Zimbabwe	321	5.77	1.56	–1.58	0.15	0.24
Hong Kong, China	35,536	10.48	0.22	1.44	0.99	0.22
Turkmenistan	2,062	7.63	1.03	–1.39	0.21	0.21
Sudan	524	6.26	1.42	–1.63	0.14	0.20
Macao, China	33,923	10.43	0.23	0.82	0.82	0.19
Venezuela, RB	5,528	8.62	0.75	–1.29	0.23	0.17
Afghanistan	254	5.54	1.63	–1.77	0.10	0.16
Equatorial Guinea	8,655	9.07	0.62	–1.24	0.25	0.15
Bermuda	62,682	11.05	0.06	1.14	0.90	0.05

[1]To allow comparisons over time, the linear maps are designed so that selectivity weights fit exactly in the 0–1 range in a fixed reference year, 2001. In other years, weights can cross these bounds.

Table 6. Discounting for selectivity

Donor	Tying-discounted gross transfers		C. Reflows[1]	D. Gross selectivity	Tying- and selectivity-discounted gross transfers (A × D + B)	Selectivity-discounted reflows (C × D)
	A. Non-emergency[1]	B. Emergency[1]				
Australia	2,902	327	0	0.54	1,883	0
Austria	409	23	3	0.54	244	1
Belgium	1,388	139	37	0.59	960	16
Bill & Melinda Gates Foundation	1,242	0	0	0.63	781	0
Canada	3,421	483	43	0.62	2,599	20
Cyprus	24	0	0	0.49	12	0
Czech Republic	58	6	0	0.42	30	0
Denmark	1,948	153	23	0.64	1,406	11
Estonia	4	0	0	0.35	1	0
Finland	703	121	0	0.59	537	0
France	7,285	88	1,563	0.52	3,906	626
Germany	8,509	311	1,656	0.54	4,931	673
Greece	187	5	0	0.50	99	0
Hungary	23	0	0	0.38	9	0
Iceland	17	0	0	0.62	10	0
Ireland	505	80	0	0.66	414	0
Israel	102	0	0	0.49	50	0
Italy	564	67	164	0.50	351	62
Japan	14,158	599	9,921	0.53	8,127	3,939
Kuwait	493	0	538	0.49	241	200
Latvia	1	0	0			
Liechtenstein	17	0	0			
Lithuania	13	0	0	0.19	2	0
Luxembourg	225	37	0	0.62	177	0
Malta	7	0	0			
Netherlands	3,980	206	62	0.63	2,722	30
New Zealand	239	24	0	0.58	162	0
Norway	3,256	305	0	0.56	2,118	0
Poland	81	0	6	0.40	32	2
Portugal	376	0	46	0.72	269	25
Romania	21	0	0	0.63	13	0
Russia	242	0	0			

Saudi Arabia	2,308	0	14			
Slovak Republic	16	0	0	0.48	8	0
Slovenia	18	0	0	0.45	8	0
South Korea	796	16	61	0.49	402	22
Spain	3,562	282	318	0.50	2,056	121
Sweden	2,538	383	0	0.61	1,943	0
Switzerland	1,462	176	16	0.58	1,018	7
Taiwan	261	0	0			
Thailand	25	0	36	0.48	12	14
Turkey	617	119	0	0.32	314	0
United Arab Emirates	360	71	159	0.40	214	49
United Kingdom	7,794	570	304	0.62	5,391	139
United States	21,547	4,443	876	0.52	15,686	336
AfDF	2,345	0		0.62	1,450	
Arab Fund (AFESD)	1,023	5	551	0.48	493	196
AsDF	1,923	6		0.48	930	
BADEA	125	0		0.66	82	
CarDB	75	0	20	0.54	41	8
EC	12,570	0	363	0.55	6,871	149
GAVI	772	0	0	0.49	376	0
GEF	530	0	0	0.50	266	0
GFATM	3,031	0	0	0.55	1,677	0
IAEA	88	0	0	0.49	43	0
IDA	10,121	0		0.58	5,862	
IDB Sp.Fund	714	7		0.50	367	
IFAD	463	0	179	0.55	253	75
Islamic Development Bank	384	0	104	0.54	207	43
Montreal Protocol	20	0	0	0.47	10	0
Nordic Dev.Fund	60	0		0.64	39	
OPEC Fund for International Development	324	3	154	0.53	176	63
SAF+ESAF(IMF)	1,346	0		0.60	806	
UNAIDS	246	0	0	0.53	129	0
UNDP	553	61	0	0.64	413	0
UNECE	12	0	0			
UNFPA	815	0	0	0.50	409	0
UNHCR	0	393	0			
UNICEF	1,022	28	0	0.51	544	0
UNPBF	47	4	0	0.78	40	0
UNRWA	522	23	0	0.45	255	0
WFP	116	127	0	0.53	189	0
WHO	357	9	0			
Japan-Sierra Leone	9	3	0	0.71	10	0

[1]From previous tables.

5. Penalizing project proliferation

Project proliferation, donor fragmentation, and lack of coordination have long been cited as major problems for aid effectiveness. Donors often act at cross-purposes—one donor's trains won't run on another's tracks, literally or metaphorically. Or donors overload recipient ministries with mission visitations and project reporting requirements (Acharya, de Lima, and Moore 2006; Roodman 2006a, 2006b). Roodman (2006a) shows theoretically how the tendency to proliferate can create bottlenecks in aid delivery on the recipient side, limiting absorptive capacity for aid. A related model in Roodman (2006b) suggests that to maximize aid effectiveness, do-

nors need to fund fewer, larger projects in *smaller* countries, all else equal, since they have less administrative capacity.

Though such transaction costs of aid are widely thought to be substantial, they have mostly defied direct measurement. For example, Brown et al. (2000) set out to measure aid transaction costs in Vietnam but ended up obtaining only anecdotal information. A pair of recent papers has made fresh contributions to analyzing the extent of proliferation and indirectly measuring its costs. Arnab Acharya, Ana Fuzzo de Lima, and Mick Moore (2006) develop indexes of donors' tendency to *proliferate* (disperse) aid among recipients, and of the tendency of recipients' aid to be *fragmented* among many donors. Stephen Knack and Aminur Rahman (2007) measured fragmentation similarly, and find it to be predictive of lower recipient bureaucratic quality. They hypothesize that donors out-compete recipient governments for the scarce resource of skilled nationals.

The inputs to the indexes of proliferation and fragmentation in these papers are data on aid disbursements by donor and recipient, from DAC Table 2a. Given that dataset, the indexes are logical first steps toward measuring proliferation. But this style of analysis also has disadvantages since it looks at allocation of aid across countries rather than allocation across projects within countries. A donor that gives aid to only one country but does so through tiny projects would score perfectly on the Acharya, de Lima, and Moore proliferation index since it would not be proliferating at all across recipients, while a donor that provided large, equal-sized blocks of pure budgetary support to several dozen nations would be a major "proliferator."

The idea of the adjustment in the CDI for project proliferation is to weight each dollar of aid based on the size of the "aid activity" of which it is part. The weights depend on the sizes of other projects in the country and the country's governance.

Calculating these size weights in a conceptually sound way turns out to be more complicated than calculating selectivity weights. One reason is that the sizes of aid activities range over many orders of magnitude, from $10,000 or smaller to $100 million or bigger. A linear map from this range to a limited span needed for weights, such as [0, 1], would have to consign all projects smaller than $10 million to near-0 weights. A map from *log* project size would work little better, for while it would compress the high end, bringing $10 million and $100 million aid activities closer together, it would explode the low end, generating large weight differences between $1,000 and $10,000 projects. A second complication is that if there is such a thing as too small a project, there is also such a thing as too big. As Radelet (2004) and Roodman (2006b) argue, large blocks of program support are less appropriate for countries where governance is poor. In such countries, the oft-criticized transaction costs associated with aid activities—meetings with donors, quarterly reports, etc.—also have the benefit of improving measurability of results and holding recipients accountable for outcomes. This makes size fundamentally different from governance and poverty. For the latter, monotonic weighting functions are reasonable: to a first approximation, the poorer or better governed the country, the more appropriate it arguably is aid. In contrast, there is in, in some theoretical sense, an *optimal* project size. It should depend on several

factors, including how big the receiving country is, how much aid it is receiving, and the quality of its governance.

For these reasons, the size weighting function in the CDI tends toward zero at both the low and high ends, with a peak in between. More precisely, it is lognormal. This is the most natural functional form for this situation because it has strictly positive support (and project size is never negative), takes strictly positive values (so that size weights are never negative), and is inherently compatible with the tendency of aid activity sizes to range over many orders of magnitude, being a normal function of log project size.

As it happens, aid activities themselves tend to be lognormally distributed by size. Thus the mathematical framework is one where a weighted sum of an approximately lognormal distribution of aid activities is taken using weights from a separate lognormal function. Figure 1, on page 28, illustrates on a logarithmic scale. The heavy line shows the distribution of aid activities by size in a hypothetical country. The most common size is at the peak of this curve. Because of the lognormal scale, however, the *average size*, which is lifted by a few very large projects, is far to the right of the peak. The dashed line shows one possible weighting curve for rewarding or penalizing projects of various sizes. The weighting curve drawn here peaks at an "optimal" size somewhat above the average project size, implying the belief that the average aid dollar is going into aid activities that are too small. The weighting curve is also relatively wide, which can be taken to indicate uncertainty about what the true optimal size is, and how much deviation from this optimum matters.

Applying such a weighting function to the distribution of projects that donors fund forces choices about the height, location, and width of this size weighting curve for each recipient. In a near-vacuum of empirical evidence about the costs of proliferation, three principles hinted at above shape the choices. First, the *actual* distribution of aid activities by size is taken as a starting point. Even though this is probably far from optimal in most countries, the choice serves o minimize arbitrariness and puts some faith in donors' judgments about where large or small projects are most appropriate. Second is a bias toward larger projects. There is more consensus that the proliferation of small projects in countries such as Tanzania and Mozambique is inefficient than that $100,000,000 million loans from Japan and the Asian Development Bank to China are too big, even though one might legitimately question the appropriateness of such *carte blanche* disbursements to a relatively unaccountable, corrupt government. Thus the parameters chosen here lead to formulas that tend to penalize projects on the small side of the observed distributions more than those on the large side. Third is a bias toward agnosticism given the poor understanding of these issues, toward preventing the differences among bilaterals' overall proliferation scores from being too great, manifest as a relatively wide weighting curve.

The choices can be stated precisely, as follows. The data source is the CRS database, for which the unit of observation is the "aid activity," which the CRS reporting guidelines describe as follows:

> An aid activity can take many forms. It could be a project or a programme, a cash transfer or delivery of goods, a training course or a research project, a debt relief operation or a contribution to an NGO. (DAC 2002)

All aid activities in the CRS database are included, except for those coded as being donor administrative costs or debt forgiveness.

Since there are three degrees of freedom in the lognormal family of curves, which can be thought of as height, width, and mode (highest-weighted project size), three constraints must be imposed. The first constraint is that the weighting function must reach a peak value of 1.0, so that only projects of "optimal" size go undiscounted. That fixes the height. To describe how the optimal size is defined, let μ_1 and σ_1 be the mean and standard deviation of a recipient's log aid activity size. These are the standard parameters of the lognormal distribution. Let *KK* be the country's Kaufmann-Kraay governance score (on which 0 is average). Then the mode of the weighting function is decreed to occur at size $2^{KK} e^{\mu_1+\sigma_1^2}$. For comparison, if the aid activities are perfectly lognormally distributed, *their* modal size is $e^{\mu_1-\sigma_1^2}$, their median at e^{μ_1}, and their average size at $e^{\mu_1+\sigma_1^2/2}$ (Aitchison and Brown 1963, p. 8). Thus for a country of average governance (*KK* = 0), the "optimal aid activity size" is $e^{\mu+\sigma_1^2}$, which is a step above the average—just as far above the average as the average is above the median, in order-of-magnitude terms. Meanwhile, as a hypothetical country's KK score climbs from 0 to about standard deviation above the mean, to 1.0, the "optimal" project size exactly doubles.[13] Finally, the width of the weighting curve, as measured by its standard deviation in log space, is set to twice that of the distribution of projects, that is, to $2\sigma_1$. A relatively broad weighting curve is meant to reflect uncertainty about the true optimal size. All of these choices are meant to be minimally arbitrary.

To simplify the calculations somewhat, the weighting is not done project by project. Rather, the mean and standard deviation of log aid activity size of donor's projects in each recipient country are computed. The donor's projects are then treated as if they are perfectly lognormally distributed, corresponding to the heavy line in Figure 1, thus fully characterized by these two numbers. *Size-weighted aid* is then calculated using a general formula for the integral of the product of two lognormal curves. (See Appendix for details.)

As elsewhere, there are practical complications. Bilateral donors that do not report full CRS commitments data, including Belgium, Spain, and Ireland, are assigned, recipient by recipient, the average weight for donors that do. Multilaterals that do not provide CRS data are assigned an average size weight of 1.0 for all recipients. Figure 2 shows that most of the multilaterals that do report get size weights near 1. Given this pattern, a figure near 1 is clearly appropriate for the only major multilateral not reporting, the IMF, which disburses in large blocks. Both emergency and non-emergency aid are subject to the discount. For consistency, debt service is discounted too, but by the average size weight for the full distribution of a recipient's projects from all donors. This implicitly assumes that the opportunity cost of debt service is a set of aid activities of a size that is not necessarily typical for the donor in that country, but is typical of all donors. Note that this choice can heavi-

[13] Scores on each of the 6 Kaufmann-Kraay components are standardized to have mean 0 and standard deviation 1. The composite has mean zero and standard deviation 0.93 (in 2002).

ly penalize a donor that disburses aid to a country through small projects and then receives comparable amounts of money in debt service. If the debt service is discounted much less than the disbursements for size, a donor's size-adjusted aid can turn negative.

The approach does penalize very large projects in theory, especially in poorly governed countries, but because the parameter choices create a bias toward large projects and a degree of agnosticism, few large projects are actually discounted much. As a result, there is a strong positive correlation between a donor's average project size across all recipients and its average size weight in the CDI. (See Figure 2.) In sum, the approach has a thought-through and somewhat sophisticated theoretical foundation, but in practice, because of the conservative parameter choices, the upshot is essentially a straightforward discount based on each donor's average log project size.

As before, the actual calculations take place at the donor-recipient level. At that level, two size weights figure: one for the donor's own portfolio of projects in the recipient country, the other for all donors' projects in each recipient country, which is used for discounting debt service.

Since this is the last adjustment for quality, the final column of Table 7 is labeled "net quality-adjusted aid." This is a dollar value that embodies both quantity and quality factors. Since this actually calculated at the donor-recipient level, the next step to describe is aggregating up to the donor level.

Figure 1. Illustration of aid activity size weighting

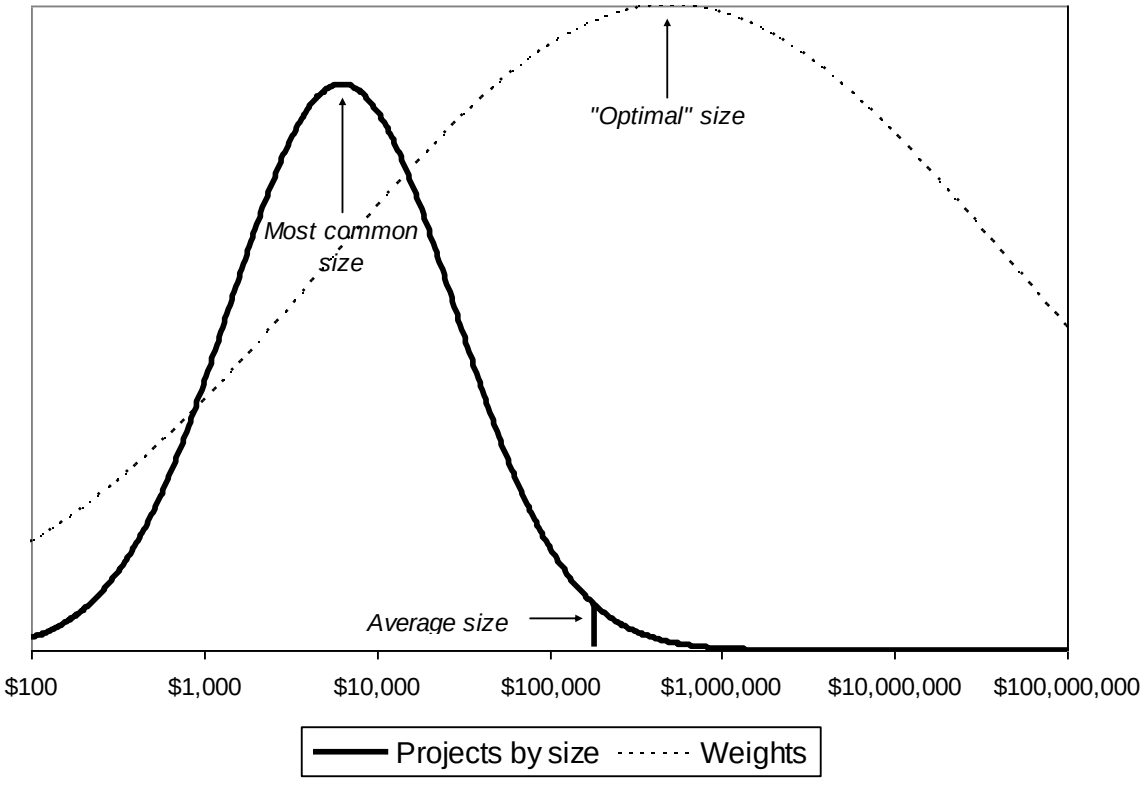


Figure 2. Average size weight in CDI versus average log aid activity commitment, 2003

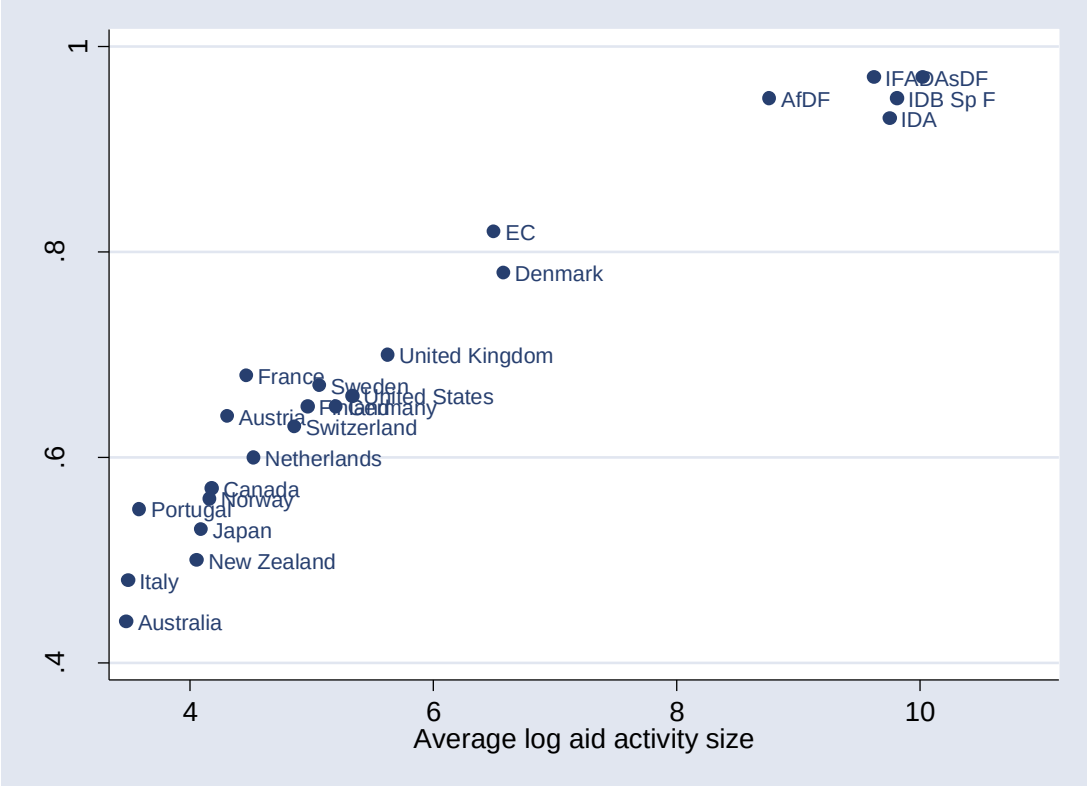


Table 7. Discounting for proliferation

Donor	A. Tying- and selectivity-discounted gross aid[1]	B. Selectivity-discounted reflows[1]	C. Size weight	D. Recipient average size weight	E. Gross quality-adjusted aid (A × C)	F. Quality-adjusted repayments (B × D)	Net quality-adjusted aid (E – F)
Australia	1,883	0	0.77	0.77	1,445	0	1,445
Austria	244	2	0.80	0.77	196	1	194
Belgium	960	22	0.80	0.74	763	16	747
Bill & Melinda Gates Foundation	781	0	0.74	0.74	578	0	578
Canada	2,599	26	0.80	0.75	2,077	20	2,057
Cyprus	12	0	0.81	0.81	10	0	10
Czech Republic	30	0	0.74	0.74	22	0	22
Denmark	1,406	15	0.78	0.77	1,091	11	1,080
Estonia	1	0	0.73	0.73	1	0	1
Finland	537	0	0.77	0.76	414	0	414
France	3,906	819	0.76	0.76	2,957	626	2,331
Germany	4,931	899	0.74	0.75	3,625	673	2,952
Greece	99	0	0.76	0.76	76	0	76
Hungary	9	0	0.76	0.76	7	0	7
Iceland	10	0	0.76	0.76	8	0	8
Ireland	414	0	0.76	0.76	314	0	314
Israel	50	0	0.72	0.72	36	0	36
Italy	351	82	0.76	0.75	265	62	203
Japan	8,127	5,275	0.70	0.75	5,678	3,939	1,739
Kuwait	241	263	0.76	0.76	183	200	-17
Latvia							
Liechtenstein							
Lithuania	2	0	0.72	0.72	2	0	2
Luxembourg	177	0	0.76	0.77	134	0	134
Malta							
Netherlands	2,722	39	0.76	0.76	2,077	30	2,047
New Zealand	162	0	0.77	0.78	125	0	125
Norway	2,118	0	0.76	0.75	1,609	0	1,609
Poland	32	2	0.71	0.71	23	2	21
Portugal	269	33	0.72	0.76	195	25	170
Romania	13	0	0.65	0.65	9	0	9
Russia							
Saudi Arabia							
Slovak Republic	8	0	0.75	0.75	6	0	6
Slovenia	8	0	0.81	0.81	6	0	6
South Korea	402	29	0.70	0.76	280	22	257
Spain	2,056	158	0.74	0.76	1,512	121	1,391
Sweden	1,943	0	0.81	0.74	1,576	0	1,576
Switzerland	1,018	9	0.80	0.77	817	7	810
Taiwan							
Thailand	12	17	0.82	0.82	10	14	-4
Turkey	314	0	0.76	0.76	238	0	238
United Arab Emirates	214	63	0.68	0.78	146	49	97
United Kingdom	5,391	188	0.77	0.74	4,163	139	4,024
United States	15,686	457	0.77	0.73	12,095	336	11,759
AfDF	1,450		0.49	0.71	713		
Arab Fund (AFESD)	493	263	0.75	0.75	369	196	172
AsDF	930		0.76	0.78	703		
BADEA	82		0.77	0.77	63		
CarDB	41	11	0.73	0.73	30	8	22
EC	6,871	198	0.74	0.75	5,087	149	4,938
GAVI	376	0	0.75	0.75	283	0	283

GEF	266	0	0.91	0.75	242	0	242
GFATM	1,677	0	0.71	0.74	1,184	0	1,184
IAEA	43	0	0.76	0.76	33	0	33
IDA	5,862		0.78	0.76	4,568		
IDB Sp.Fund	367		0.79	0.76	291		
IFAD	253	98	0.86	0.76	218	75	143
Islamic Development Bank	207	56	0.76	0.76	157	43	115
Montreal Protocol	10	0	0.72	0.72	7	0	7
Nordic Dev.Fund	39		0.94	0.78	37		
OPEC Fund for International Development	176	82	0.81	0.77	142	63	79
SAF+ESAF(IMF)	806		0.38	0.71	309		
UNAIDS	129	0	0.68	0.75	88	0	88
UNDP	413	0	0.74	0.75	306	0	306
UNECE							
UNFPA	409	0	0.70	0.76	288	0	288
UNHCR			0.77	0.77			
UNICEF	544	0	0.78	0.74	422	0	422
UNPBF	40	0	0.75	0.75	30	0	30
UNRWA	255	0	0.77	0.77	197	0	197
WFP	189	0		0.78		0	
WHO							
Japan-Sierra Leone	10	0	0.79	0.73	8	0	8

[1] From previous tables.

6. Aggregation to the donor level

In principle, this aggregation is matter of simple sums over recipients. But as always data problems intrude and complicate. Not all aid in the DAC database is fully disaggregated by recipient country, partly because administrative costs at headquarters are hard to allocate, partly because aid can support projects or programs intended to benefit an entire region or continent. The United States, for example, gave $2.435 billion in gross transfers in 2003 to "Least developed countries unspecified," $130 million to "Americas Unspecified," and a separate $37 million to "North and Central America Unallocated." In addition, it is impossible to assign selectivity weights to some recipients for lack of data for GDP/capita or the KK composite. These aid flows cannot be discounted for selectivity without further assumptions. Similarly, some recipients, including recipient groups like those just mentioned, have no commitments listed in the CRS database for some donors, so that no size weight can be directly computed.

Leaving out aid that cannot be directly discounted for selectivity or size would understate donors' contributions. So such aid is incorporated as follows. For each sub-continental region, as defined in the DAC database, such aid is discounted by the donor's average selectivity and size weights for aid that *can* be directly discounted. Once this discounting is done, all selectivity-discounted aid to each region is summed. This procedure

repeats at the level of the continent, then the Part, then the aid recipient universe.[14] This is how donor-level figures in previous tables are calculated.

7. Allocating multilateral quality-adjusted aid to bilaterals

Since the motivation for this exercise is to compare national governments, it is important to give bilaterals credit for their contributions to multilateral institutions. This final step in computing the index of official aid performance does this. But it operates in a way that is the mirror image of the standard DAC approach for imputing aid through multilaterals. In the DAC approach, each bilateral's contribution to each multilateral is imputed forward to recipient countries based on the multilateral's allocation across recipients in the same year. So if Japan gives $50 million to the Asian Development Fund in some year, and 10% of the AsDF's Net ODA goes to Indonesia that year, then 10% × $50 million = $5 million is imputed as Japan-Indonesia aid. In the CDI, the process runs the other way, because it is necessary to transmit back the information about the multilaterals' aid quality that is contained in their quality-adjusted aid totals. So in the aid index, bilaterals receive credit for the aid programs of multilaterals in proportion to the bilaterals' contributions to those multilaterals during the same year.

The calculations properly handle the fact that multilaterals occasionally give aid to other multilaterals, so that the flow of money from a bilateral donor to its ultimate multilateral recipient can take more than one step. For example, since the United Kingdom accounted for 8.23% of net contributions to the UNDP during 2005 (6.56% of that disbursed directly and 1.67% through the EC), it receives credit for 8.23% of the UNDP's quality-adjusted aid of $153 million, or $12.6 million.[15]

Table 8 shows the results of all this aggregation and imputation. The penultimate column is the final measure of official aid performance: quality-adjusted aid as a share of donor Gross National Income. GNI figures are converted to dollars using market exchange rates, and are from the DAC.

Despite the quality adjustments, what most distinguishes donors from each other in this index is still the sheer quantity of aid they disburse, especially when measured as true net transfers. Denmark, the Netherlands, Norway, and Sweden are large donors by DAC's Net ODA measure, and they score highest on this one too, with at least 0.39% of GNI. Two large donors by DAC's standard Net ODA measure, the United States and Japan, score among the lowest on this index of relative effort, at 0.09% and 0.05% respectively. One reason for Japan's low score is that its true net transfers are much lower than its Net ODA. The newest entrant to DAC—South Korea—is a step behind Japan at 0.03%.

[14] The DAC database divides Part II counties not into continents but into two major groups—former eastern bloc nations, and relatively rich non-DAC members. For the present calculations, these two groups are treated as "continents."

[15] A few small multilaterals, such as the Central American Bank for Economic Integration receive contributions in but do not themselves report to DAC on their own aid allocations (examples include). This made it impossible to compute their quality-adjusted aid and allocate it back to bilaterals. To prevent contributions to these unscored multilaterals from being dropped, a simple extrapolation was performed based on each bilateral's ratio of quality-adjusted allocated back from scored multilaterals to contributions the donor made to those multilaterals.

The final column of Table 8 offers a measure of aid quality: the ratio of quality-adjusted aid to net aid transfers. U.S. aid quality is low despite large projects because it channels the lion's share of its aid through its bilateral program, which features high tying and low selectivity for poverty and good governance. One subtle but important reason that Japan's aid quality measures low is the way its aid quantities move around. The *opportunity cost* of the substantial debt service it receives is assumed to be equivalent to the value of high-quality aid since if the recipient were not paying the debt service, it would be free to use the aid without donor constraints such as tying and small project size. Penalties for tying and project proliferation are computed as a fraction of gross aid and so loom large relative to Japan's much-smaller net aid. The leader on quality is Ireland.

Although the final scores are expressed as percentages of GNI, they should not be compared to other variables so expressed, such as Net ODA/GNI, only to each other. The selectivity adjustment, for example, could have super-weighted aid to the most appropriate recipients rather than discounting it to less appropriate ones. This equally meaningful choice would make little difference for the relative results, but would raise scores across the board.

I back-calculate this index of official aid performance to explore time-series as well as cross-sectional variation in scores. What sets the starting point of the time frame is the availability of the Kaufmann-Kraay governance variable—for even years in 1996–2004. For odd years, I use the previous year's score, except that 1995 calculations also use the 1996 KK scores. This allows calculation of the index for 1995–2010. Total quality-adjusted aid/GNI of bilaterals hardly changed over this period. The simple average was 0.196% in 1995 and 0.187% in 2010; and the correlation of 1995 and 2010 scores is 0.84.[16] (See Figure 3.) Aid quality (quality-adjusted aid/net aid transfers) is more volatile, but also shows little long term trend.

[16] These figures exclude Greece, which did not report to DAC for 1995, and may have given essentially no aid.

Table 8. Allocating multilateral quality-adjusted aid to bilaterals

Donor	Gross aid	Net aid			Quality-adjusted aid			GNI	**Adjusted aid/GNI**	Adjusted/ Net aid (Aid Quality)
		Bilateral	Multilateral	Total	Bilateral	Multilateral	Total			
(million $)		----- (million $) -----			----- (million $) -----			(million $)	----- (%) -----	
Australia	3,826	3,241	585	3,826	1,445	309	1,754	1,185,552	**0.15**	46
Austria	1,062	467	592	1,059	194	224	419	374,795	**0.11**	40
Belgium	2,485	1,507	941	2,448	747	364	1,111	469,576	**0.24**	45
Canada	5,224	3,896	1,286	5,182	2,057	578	2,636	1,549,596	**0.17**	51
Czech Republic	225	79	146	225	22	55	77	179,722	**0.04**	34
Denmark	2,896	2,118	755	2,873	1,080	310	1,390	315,792	**0.44**	48
Finland	1,328	839	489	1,328	414	204	618	242,168	**0.26**	47
France	12,511	5,883	5,065	10,948	2,331	1,905	4,236	2,606,749	**0.16**	39
Germany	14,112	7,565	4,892	12,457	2,952	1,844	4,797	3,357,987	**0.14**	39
Greece	502	212	290	502	76	109	184	296,494	**0.06**	37
Hungary	113	28	85	113	7	32	38	123,849	**0.03**	34
Ireland	891	585	306	891	314	121	435	171,260	**0.25**	49
Italy	2,901	530	2,207	2,737	203	838	1,041	2,023,915	**0.05**	38
Japan	18,681	5,027	3,733	8,760	1,739	1,608	3,347	5,602,749	**0.06**	38
Luxembourg	402	262	140	402	134	59	193	38,478	**0.50**	48
Netherlands	5,985	4,229	1,694	5,923	2,047	705	2,752	780,172	**0.35**	46
New Zealand	342	271	71	342	125	35	161	134,029	**0.12**	47
Norway	4,577	3,561	1,016	4,577	1,609	478	2,087	415,948	**0.50**	46
Poland	378	96	276	372	21	103	124	452,365	**0.03**	33
Portugal	677	383	249	632	170	93	263	220,964	**0.12**	42
Slovak Republic	73	20	53	73	6	20	25	86,279	**0.03**	35
South Korea	1,205	870	274	1,144	257	119	376	1,014,584	**0.04**	33
Spain	5,924	3,677	1,929	5,606	1,391	742	2,133	1,388,744	**0.15**	38
Sweden	4,530	2,923	1,607	4,530	1,576	687	2,263	467,598	**0.48**	50
Switzerland	2,287	1,682	589	2,271	810	260	1,070	568,751	**0.19**	47
United Kingdom	13,366	8,060	5,002	13,062	4,024	1,920	5,944	2,279,589	**0.26**	46
United States	31,010	26,358	3,776	30,134	11,759	1,937	13,696	14,635,600	**0.09**	45

Figure 3. Quality-adjusted aid/GNI by bilateral donor, 1995–2010

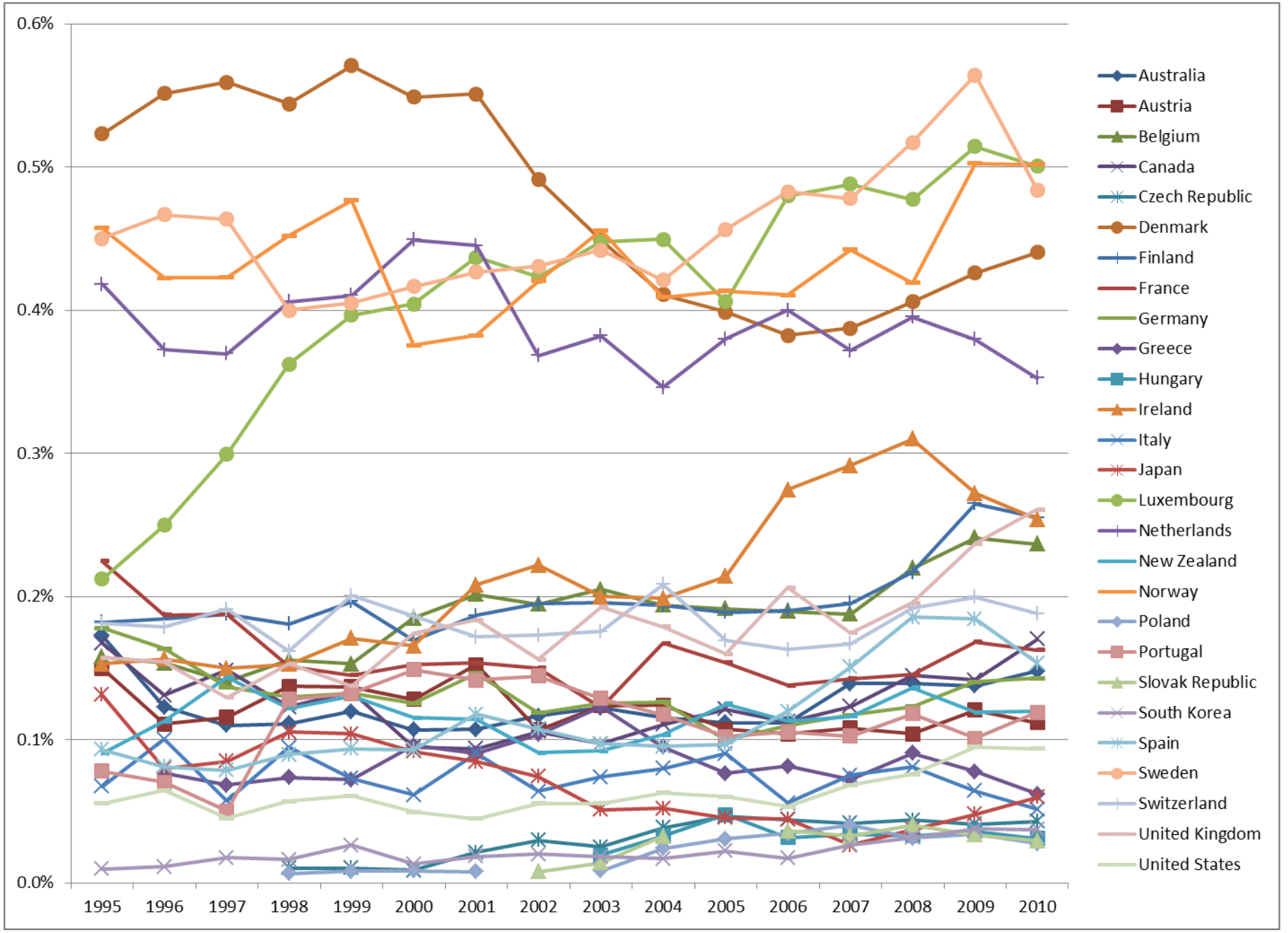
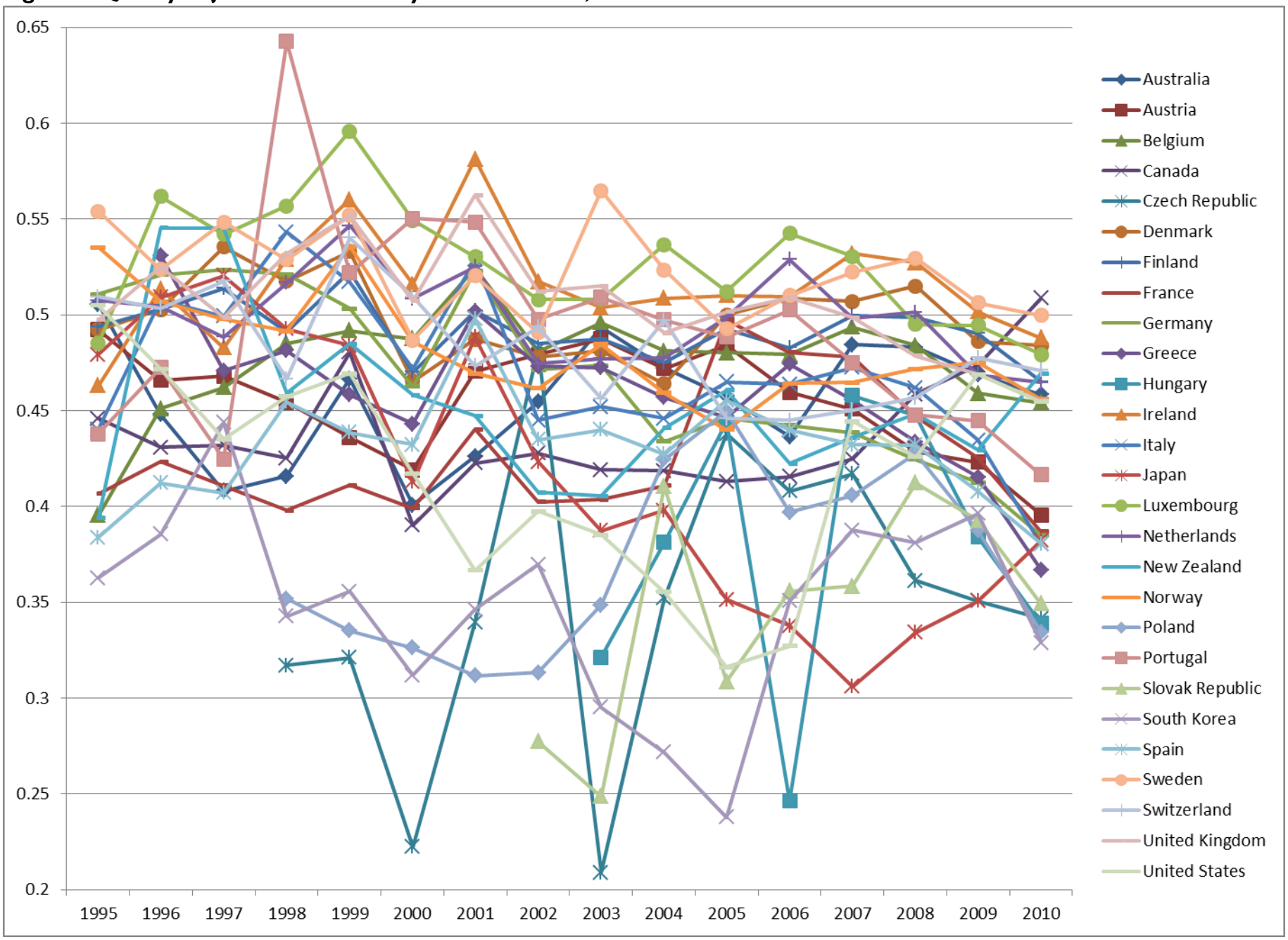


Figure 4. Quality-adjusted aid/net aid by bilateral donor, 1995–2010



8. Rewarding tax policies that support private giving

The focus so far as been on foreign aid in the sense of public expenditure. However, private citizens also give aid to developing countries, usually via non-governmental organizations. Private giving is of course not public policy per se, but it is influenced by public policy—fiscal policy in particular. The aid index therefore incorporates estimates of the charitable giving caused by public policy. The approach taken here is to estimate the proportional increase in giving caused by each country's tax policies, compare that to actual giving, then work backwards to estimate how much giving would have occurred in the absence of the policies and how much is a credit to their presence. Two aspects of fiscal policy are considered. First are targeted income tax incentives that lower the "price" of giving. Second is the total tax revenue/GDP ratio: lower taxes leave citizens and corporations with more after-tax income to give to charity.

The approach here will seem simplistic to some and too sophisticated to others. To make the calculations practical, we make several simplifying assumptions. Each country's tax policies are complex and idiosyncratic. No two households are in exactly the same financial position, and so the tax codes present different incentives to different households. And of course different people respond to the same incentives differently. On the other hand, the sophistication of the calculations, such as it is, should not be read to imply that we see our estimates as beyond improvement.

According to a survey reported in Roodman and Standley (2006), all but three index countries—Austria, Finland, and Sweden—offer income tax incentives for charitable giving. Australia, Belgium, Denmark, Germany, Greece, Ireland, Japan, Netherlands, Norway, Switzerland, the United Kingdom, and the United States allow partial or full deduction of charitable donations from taxable income. Canada, France, Italy, New Zealand, Portugal, and Spain offer partial credits—through the tax code, they reimburse a percentage of donations. These incentives lower the price of giving in the sense that a dollar of forgone after-tax income buys more than a dollar of charity. Charitable donations can fund the operations of non-profit groups working in developing countries, such as Oxfam and CARE, or they can go to foundations that fund such projects.

We translate the presence of a tax incentive into an estimate of the increase in charitable giving in three steps. First, we express the tax measure as a price effect. For credits, this step is straightforward. Canada's 45% tax credit, for example, reduces the price of giving by 45%. For deductions, we used a crude but available proxy for the marginal income tax rate faced by the households with above-average incomes that appear to generate most charity. This proxy is the marginal income tax rate for people at 167% of the income level of the average production worker, from the OECD Tax Database. For example, the rate was 31.7% for the United States in 2008, so deductibility of charitable giving in the United States is treated as reducing the price by 31.7% in that year. The second step is to factor in whether the deduction or credit is capped. In countries where high-income,

high-giving people account for most charity in the aggregate, caps can severely limit the incentive effect in practice. Precisely how much, however, is hard to know, especially because there is little information about the distribution of giving by income group outside the United States. Given the uncertainty, we factor caps in coarsely, by taking the simple average of the below- and above-threshold price incentives. For most countries with caps, the above-threshold price incentive is 0—there is no tax incentive to exceed the cap—so the price effect is halved. (See Table 9.)

Finally, having estimated the price effect, we couple it with an estimate of the price elasticity of giving. Research puts it at around 0.5 in the United States (Andreoni 2001). Thus, if a representative individual in the United States faced a price effect of 31.7% in 2008, full deductibility of charitable contributions multiplied giving by a factor of

$$(1 - 0.317)^{-0.5} = 1.210, \text{ for a } 21.0\% \text{ increase.}$$

The procedure is similar for the effect of lower total taxes. When the overall tax ratio is lower, individuals have more money to give to charity. Thus, while high *marginal* tax rates *increase* the incentive to give when we look at the price effects of tax deductions, higher *average* taxes *decrease* the incentive to give when we look at income effects. Among the 27 scored countries, the tax revenue/GDP ratio in 2001, the last year with data available for the first edition of the CDI, ranged from 27.4% in Japan to 51.9% in Sweden (OECD 2004). To reward countries for lower tax ratios, we need a baseline against which to define lowness. We choose Sweden's 2001 tax ratio, the highest. We combine this with an estimate of the income of elasticity of giving of 1.1 (Andreoni 2001). The United States in 2008, to continue the example, is treated as having reduced its total tax burden in 2008, the last year with data available for the current aid index, from Sweden's 2001 ratio of 51.9% to the actual 26.9%. (Sweden's 2001 ratio is used every year for a consistent benchmark.) This hypothetically raised the privately claimed share of GDP from 100% – 51.9% = 48.1% to 100% – 26.9% = 73.1%, an increase of 73.1% / 48.1% – 100% = 52.1%.[17] As a result, the lower U.S. tax burden is estimated to have multiplied charity by

$$\left(\frac{1-0.269}{1-0.519}\right)^{1.1} = 1.586, \text{ for a } 58.6\% \text{ increase.}$$

The two multipliers are then combined, and divided into observed giving in order to estimate giving in the absence of these favorable policies. Observed giving is "grants by NGOs" from DAC Table 1; it counts contributions by foundations and individuals, which do ordinarily go through NGOs, but excludes official aid that is channeled through NGOs. Just as with official aid, grants by NGOs to Part 2 countries are also counted. The

[17] Some share of the revenue funds transfer payments, which increase recipients' disposable income and should therefore increase charitable giving. However, the transfer payments going to the high-income people that appear to account for most charity are probably relatively small.

result is a set of estimates for the dollar increase in private giving to developing countries caused by fiscal policy. In the 2008 U.S. case, the multipliers combine to 1.210 × 1.586 = 1.919. Observed giving of $17.122 billion in 2008 happens to be 1.919 times $8.922 billion, so U.S. policy is credited for the difference, $8.200 billion. (The 2009 figure, used in the 2011 CDI, is $8.156 billion.)

To incorporate the results on charitable giving attributed to policy into the main quality-adjusted aid measure, it is necessary to adjust the charitable giving results for quality in parallel fashion. As noted above, quality-adjusted aid cannot be directly compared or added to simple aid totals. Moreover, private giving too can go to countries that are more or less appropriate for aid, and can contribute to the problems of project proliferation. As a rough adjustment in the absence of information on the quality of private aid, the CDI discounts policy-induced private giving by the simple average of the quality discounts for the bilaterals' own aid programs, relative to net aid transfers, which is 64% for 2009.

Table 10 incorporates private giving into the previous results on official aid. The last column of this table reports the final results of this evaluation of aid policy, counting both quality-adjusted official aid and charitable giving attributable to fiscal policy. The latter turns out to have small effects on the scores. In the case of the United States, a country often pointed to as a stingy public donor and a generous source of private charity, the result is $2.945 billion in quality-adjusted charitable giving attributed to fiscal policy in 2009. Added to the country's $12.604 billion in official quality-adjusted aid, this raises the final U.S. score on the aid index from 0.09% to 0.11% of GNI, putting the country ahead of Greece, Italy, Japan, and South Korea.

Table 9. Computation of price incentive of tax policy

Country	A. Tax deduction?	B. Marginal income tax rate (%)[1]	C. Tax credit	D. Deduction or credit capped?	E. Tax incentive	F. Increase in giving with incentive (%)	G. Tax revenue/ GDP	H. Giving increase because of smaller government	I. Combined increase (%)	J. Grants by NGOs (million $)[2]	K. Giving in absence of favorable tax policies	Giving attributed to tax policies
Formula:						(1–E)^price elasticity–1[3]		((1–G)/(1–51.9%))^ income elasticity–1[4]	(1+F)× (1+H)–1		J/(1+I)	J–K
Australia	Yes	39.5%	0.0%	No	39.5%	28.6%	25.9%	60.8%	106.7%	928	449	479
Austria	Yes	37.0%	0.0%	No	37.0%	26.0%	42.0%	22.9%	54.9%	167	108	59
Belgium	Yes	46.7%	0.0%	No	46.7%	36.9%	43.8%	18.7%	62.6%	377	232	145
Canada	No	33.0%	29.0%	No	29.0%	18.7%	31.0%	48.8%	76.6%	1,953	1,106	847
Czech Republic	Yes	20.1%	0.0%	No	20.1%	11.9%	34.9%	39.5%	56.1%	0	0	0
Denmark	Yes	48.1%	0.0%	Yes	24.0%	14.7%	48.2%	8.5%	24.5%	178	143	35
Finland	No	40.2%	0.0%	No	0.0%	0.0%	42.1%	22.5%	22.5%	14	11	3
France	No	30.1%	66.0%	No	66.0%	71.5%	42.9%	20.9%	107.3%	0	0	0
Germany	Yes	44.3%	0.0%	No	44.3%	34.0%	36.3%	36.2%	82.5%	1,464	802	662
Greece	Yes	21.8%	0.0%	No	21.8%	13.1%	30.9%	48.9%	68.4%	10	6	4
Hungary	No	40.6%	30.0%	Yes	15.0%	8.5%	37.6%	33.1%	44.4%	0	0	0
Ireland	Yes	43.0%	0.0%	No	43.0%	32.5%	28.0%	55.9%	106.5%	300	145	155
Italy	No	38.7%	19.0%	Yes	9.5%	5.1%	43.0%	20.6%	26.7%	150	119	32
Japan	Yes	25.4%	0.0%	No	25.4%	15.8%	26.9%	58.4%	83.4%	556	303	253
Luxembourg	Yes	34.7%	0.0%	No	34.7%	23.7%	36.7%	35.3%	67.5%	9	5	4
Netherlands	Yes	50.1%	0.0%	No	50.1%	41.6%	38.2%	31.6%	86.4%	657	352	304
New Zealand	No	35.5%	33.3%	No	33.3%	22.4%	31.3%	48.0%	81.2%	49	27	22
Norway	Yes	40.0%	0.0%	Yes	20.0%	11.8%	42.8%	21.0%	35.2%	0	0	0
Poland	Yes	8.8%	0.0%	No	8.8%	4.7%	31.8%	46.9%	53.8%	0	0	0
Portugal	No	34.9%	25.0%	No	25.0%	15.5%	31.3%	48.1%	71.0%	5	3	2
Slovakia	No	16.7%	0.0%	No	0.0%	0.0%	28.4%	55.0%	55.0%	0	0	0
South Korea	Yes	15.1%	0.0%	No	15.1%	8.5%	25.1%	62.8%	76.8%	49	28	21
Spain	No	37.0%	25.0%	No	25.0%	15.5%	31.7%	47.1%	69.8%	0	0	0
Sweden	No	56.5%	0.0%	No	0.0%	0.0%	45.8%	14.1%	14.1%	221	194	27
Switzerland	Yes	25.9%	0.0%	No	25.9%	16.2%	29.8%	51.5%	76.0%	414	235	179
United Kingdom	Yes	40.0%	0.0%	No	40.0%	29.1%	35.0%	39.2%	79.7%	352	196	156
United States	Yes	31.7%	0.0%	No	31.7%	21.0%	24.8%	63.4%	97.7%	22,786	11,524	11,262
EU	0	0.0%	0.0%	0	35.0%	0.0%	37.8%	0.0%	0.0%	0	2,316	1,587
Europe	0	0.0%	0.0%	0	34.5%	0.0%	37.7%	0.0%	0.0%	0	2,551	1,766

[1]Marginal income tax rate for single individual at 167% of income level of the average production worker. [2]Data for latest available year. [3]Price elasticity of giving taken to be –0.5. [4]Income elasticity of giving taken to be 1.1. 51.9% is the highest revenue/GDP observed, in Sweden, in the reference year of 2001.

Table 10. Incorporating private giving attributable to public policy

Donor	A. Quality-adjusted official aid[1]	B. Charitable giving credited to policy[1]	C. Quality-adjusted charitable giving credited to policy (B × (1–58%))	**Adjusted (aid+charitable giving)/GNI** ((A + C)/GNI, %)
Australia	1,754	479	201	**0.16**
Austria	419	59	25	**0.12**
Belgium	1,111	145	61	**0.25**
Canada	2,636	847	355	**0.19**
Czech Republic	77	0	0	**0.04**
Denmark	1,390	35	15	**0.44**
Finland	618	3	1	**0.26**
France	4,236	0	0	**0.16**
Germany	4,797	662	277	**0.15**
Greece	184	4	2	**0.06**
Hungary	38	0	0	**0.03**
Ireland	435	155	65	**0.29**
Italy	1,041	32	13	**0.05**
Japan	3,347	253	106	**0.06**
Luxembourg	193	4	1	**0.50**
Netherlands	2,752	304	127	**0.37**
New Zealand	161	22	9	**0.13**
Norway	2,087	0	0	**0.50**
Poland	124	0	0	**0.03**
Portugal	263	2	1	**0.12**
Slovak Republic	25	0	0	**0.03**
South Korea	376	21	9	**0.04**
Spain	2,133	0	0	**0.15**
Sweden	2,263	27	11	**0.49**
Switzerland	1,070	179	75	**0.20**
United Kingdom	5,944	156	65	**0.26**
United States	13,696	11,262	4,718	**0.13**
EU	28,043	1,587	665	**0.18**
Europe	31,200	1,766	740	**0.19**

[1]From previous tables.

Appendix. Size weighting formula

This appendix derives the formula used to compute size-weighted aid for each donor-recipient pair. It first derives a general formula for the integral of the product of two lognormal curves. In the application in this paper, one curve represents the distribution of aid activities by size and the other the weights applied to them based on size. This appendix then shows how the parameters of the size weighting curve are mathematically determined.

Suppose we have two lognormal curves of the form:

$$h_1(x) = \frac{N_1}{\sqrt{2\pi}\sigma_1 x} e^{-\frac{1}{2}\left(\frac{\ln x - \mu_1}{\sigma_1}\right)^2}$$

$$h_2(x) = \frac{N_2}{\sqrt{2\pi}\sigma_2 x} e^{-\frac{1}{2}\left(\frac{\ln x - \mu_2}{\sigma_2}\right)^2}$$

If $u = \ln x$, then $x = e^u$, $du = dx/x$, and the total integral of the product of the two curves is

$$\int_0^\infty \frac{N_1}{\sqrt{2\pi}\sigma_1 x} e^{-\frac{1}{2}\left(\frac{\ln x - \mu_1}{\sigma_1}\right)^2} \frac{N_2}{\sqrt{2\pi}\sigma_2 x} e^{-\frac{1}{2}\left(\frac{\ln x - \mu_2}{\sigma_2}\right)^2} dx$$

$$= \frac{N_1 N_2}{2\pi\sigma_1\sigma_2} \int_{-\infty}^\infty \frac{1}{e^u} e^{-\frac{1}{2}\left(\frac{u-\mu_1}{\sigma_1}\right)^2 - \frac{1}{2}\left(\frac{u-\mu_2}{\sigma_2}\right)^2} du$$

$$= \frac{N_1 N_2}{2\pi\sigma_1\sigma_2} \int_{-\infty}^\infty \frac{1}{e^u} e^{-\frac{1}{2}\left(u^2\left(\frac{1}{\sigma_1^2}+\frac{1}{\sigma_2^2}\right) - 2u\left(\frac{\mu_1}{\sigma_1^2}+\frac{\mu_2}{\sigma_2^2}\right) + \frac{\mu_1^2}{\sigma_1^2}+\frac{\mu_2^2}{\sigma_2^2}\right)} du$$

$$= \frac{N_1 N_2}{2\pi\sigma_1\sigma_2} \int_{-\infty}^\infty e^{-\frac{1}{2}\left(u^2\left(\frac{1}{\sigma_1^2}+\frac{1}{\sigma_2^2}\right) - 2u\left(\frac{\mu_1}{\sigma_1^2}+\frac{\mu_2}{\sigma_2^2}-1\right) + \frac{\mu_1^2}{\sigma_1^2}+\frac{\mu_2^2}{\sigma_2^2}\right)} du.$$

This arranges the exponent as a quadratic expression in u. Completing the square in that expression gives

$$\frac{N_1 N_2}{2\pi\sigma_1\sigma_2} \int_{-\infty}^\infty e^{-\frac{1}{2}\left(\left(u\sqrt{\frac{1}{\sigma_1^2}+\frac{1}{\sigma_2^2}} - \frac{\frac{\mu_1}{\sigma_1^2}+\frac{\mu_2}{\sigma_2^2}-1}{\sqrt{\frac{1}{\sigma_1^2}+\frac{1}{\sigma_2^2}}}\right)^2 - \frac{\left(\frac{\mu_1}{\sigma_1^2}+\frac{\mu_2}{\sigma_2^2}-1\right)^2}{\frac{1}{\sigma_1^2}+\frac{1}{\sigma_2^2}} + \frac{\mu_1^2}{\sigma_1^2}+\frac{\mu_2^2}{\sigma_2^2}\right)} du$$

$$= \frac{N_1 N_2}{2\pi\sigma_1\sigma_2} e^{-\frac{1}{2}\left(-\frac{\left(\frac{\mu_1}{\sigma_1^2}+\frac{\mu_2}{\sigma_2^2}-1\right)^2}{\frac{1}{\sigma_1^2}+\frac{1}{\sigma_2^2}} + \frac{\mu_1^2}{\sigma_1^2}+\frac{\mu_2^2}{\sigma_2^2}\right)} \int_{-\infty}^\infty e^{-\frac{1}{2}\left(u\sqrt{\frac{1}{\sigma_1^2}+\frac{1}{\sigma_2^2}} - \frac{\frac{\mu_1}{\sigma_1^2}+\frac{\mu_2}{\sigma_2^2}-1}{\sqrt{\frac{1}{\sigma_1^2}+\frac{1}{\sigma_2^2}}}\right)^2} du.$$

The integral has been transformed into that of a normal curve, and evaluates to

$$\frac{\sqrt{2\pi}}{\sqrt{\frac{1}{\sigma_1^2}+\frac{1}{\sigma_2^2}}}.$$

The whole expression is therefore

$$\frac{N_1 N_2}{2\pi\sigma_1\sigma_2}\frac{\sqrt{2\pi}}{\sqrt{\frac{1}{\sigma_1^{\,2}}+\frac{1}{\sigma_2^{\,2}}}}e^{-\frac{1}{2}\left(-\frac{\left(\frac{\mu_1}{\sigma_1^{\,2}}+\frac{\mu_2}{\sigma_2^{\,2}}-1\right)^2}{\frac{1}{\sigma_1^{\,2}}+\frac{1}{\sigma_2^{\,2}}}+\frac{\mu_1^{\,2}}{\sigma_1^{\,2}}+\frac{\mu_2^{\,2}}{\sigma_2^{\,2}}\right)}$$

$$=\frac{N_1 N_2}{\sqrt{2\pi}\sqrt{\sigma_1^{\,2}+\sigma_2^{\,2}}}e^{-\frac{1}{2}\left(\frac{\mu_1^{\,2}}{\sigma_1^{\,2}}+\frac{\mu_2^{\,2}}{\sigma_2^{\,2}}-\frac{\left(\frac{\mu_1}{\sigma_1^{\,2}}+\frac{\mu_2}{\sigma_2^{\,2}}-1\right)^2}{\frac{1}{\sigma_1^{\,2}}+\frac{1}{\sigma_2^{\,2}}}\right)}.$$

Letting $\eta_1 = \mu_1/\sigma_1$, $\eta_2 = \mu_2/\sigma_2$, and $\hat{\sigma} = \sqrt{\sigma_1^{\,2}+\sigma_2^{\,2}}$, this can be rewritten as

$$\int_0^\infty h_1(x)h_2(x)dx = \frac{N_1 N_2}{\sqrt{2\pi}\hat{\sigma}}e^{-\frac{1}{2}\left(\eta_1^{\,2}+\eta_2^{\,2}-\frac{\sigma_1^{\,2}\sigma_2^{\,2}}{\hat{\sigma}^2}\left(\frac{\eta_1}{\sigma_1}+\frac{\eta_2}{\sigma_2}-1\right)^2\right)}. \qquad (1)$$

In the present case, h_1 is the distribution of aid activities by size, so N_1, the number of aid activities, is known, and μ_1 and σ_1 can be estimated from the data. To fix the three parameters of h_2, the size weighting function, we impose three constraints. First, we require that the peak value of the weighting function is 1. In general, the mode of h_2 is $e^{\mu_2-\sigma_2^{\,2}}$ (Aitchison and Brown 1963), at which it takes the value

$$h_2\left(e^{\mu_2-\sigma_2^{\,2}}\right)=\frac{N_2}{\sqrt{2\pi}\sigma_2 e^{\mu_2-\sigma_2^{\,2}}}e^{-\frac{1}{2\sigma_2^{\,2}}\left(\mu_2-\sigma^2-\mu_2\right)^2}=\frac{N_2}{\sqrt{2\pi}\sigma_2 e^{\mu_2-\frac{\sigma_2^{\,2}}{2}}}.$$

This is 1 when

$$N_2=\sqrt{2\pi}\sigma_2 e^{\mu_2-\frac{\sigma_2^{\,2}}{2}}.$$

As discussed in the main text, we next require that h_2 peaks at $2^{KK}e^{\mu_1+\sigma_1^{\,2}}$, where *KK* is the recipient's Kaufmann-Kraay governance score.[18] And we require that h_2 is twice as wide as h_1, that is, $\sigma_2 = 2\sigma_1$. Since the peak of h_2 occurs at $e^{\mu_2-\sigma_2^{\,2}}$, we have $2^{KK}e^{\mu_1+\sigma_1^{\,2}}=e^{\mu_2-\sigma_2^{\,2}}$. Ergo

$$\mu_2=\ln\left(2^{KK}e^{\mu_1+\sigma_1^{\,2}}\right)+\sigma_2^{\,2}=\mu_1+\sigma_1^{\,2}+KK\ln 2+4\sigma_1^{\,2}=\mu_1+5\sigma_1^{\,2}+KK\ln 2.$$

[18] Previous editions of this paper erroneously stated that h_2 peaks at $2^{KK}e^{\mu_1+\sigma_1^{\,2}/2}$. I thank Ken Togo and Yoshio Wada (2007) for pointing out this error.

Having expressed N_2, μ_2, and σ_2 as functions of N_1, μ_1, σ_1, and KK, we can then apply (1) to estimate total size-weighted aid for a given project distribution.

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