The Commitment to Development Index: A Scorecard of Rich-Country Policies

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Introduction

We present here a measure of the extent to which the policy stance of the world's richest countries reflects their stated goals of advancing the development of the world's poor countries. The analysis and results we describe constitute the technical input to the Commitment to Development Index (CDI) sponsored by the Center for Global Development with *Foreign Policy* magazine.[1]

The main purpose of the index is to stimulate interest and improved understanding among policy makers and the public of the many ways rich countries help or hinder development in poor countries. Such interest and understanding will, we hope, make it possible for the citizens of the world to hold rich countries more accountable for their own decisions as they affect people in poor countries. It could also mobilize peer pressure within the community of rich nations. Countries have agreed on a set of "Millennium Development Goals" for specific progress on poverty and education, health, and other indicators in developing countries by 2015. The eighth goal commits rich countries to work in partnership with developing countries to meet these goals, through debt cancellation, trade policy reforms, and so on, but contains no quantitative measures or targets.

In addition, we hope that our effort, crude and imperfect as it is, will stimulate new data collection, new research and a lively debate in the research community on the concept of "commitment to development." We will be delighted if our index catalyzes a new round of work in the scholarly and policy community leading to better data, improved methods, and more transparent measurement of the impact of rich countries' policies on poor countries.[2]

The Commitment to Development Index ranks 21 countries—all the members of the Development Assistance Committee of the Organization for Economic Cooperation and Develop-

[1]The CGD is grateful to the Rockefeller Foundation for its support of some of the technical work; to staff at the Brookings Institution and the Migration Policy Institute for their work on the security and migration components of the index; to Michael Clemens and Ramzi Nemo for help on implementing the security component; and, for their participation in review meetings and their comments, to Kevin Baumert, Jere Behrman, Kimberly Elliot, Ann Florini, Sakiko Fukuda-Parr, Stephen Goodin, Ricardo Hausmann, Lisa Jordan, Charles Keely, Lorelie Kelly, Stephen Knack, Philip Levy, Penelope Lewis, Eduardo Lora, Theodore Moran, David Mosher, Richard Newfarmer, Robert Picciotto, P.J. Simmons, and Shang-Jin Wei. The design choices embodied in the CDI do not necessarily represent the views of any of these contributors.

[2] Recently, interest has grown in ways to assess the overall contribution of rich countries to the development of poor ones. In 2002, Oxfam International launched its "Make Trade Fair" with a report entitled *Rigged Rules and Double Standards: Trade, Globalisation, and the Fight against Poverty* (Oxfam 2002). And in more diplomatic terms, the Organisation for Economic Co-operation and Development (OECD) has pursued a research program on "policy coherence" with regard to development (OECD 1999).

ment except Luxembourg—in six policy areas[3]: aid, trade, environment, investment, migration, and peacekeeping. The index departs dramatically from the usual approach to comparing donors, in which the volume of a country's foreign aid (as a proportion of its own GDP) is the primary metric. In fact, the sheer quantity of aid, independent of where it goes and in what form, is a poor predictor of its overall benefits for development. Moreover, foreign aid is only one aspect of the relationship between rich and poor countries. Some rich countries aid generously and selectively, yet impose such formidable barriers against poor-country exports that every dollar given in aid is effectively taken away through trade policy. Thus the CDI considers the quality of aid as well as quantity, and puts aid in a broader policy context.

This paper reviews the index component by component, with results for each one for 2003, and overall results at the end. Our work builds on background papers we commissioned on most of the six policy areas; we refer readers to these papers for more detailed information on the data used and on the technical approaches taken. In constructing the index, we sometimes departed from the background paper recommendations; we are explicit below in describing those departures. In section 1 we describe how we handled some overall design challenges, and make apologies for the many conceptual and other shortcomings of the resulting index. In section 2 we review the index components. In section 3 we present the overall scores and discuss some analyses of their sensitivity to underlying assumptions.

1. Design Challenges and Apologies

The CDI attempts to measure policies, in order to create incentives for reform. But policies are complex and difficult to observe and measure in numerical terms. We developed the richest measures of policies in those areas where sustained academic and government interest has led to development of large databases and clear conceptual frameworks—namely, aid and trade. For the other components, lack of data sometimes forced us to use simple outcomes, such as foreign direct investment flows, as the best proxy for the policies that affect those outcomes.[4]

In the discussion below, we try to be clear about the choices we have made about what to measure and why. For example, in the case of migration, paucity of data made it hard to distinguish rich countries by the extent to which they discriminate between skilled and unskilled labor—a data lacuna that could be filled with an effort led by the OECD. (See box.) We do not view the index as cast in stone, but as the first edition of a methodology that will improve over time in response to criticism, new research, and new data.

Policy effort vs. impact. Our focus in measuring policies is on decisions that policy makers (legislators, executives) can change. Our objective is to make the index responsive to change,

[3] To develop the index, CGD commissioned options papers for most of the envisioned components. We are grateful to the authors involved: William Cline, CGD (trade); William Easterly, CGD (aid); Kim Hamilton and Elizabeth Grieco, Migration Policy Institute (migration); Michael O'Hanlon, Brookings Institution (security); John Williamson and Josh Catlin, Institute for International Economics (investment). One of us, David Roodman, CGD, prepared papers on a new version of the aid component, and the environment component. These papers are available at www.cgdev.org. The design choices embodied in the CDI do not necessarily represent the views of any of these contributors.

[4] We and our collaborators developed the necessary data where we could. We outline below several initiatives for creation of databases that would ideally be taken up by various international agencies.

be it improvement or deterioration, in countries' aid, trade, or other policies with respect to development. That is important since we want to calculate and report new results annually, making the index a kind of report card that rewards policy reforms that benefit developing countries. This objective leads us to assess *policy effort* rather than the overall *impact* of policies. Trade barriers of the same level in Switzerland in the United States would represent the same level of effort, but would have vastly different impacts because the U.S. market is so much bigger. This choice shapes the whole index. For example, in assessing policy effort, we divide aid, imports, emissions and other flows by a given rich country's economic or population size. Were we measuring a rich country's impact, we would use the absolute flow of its aid, and would be interested in the impact of many factors that may be affected more by a rich countries' wealth or location than by its development-relevant policies.

Time frame. Are we interested in countries' contributions to development over the 1990s, say, or their policy stances now? We favored the latter, since our goal is to raise awareness about current policy and influence it, and since we want the index to be sensitive to year-to-year changes. In practice, however, the time period for the best *estimator* of current policy varied from component to component. We always used the latest data available. The oldest data used, on fishing subsidies, are for 1997. Most data are for 2000, 2001, or 2002. For highly volatile variables, such as financial contributions to U.N. peacekeeping, we took multi-year averages, on the grounds that the underlying policy stances vary much less than the annual changes suggest.

Standardization of scores. We faced the question of how to standardize variables measured in different units. The idea that rich countries are taking away with one hand (trade policy) what they give with another (aid) suggests that money could serve as a common unit for comparison. Then we could subtract the costs of trade barriers, say, from the benefits of aid. However, we could find no theoretically sound way to express such variables as immigrant flows and ratification of the Kyoto Protocol in dollar terms. Thus we were forced to standardize scores in unit-less values.

In general, we restricted ourselves to applying linear transformations for standardization, which allowed two free parameters: scaling and translation. Usually, we scaled only, so that if country A had emissions or trade barriers twice as high as country B, then its standardized score would also be twice B's. In fashioning components that themselves combine multiple indicators, we scaled each indicator so that its average would be +5 or –5, depending on whether the quantity was a "good" like aid or a "bad" like trade barriers. That is, we divided each score by the average and multiplied by ±5. The choice of 5 merely set the scale and has no effect on relative scores.

However, two components—trade and environment—are composites of "good" and "bad" indicators, which forced us to standardize differently. Environment, for example, contains measures of emissions and of funding for R&D on environmentally sustainable energy technologies. Taking weighted averages of two indicators with different means (in this case, +5 and –5) can generate perverse results.[5] So before making composites of indicators with different means,

[5] Consider this example from a draft version of the index. The trade component gives 75% weight to a direct measure of trade barriers, and 25% to a measure of imports from developing countries as a share of GDP. The United States has the best score on trade barriers, 9.7% tariff-equivalent, while Norway has the worst, 61.1%. After re-

we chose one of the indicators in each case as primary and linearly transformed the other to have the same mean and standard deviation as the primary one.

To make the overall results easier to graphs, and to create a single, composite index, we standardized the final scores for each component somewhat differently. They too are simply scaled, but scaled so that the best performer on a good indicator gets a +9 while the worst on a harmful one gets a –9. We chose 9 rather than 10 to signal that no country is perfect on the good indicators, and to allow room for improvement on those indicators within the 10-point scale. We then added 10 to the "bad" scores, so that all scores stay within the intuitive 10-point scale. We intend to use the scalings chosen this year in future editions, so that the scores are comparable over time. Next year the best performer on, say, migration could get an 8.9 or 9.1 rather than 9.0. We do not report these standardized scores in the component-by-component review, but they appear at the end, where the overall scores are computed.

The weighting problem. All of the components are themselves compiled by combining values on several variables. For example, the aid component takes into account both quantity and aspects of quality. In some cases, such as aid, we "discount" quantity by a factor reflecting quality (such as whether the aid is tied to use of donor services or products). In other cases, such as environment, we take weighted averages of "scores." Either way, we faced choices: on how heavily to "discount" or on what weights to give individual subcomponents. In all cases, we made judgments that can legitimately be challenged. But choices had to be made. By setting out all the information and scores on each subcomponent and announcing our weights, we make it possible for others to test the sensitivity of our results, within and across components, and to make their own judgments about our choices.

One of the most controversial aspects of the index is that the six components are weighted equally in the final score, which is a simple average of the six. Any choice of weights will beg questions. It will be based on untested priors about how rich-country policies affect developing countries in general, and on assumptions about the different impacts on different countries. And it will involve value judgments about the relative importance of various affected countries. We decided it was better to be simple and simplistic than complex and simplistic.

Section 3. The Six Components

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scaling the trade barrier variable to have a mean of –5, the United States gets a score of –2.1 on it and Norway a –13.4. Rightly, Norway's trade barriers appear 6.3 times worse. On the other variable, revealed openness, the United States has a score of 10.8% of GDP, while Norway has 8.8%; these values scale to 4.7 and 3.8 respectively once that variable is forced to have mean 5. Although Norway is lowest among countries on revealed openness too, the relative difference between best and worst is much less than on the trade barrier measure. Yet when the two standardized variables are averaged 75%/25%, the resulting overall scores are –9.1 for Norway and –0.4 for the United States, making Norway appear *20.9* times as bad on trade, instead of 6.3 times. Averaging in a variable with relatively little variation (revealed openness) has exploded the apparent difference between best and worst, rather than narrowing it. If the United States had achieved 15.05% of GDP on revealed openness instead of 10.8%, it would have appeared 27,000 better than Norway on the overall trade index when computed this way.

Aid

The aid component designed by Roodman (2003a) modifies the traditional quantity measure of aid programs (aid/donor GDP) to reflect several concerns, among them tying, high administrative costs, selectivity, and debt service.

The calculation runs as follows (see Table 1, Table 2, and Table 3):

- The starting point is gross disbursements of grants and concessional loans by donor (bilateral or multilateral) and recipient for 2001. Included here is what DAC terms Official Development Assistance (ODA) and Official Assistance (OA).[6]
- For bilaterals, administrative costs are subtracted. (Among multilaterals, only the European Commission reports administrative costs to DAC.) Administrative costs are legitimate in themselves, but large donor-to-donor variations in their share of gross ODA may indicate inefficiencies. At any rate, netting out administrative costs gives a truer picture of the amount of aid reaching recipients, which is a legitimate basis for comparison. DAC does not report administrative costs by donor *and* recipient, so the administrative share in gross ODA is assumed to be the same across all recipients of any given donor.
- For bilaterals, tied aid is discounted 20%, based on studies of the cost of tying.[7] "Partially untied" aid is discounted 10%. The DAC figures on tying apply to gross ODA *commitments*, excluding administrative costs, technical cooperation, and debt forgiveness grants. We apply the discount to gross d*isbursements*. Three countries—Austria, New Zealand, and the United States—did not report the amount of aid they tied in 2001. For these, we used the tied aid shares for the last year they reported. Like administrative costs, these figures are not disaggregated by recipient, so we assume the percentage is the same across recipients of a given donor. Multilateral aid is assumed untied except that technical cooperation grants by both bilaterals and multilaterals are treated as 100% tied.
- Principal *and* interest payments are netted out, to more closely reflect net transfers to recipients. (DAC's standard "net ODA" is net of principal payments only.) The change reduces Japan's aid number most, because Japan still lends heavily to developing countries and generally not forgiven as much of the debt owed it by them as the other major donors have. Again, we were motivated by a focus on actual net transfers to recipients.
- For each donor and recipient, aid is discounted by a recipient-specific "selectivity weight," which reflects its poverty and governance quality. The basis for the weights is a regression of composite governance scores from Kaufmann, Kraay, and Zoido-Lobatón (2002) on log PPP GDP/capita.[8] (See Figure 1.) The idea is to compute selectivity weights as a linear function of log GDP/capita and the regression residuals, such that the poorer a country and the better its governance *relative to its GDP/capita peers*, the less the discount. Since governance and log GDP/capita are in different units, we use the slope of the regression line to translate between the two scales. Specifically, a recipient's raw weight is calculated as the residual from the regression (which reflects the quality of

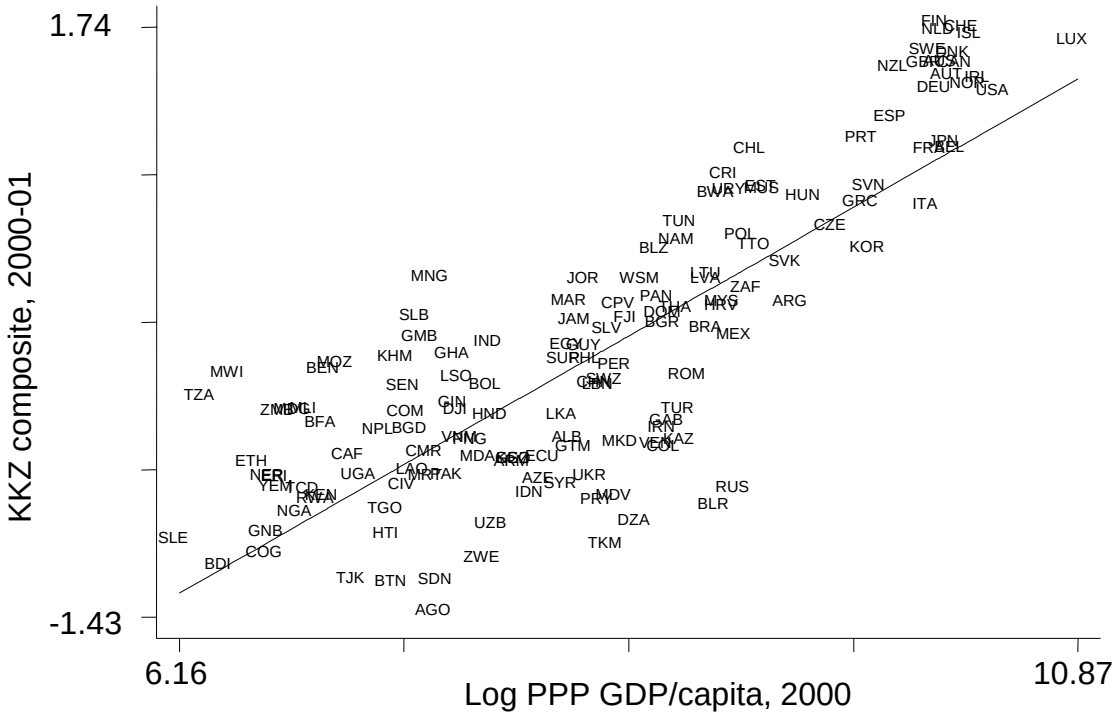
[6] OA is like ODA except that it goes to "Part II" countries, which include most European states that emerged out of the Soviet bloc and richer non-DAC members such as Israel and Singapore. DAC excludes OA from its most frequently cited statistic (net ODA), but we included it in our quality-adjusted aid measure because many Part II countries are in need and receiving aid. Some, such as Ukraine, are poorer than many Part I countries.

[7] See Jepma (1991, p. 15).

[8] The results reported in Roodman (2003a) use GDP/capita figures for 2001. The results here are based on 2000 figures.

its governance given its income) minus its *predicted absolute KKZ score*, a value that functions as a proxy for log GDP/capita on the KKZ scale (the two rise and fall together). Among all recipient countries, Tanzania ends up with the highest (best) weight, and Russia with the lowest.[9] The raw weights for developing countries are then linearly transformed to a range between 0.5 and 1.0. Thus $100 million of transfers to Tanzania is booked at face value, while the same to Russia counts as $50 million. Emergency aid is exempted from this discounting, to acknowledge that aid effectiveness depends on more than the choice of recipient, indeed, that some forms of aid may be more needed in countries with the worst "policy environments."

Figure 1. KKZ Governance Score vs. Log GDP/capita, 2000



- For each bilateral and multilateral donor, the resulting "quality-adjusted aid" figures are summed across recipients.
- The quality-adjusted aid totals of multilaterals are allocated back to bilaterals in proportion to the bilaterals' contributions to the multilaterals during 2001. For example, since France accounted for 5.5 percent of contributions to the World Bank's concessional lending arm, the International Development Association (IDA), it received 5.5 percent of the IDA's quality-adjusted aid of $3.5 billion, or $190 million.
- The final measure is bilaterals' total quality-adjusted aid as a share of GDP.

[9] Tanzania received a composite KKZ score of –0.27 for 2000–01, but the regression predicts its score to be only -1.22 because of its low GDP/capita. The residual is +0.95: Tanzania has a high governance score for its income. Subtracting its predicted KKZ score gives it a raw weight of 0.95 –(–1.22)=2.17. Since that is the highest raw weight in the sample, Tanzania gets a 1.0 after transformation. Russia gets the lowest score after transformation, 0.5.

The weighting does not directly reflect selectivity with respect to recipients' economic policies. We omitted this aspect of selectivity even though we believe sensible economic policy, especially fiscal discipline and sound monetary policy, are critical to economic stability, growth, and human development. One reason for the omission is that the well-known result of Burnside and Dollar (2000), essentially that "aid works in a good policy environment," is not robust to alternative specifications (Hansen and Tarp, 2001), nor to the addition of data for more countries and years (Easterly, Levine, and Roodman, 2003). The second is that it is not clear what measure of economic policy we would use; for example, there is no consensus on the measurement or even the relevance of "open" trade policy (Rodríguez and Rodrik, 2002; Birdsall and Hamoudi, 2002).[10] Third, the studies examine only short-term impacts of on growth (four years or less) but aid often targets education and health, where investments can take much longer to generate growth.[11] Finally, data on policies are unavailable for many countries (the Burnside and Dollar study covers only 56 countries), which is a serious obstacle to measuring selectivity.

Despite our quality adjustments, what most distinguishes donors from each other in our measure is still the quantity of aid they disburse, especially when measured as true net transfers (net of interest payments). Denmark, Norway, and Sweden are large donors by DAC's measure, and they score highest on ours, in the 0.57–0.77% range. The United States scores lowest on ours, at 0.07%. Japan is second-lowest, a result that may be surprising given that it was the world's largest donor by DAC's measure until recently, despite having an economy half the size of the U.S. economy. But Japan received $2 billion in interest payments on concessional loans, which DAC did not net out of "net" ODA and OA, and gave $2 billion in technical cooperation, which we discount as tied.

The final column of Table 3 compares our index of aid performance to the DAC measure of net ODA and OA. This summarizes all of the "adjustments" in quality-adjusted aid. Japan suffers most from the changes, with a 56 percent discount in 2001. The United States suffers too, with a 46 percent discount reflecting substantial interest received, extensive tying, and low selectivity. It is important to keep in mind in reviewing this table that quality-adjusted aid as defined here incorporates only a few aspects of aid quality, leaving out diverse factors such as appropriateness of project designs, appropriateness and enforcement of loan conditions, and so on. It is far from the final word on measuring aid and its quality.

[10] The U.S. proposes to use a Heritage Foundation measure of economic freedom in assessing country eligibility for its Millennium Challenge Account (Radelet, 2003), which is likely to be controversial as it is based on subjective judgments.

[11] Beynon (2001), raises this and other points in a comprehensive review of the literature on aid effectiveness and selectivity.

Table 1. Summary of Aid Component, Step 1

Donor	(1) Gross ODA and OA, 2001	(2) Of which: Admini-strative	(3) Of which: Debt for-giveness	(4) Of which: Tech coop	(5) Partially untied share	(6) Tied share	(7) Gross aid after tying discount[1]
	(million $)	(%)	(million $)	(million $)	(%)	(%)	(million $)
Arab Agencies	381	0.0	0	0	0.0	0.0	381
Australia	662	7.0	7	402	0.0	40.7	519
Austria	571	4.4	146	89	0.0[2]	40.8[2]	503
Belgium	522	4.6	54	218	0.0	10.2	450
Canada	1,374	11.3	121	360	0.0	68.3	1,045
Denmark	1,192	7.9	11	138	0.0	6.7	1,057
Finland	261	7.1	5	91	0.0	12.5	220
France	4,200	6.9	768	1,891	24.3	9.1	3,480
Germany	3,909	7.8	174	1,862	0.0	15.4	3,183
Greece	89	0.0	0	21	0.0	82.7	74
Ireland	185	7.1	0	11	0.0	0.0	169
Italy	651	7.0	10	96	0.0	92.2	494
Japan	10,416	9.6	446	2,071	1.4	17.5	8,752
Luxembourg	109	1.0	0	5	0.0	3.3	106
Netherlands	2,383	8.2	163	634	0.3	8.5	2,036
New Zealand	85	8.3	0	42	0.0[3]	0.0[3]	70
Norway	974	7.0	0	150	0.0	1.1	874
Portugal	184	3.3	17	118	1.7	40.6	151
Spain	1,281	4.6	382	185	0.1	31.0	1,144
Sweden	1,318	5.7	0	101	10.1	3.5	1,203
Switzerland	705	2.8	0	121	0.0	3.9	657
United Kingdom	2,829	11.0	374	848	0.0	6.1	2,334
United States	10,744	9.5	23	6,455	0.0[4]	71.6[4]	7,966
AfDF	464		0	0	0.0	0.0	464
AsDF	1,031		0	0	0.0	0.0	1,031
CarDB	50		0	0	0.0	0.0	50
EBRD	51		0	0	0.0	0.0	51
EC	8,732		0	0	0.0	0.0	8,732
GEF	139		0	0	0.0	0.0	139
IBRD	48		48	0	0.0	0.0	48
IDA	6,112		201	0	0.0	0.0	6,112
IDB Sp.Fund	546		0	113	0.0	0.0	523
IFAD	254		0	0	0.0	0.0	254
Montreal Protocol	72		0	0	0.0	0.0	72
Nordic Dev.Fund	33		0	0	0.0	0.0	33
Other UN	569		0	569	0.0	0.0	456
SAF+ESAF(IMF)	1,111		0	0	0.0	0.0	1,111
UNDP	287		0	287	0.0	0.0	230
UNFPA	314		0	314	0.0	0.0	251
UNHCR	569		0	0	0.0	0.0	569
UNICEF	605		0	0	0.0	0.0	605
UNRWA	359		0	0	0.0	0.0	359
UNTA	422		0	422	0.0	0.0	338

[1]Computed: (1*(100%–2)–3–4)*(100%–5*12.5%–6*25%)+4*(100%–25%)+3. [2]Figure is for 2000. [3]Figure is for 1992. [4]Figure is for 1996.

Table 2. Summary of Aid Component, Step 2

	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Donor	Gross aid after tying discount[1]	Amortization	Interest	Net aid after tying discount[2]	Emergency	Average recipient weight	Quality-adjusted aid quantity[3]
	----------(million $)----------					(%)	(million $)
Arab Agencies	381	236	0	145	0	0.84	122
Australia	519	0	0	519	49	0.74	395
Austria	503	68	52	383	26	0.74	291
Belgium	450	13	2	434	27	0.81	357
Canada	1,045	23	2	1,021	210	0.74	810
Denmark	1,057	44	0	1,012	114	0.79	827
Finland	220	4	1	215	42	0.75	172
France	3,480	593	175	2,712	240	0.72	2,015
Germany	3,183	805	377	2,001	242	0.76	1,578
Greece	74	0	0	74	4	0.66	50
Ireland	169	0	0	169	18	0.85	147
Italy	494	188	45	262	66	0.86	233
Japan	8,752	2,934	2,132	3,686	30	0.79	2,913
Luxembourg	106	0	0	106	13	0.76	83
Netherlands	2,036	62	46	1,927	285	0.77	1,543
New Zealand	70	0	0	70	3	0.76	54
Norway	874	4	0	870	181	0.77	711
Portugal	151	0	1	150	2	0.77	116
Spain	1,144	117	0	1,027	38	0.71	739
Sweden	1,203	0	0	1,203	244	0.76	973
Switzerland	657	5	0	651	140	0.76	530
United Kingdom	2,334	120	0	2,213	262	0.84	1,900
United States	7,966	1,000	488	6,478	1,258	0.69	4,879
AfDF	464	45	15	403	0	0.87	349
AsDF	1,031	219	146	665	0	0.76	508
CarDB	50	19	8	23	0	0.80	19
EBRD	51	0	0	51	0	0.60	31
EC	8,732	532	397	7,803	578	0.70	5,636
GEF	139	0	0	139	0	0.68	94
IBRD	48	0	0	48	0	0.76	36
IDA	6,112	1,198	618	4,297	0	0.82	3,511
IDB Sp.Fund	523	269	132	122	0	0.77	93
IFAD	254	88	33	133	0	0.80	106
Montreal Prot.	72	0	0	72	0	0.74	53
Nordic Dev.Fund	33	1	0	32	0	0.80	26
Other UN	456	0	0	456	0	0.74	337
SAF+ESAF(IMF)	1,111	1,003	0	107	0	0.85	91
UNDP	230	0	0	230	0	0.80	183
UNFPA	251	0	0	251	0	0.77	194
UNHCR	569	0	0	569	0	0.74	422
UNICEF	605	0	0	605	0	0.79	478
UNRWA	359	0	0	359	0	0.72	259
UNTA	338	0	0	338	0	0.74	250

[1]Last column of previous table. [2]Computed: 7–8–9. [3]Computed: (10–11)*12+11. [4]Computed: 13/(1–8).

Table 3. Summary of Aid Component, Step 3

Country	Bilateral net ODA+OA	Bilateral quality-adjusted aid	Net ODA to multilaterals	Multilateral quality-adjusted aid	Total quality-adjusted aid	**Overall aid score**: Adjusted aid/GDP	Memo: Adjusted aid/ (Net ODA+OA)
	----------	----------	(million $)	----------	----------	(%)	
Australia	662	395	221	156	551	0.15	0.62
Austria	503	291	246	168	459	0.24	0.61
Belgium	508	357	454	327	684	0.30	0.71
Canada	1,351	810	352	179	989	0.15	0.58
Denmark	1,147	827	674	432	1,259	0.77	0.69
Finland	257	172	194	138	310	0.25	0.69
France	3,607	2,015	2,079	1,495	3,510	0.27	0.62
Germany	3,104	1,578	2,632	1,817	3,395	0.18	0.59
Greece	89	50	122	96	146	0.13	0.69
Ireland	185	147	103	76	223	0.22	0.78
Italy	463	233	1,463	1,075	1,308	0.12	0.68
Japan	7,482	2,913	2,524	1,507	4,420	0.10	0.44
Netherlands	2,321	1,543	1,077	691	2,234	0.60	0.66
N. Zealand	85	54	27	17	70	0.15	0.63
Norway	970	711	413	229	940	0.57	0.68
Portugal	184	116	114	87	203	0.19	0.68
Spain	1,164	739	593	438	1,178	0.20	0.67
Sweden	1,318	973	467	286	1,260	0.60	0.71
Switzerland	700	530	279	174	704	0.28	0.72
U.K.	2,708	1,900	2,486	1,777	3,677	0.26	0.71
U.S.	9,743	4,879	3,350	2,184	7,063	0.07	0.54

Trade

The focus of the trade index developed by William Cline (2002) is a measure of barriers in rich-counties to exports from poorer ones. Cline's index has two major parts. First is an aggregate measure of protection (AMP), which combines information on tariffs, non-tariff measures, and domestic production subsidies, and expresses them on a tariff-equivalent basis. Since the members of the European Union by and large have a unified trade policy, they are treated as a unit. Cline divides goods into four categories: textiles and apparel, agriculture, other manufactures, and fuels. He incorporates into the AMP information on tariffs in all four sectors, as well as information on non-tariff barriers (NTBs), such as quotas, against textiles and apparel,[12] and estimates of the trade effects agriculture subsidies.

Out of concern that unmeasured (tacit) barriers may be an important factor in reducing access of developing countries to rich country markets, especially in Japan, Cline supplements the AMP with an indicator of "revealed openness," which incorporates direct measures of total imports from developing countries, total manufactures imports from them, and total imports from the poorest ("at risk") developing countries. The aggregate measure of protection receives a weight of 75% in the overall trade index, and revealed openness, 25%.

[12] Cline implicitly assumes that the lost producer surplus for developing countries is not offset by any increase for exporters in rents from the higher prices they might receive under quota systems.

We adopt Cline's approach with some minor modifications. We recalculated the sectoral composition of each rich country's imports from developing countries using the UNCTAD TRAINS database (2001).[13] (See Table 4.) These numbers are the basis of weights used to average levels of protection across sectors. The update led to a few significant changes. Notably, the estimated share of agriculture in Norway's imports from developing countries fell from 25% to 10%.

Table 4. Sectoral Distribution of Goods Imports from Developing Countries

	Manufactures	Textiles	Apparel	Agriculture	Fuels
	----------	----------	(%)	----------	----------
Australia	70.8	3.3	6.4	4.6	14.9
Canada	75.1	2.4	7.2	7.0	8.4
EU	63.0	2.6	10.3	9.3	14.7
Japan	53.8	1.5	8.8	7.9	28.0
New Zealand	62.4	3.5	9.0	7.6	17.5
Norway	70.8	1.2	13.6	10.1	4.3
Switzerland	70.2	1.6	9.8	10.9	7.5
United States	71.4	1.2	11.1	4.6	11.7

We made other changes. Cline treats the members of the European Union (EU) as one entity; all the members receive the same overall score. In the aggregate measure of protection, we incorporate differences among the 15 members of the European Union in the benefits of the protection they receive via agricultural subsidies.[14] To do so, we use Cline's estimates of the tariff-equivalent levels of agricultural subsidization by individual EU members (which differ by countries since the relevant increase in domestic producer prices varies, as does the market share of imports in total domestic agricultural consumption). Although the agricultural subsidies are unified in the EU under the Common Agricultural Policy, the Policy itself can be thought of as the outcome of a political process in which each country can be expected to have maximized its receipts by lobbying for subsidies on the products it is most able to produce. But because agricultural tariffs, not subsidies, dominate the results, and tariffs were assumed the same for all EU members, the changes are small in practice.

We also adopted a more direct procedure for combining protection levels by sector into the single overall value Cline calls the AMP. The change, which we describe in the Appendix,

[13] Cline uses alternative sources for various countries, including WTO estimates for Japan and the European Union and broad Standard International Trade Classification categories for the United States, Norway, and New Zealand. The larger weight for agriculture in Cline's estimates stems in part from the inclusion of the full category 2 (crude materials except fuels) in the agriculture grouping for the SITC-based estimates. The main differences in the estimated AMPs are for Japan (34.8 here versus 42.7 in Cline) and Norway (61.1 versus 100.0). The TRAINS database used for the present study provides a more detailed and uniform source. Following the World Trade Organization's official definition, we took agriculture to be chapters 1–2 and 4–24 of the Harmonized System of product classification. Fuels were 25–27. Textiles were 50–60. Apparel was 61–63. "Manufactures" were taken to include everything else, including chapter 3, fish.

[14] We also experimented with computing revealed openness separately for each EU member, but found that it gave the Netherlands and Belgium outsized scores, probably because they have small economies and are ports of entry for the continent. The two probably ship a good share of their reported imports from developing countries on to other nations.

has no major effect on the results, although it does somewhat reduce Norway's extreme score. Table 5 and Table 6 show our calculations of protection by sector and overall.[15]

The final change we made was to simplify the revealed openness component in small ways. We computed the raw measure as the sum of three quantities, all over receiving-country GDP, namely: imports from all developing countries, imports of manufactures only from all developing countries, and imports from low-income developing countries.[16] All EU members are assigned the same revealed openness score. Our resulting revealed openness scores are shown in Table 7.

Table 8 shows the calculation of the overall trade component. Because the revealed openness scores are transformed to have the same mean and standard deviation as the aggregate protection measure, these transformed scores, and the overall trade score can all be thought as being in tariff-equivalent terms. For example, Japan's AMP is 34.8%. After leavening with revealed openness, its final score is 33.9%, which suggests that the AMP reasonably represents its protectionism.

Agricultural *tariffs* dominate the results, giving Norway in particular a very low score, and Japan and Switzerland low scores as well. Agricultural *subsidies*, though harmful, appear not nearly as protective against developing countries. The source of the very high numbers for the EU, Norway, Switzerland, and Japan are tariff-rate quotas (TRQs) under the Uruguay Round agreement of the World Trade Organization. Under this system, countries replaced import quotas with pairs of tariffs. TRQs impose lower tariffs on imports within the quota limit and very high ones on imports above it, to cap imports at the old quota level.

[15] The figures on total agricultural protection in Table 6 should match those in Table 5. However, because of an error in the 2003 edition of the Index, they are too high, subsidies having been double-counted. The effects of this error on standings in the trade component and overall index are modest. We are indebted to Arne Melchior for discovering this error.

[16] All imports data in our calculation are for 1999, and are from UNCTAD (2001). Manufactured goods were those in BEC (Broad Economic Categories) lines other than 11, 21, and 31. A country was considered to be low-income if it made the current "operational cutoff" for eligibility at the World Bank's concessional lending window, the International Development Association. Specifically, a country had to have GDP per capita below $875 a year using the Bank's Atlas method for computing GDP (World Bank 2002a, p. 115, 2002b).

Table 5. Protection in Tariff-equivalents

	Manufac-tures	Textiles			Apparel			Agriculture			
	Tariffs	Tariffs	Non-tariff	Total	Tariffs	Non-tariff	Total	Tariffs	Subsi-dies	Total	Fuels
	(%)	--------- (%) ---------			--------- (%) ---------			--------- (%) ---------			(%)
Australia	13.4	17.0	7.1	25.3	29.3	8.3	40.0	2.5	2.6	5.2	0.0
Austria	5.0	9.7	5.1	15.3	12.1	5.2	17.9	67.0	19.5	99.6	0.0
Belgium	5.0	9.7	5.1	15.3	12.1	5.2	17.9	67.0	20.6	101.4	0.0
Canada	5.4	15.7	9.1	26.2	21.2	11.4	35.0	63.0	1.8	65.9	0.0
Denmark	5.0	9.7	5.1	15.3	12.1	5.2	17.9	67.0	18.9	98.6	0.0
Finland	5.0	9.7	5.1	15.3	12.1	5.2	17.9	67.0	18.0	97.1	0.0
France	5.0	9.7	5.1	15.3	12.1	5.2	17.9	67.0	18.1	97.2	0.0
Germany	5.0	9.7	5.1	15.3	12.1	5.2	17.9	67.0	18.3	97.6	0.0
Greece	5.0	9.7	5.1	15.3	12.1	5.2	17.9	67.0	22.0	103.7	0.0
Ireland	5.0	9.7	5.1	15.3	12.1	5.2	17.9	67.0	23.6	106.4	0.0
Italy	5.0	9.7	5.1	15.3	12.1	5.2	17.9	67.0	13.5	89.5	0.0
Japan	3.6	8.5	0.0	8.5	12.5	0.0	12.5	202.0	9.8	231.6	0.0
Netherlands	5.0	9.7	5.1	15.3	12.1	5.2	17.9	67.0	12.8	88.4	0.0
New Zealand	12.3	8.6	7.1	16.3	25.0	8.3	35.4	5.0	0.0	5.0	0.0
Norway	3.6	13.8	7.1	21.9	17.5	8.3	27.3	273.0	8.6	305.1	0.0
Portugal	5.0	9.7	5.1	15.3	12.1	5.2	17.9	67.0	15.0	92.1	0.0
Spain	5.0	9.7	5.1	15.3	12.1	5.2	17.9	67.0	18.0	97.1	0.0
Sweden	5.0	9.7	5.1	15.3	12.1	5.2	17.9	67.0	15.1	92.2	0.0
Switzerland	1.9	0.7	7.1	7.8	17.5	8.3	27.3	161.0	10.0	187.1	0.0
U.K.	5.0	9.7	5.1	15.3	12.1	5.2	17.9	67.0	16.3	94.2	0.0
United States	4.6	11.2	9.1	21.3	13.3	11.4	26.2	11.0	20.8	34.1	0.0

Table 6. Computation of Aggregate Measure of Protection (AMP)

	Protection (tariff-equivalent, %)					Share of imports from developing countries					Aggregate Protection (tariff-equivalent)
	Manufactures	Textiles	Apparel	Agriculture	Fuels	Manufactures	Textiles	Apparel	Agriculture	Fuels	
	---------- (%)----------					---------- (%)----------					(%)
Australia	13.4	25.3	40.0	7.9	0.0	70.8	3.3	6.4	4.6	14.9	13.4
Austria	5.0	15.3	17.9	138.7	0.0	63.0	2.6	10.3	9.3	14.7	21.8
Belgium	5.0	15.3	17.9	140.9	0.0	63.0	2.6	10.3	9.3	14.7	22.1
Canada	5.4	26.2	35.0	68.9	0.0	75.1	2.4	7.2	7.0	8.4	12.7
Denmark	5.0	15.3	17.9	137.5	0.0	63.0	2.6	10.3	9.3	14.7	21.6
Finland	5.0	15.3	17.9	135.7	0.0	63.0	2.6	10.3	9.3	14.7	21.3
France	5.0	15.3	17.9	135.9	0.0	63.0	2.6	10.3	9.3	14.7	21.4
Germany	5.0	15.3	17.9	136.3	0.0	63.0	2.6	10.3	9.3	14.7	21.4
Greece	5.0	15.3	17.9	143.7	0.0	63.0	2.6	10.3	9.3	14.7	22.5
Ireland	5.0	15.3	17.9	146.9	0.0	63.0	2.6	10.3	9.3	14.7	22.9
Italy	5.0	15.3	17.9	126.7	0.0	63.0	2.6	10.3	9.3	14.7	20.1
Japan	3.6	8.5	12.5	264.1	0.0	53.8	1.5	8.8	7.9	28.0	34.8
Netherlands	5.0	15.3	17.9	125.3	0.0	63.0	2.6	10.3	9.3	14.7	19.9
New Zealand	12.3	16.3	35.4	5.0	0.0	62.4	3.5	9.0	7.6	17.5	12.0
Norway	3.6	21.9	27.3	339.9	0.0	70.8	1.2	13.6	10.1	4.3	61.1
Portugal	5.0	15.3	17.9	129.7	0.0	63.0	2.6	10.3	9.3	14.7	20.5
Spain	5.0	15.3	17.9	135.7	0.0	63.0	2.6	10.3	9.3	14.7	21.3
Sweden	5.0	15.3	17.9	129.9	0.0	63.0	2.6	10.3	9.3	14.7	20.5
Switzerland	1.9	7.8	27.3	215.8	0.0	70.2	1.6	9.8	10.9	7.5	37.1
United Kingdom	5.0	15.3	17.9	132.3	0.0	63.0	2.6	10.3	9.3	14.7	20.9
United States	4.6	21.3	26.2	62.0	0.0	71.4	1.2	11.1	4.6	11.7	9.7

Table 7. Computation of Revealed Openness Score

	Imports from developing countries/ GDP	Imports from low-income developing countries/ GDP	Imports of manufactures from developing countries/ GDP	Total
	---------- (%) ----------			
Australia	4.9	1.5	4.2	10.6
Austria	6.2	1.4	4.9	12.5
Belgium	6.2	1.4	4.9	12.5
Canada	3.9	1.0	3.4	8.3
Denmark	6.2	1.4	4.9	12.5
Finland	6.2	1.4	4.9	12.5
France	6.2	1.4	4.9	12.5
Germany	6.2	1.4	4.9	12.5
Greece	6.2	1.4	4.9	12.5
Ireland	6.2	1.4	4.9	12.5
Italy	6.2	1.4	4.9	12.5
Japan	5.0	1.8	3.6	10.4
Netherlands	6.2	1.4	4.9	12.5
New Zealand	4.7	1.4	3.8	9.9
Norway	4.2	0.9	3.7	8.8
Portugal	6.2	1.4	4.9	12.5
Spain	6.2	1.4	4.9	12.5
Sweden	6.2	1.4	4.9	12.5
Switzerland	4.4	1.0	3.7	9.1
United Kingdom	6.2	1.4	4.9	12.5
United States	5.1	1.3	4.4	10.8

Table 8. Computation of Overall Trade Score

	AMP (75% of score)	Revealed openness (25% of score)		**Overall trade score**
		Raw score	Transformed to AMP scale	
	----------	---------- (%)	----------	----------
Australia	13.4	10.6	30.3	17.6
Austria	21.8	12.5	15.9	20.3
Belgium	22.1	12.5	15.9	20.5
Canada	12.7	8.3	47.0	21.3
Denmark	21.6	12.5	15.9	20.2
Finland	21.3	12.5	15.9	20.0
France	21.4	12.5	15.9	20.0
Germany	21.4	12.5	15.9	20.0
Greece	22.5	12.5	15.9	20.8
Ireland	22.9	12.5	15.9	21.2
Italy	20.1	12.5	15.9	19.0
Japan	34.8	10.4	31.3	33.9
Netherlands	19.9	12.5	15.9	18.9
New Zealand	12.0	9.9	35.3	17.8
Norway	61.1	8.8	43.3	56.6
Portugal	20.5	12.5	15.9	19.3
Spain	21.3	12.5	15.9	20.0
Sweden	20.5	12.5	15.9	19.4
Switzerland	37.1	9.1	41.0	38.1
United Kingdom	20.9	12.5	15.9	19.6
United States	9.7	10.8	28.7	14.5
Average	22.8	11.6	22.8	
Standard deviation	10.5	1.4	10.5	

Environment

Among the policies areas to be covered by the index, environmental policies are the hardest to project into a single numerical dimension. Considerations run from treaty ratifications to dollar amounts of subsidies to rates of pollution, which are not easy to compare. The approach we take in the environment component is to organize the relative wealth of available indicators into a hierarchy, put each indicator on a standard scale, and take weighted averages at each level in the hierarchy. At top level, the index is based on three components: depletion of shared commons (67% weight), contributions to international efforts—governmental cooperation (17%), and contributions to international efforts—technology (17%). Thus, it is divided between environmental impacts of rich-countries' own economic activities on poorer countries, and rich countries' efforts to help poorer achieve sustainable development.

Following is an outline of the component's construction, with some commentary. Roodman (2003b) contains more detail. Percentages indicate each variable's weight at the next level up:

1) Depletion of shared commons (67%)
   a) Climate stability—greenhouse gas emissions per capita (67%). The risks of climate change bear particularly on developing countries in part because they have less capacity to adapt.
   b) Ozone layer—consumption per capita of ozone-depleting substances (17%)
   c) Marine fisheries—fishing subsidies per capita (17%). Rich country-fleets are contributing to overfishing in many international fisheries reducing the available resource for developing countries.
2) Contributions to international efforts—governmental cooperation (17%)
   a) Participation in multilateral environmental institutions (50%). One point each for ratification of:
      i) Kyoto Protocol on climate change
      ii) Beijing Amendment to the Montreal Protocol on ozone-depleting substances. The international community has adopted a series of amendments strengthening the Montreal Protocol on Substances that Deplete the Ozone Layer. The Beijing Amendment is the latest. Countries that have ratified it ratified all earlier amendments.
      iii) Convention on Biological Diversity
   b) Financial contributions to such institutions (50%)
      i) Contributions to GEF's second replenishment (50%). The Global Environment Facility, housed at the World Bank, is a conduit for grant funding for projects in developing countries with global environmental benefits, in areas relating to biodiversity loss, climate change, degradation of international waters, ozone depletion, land degradation, and persistent organic pollutants. The measure used is countries' contributions to its second funding cycle, or "replenishment," which roughly covered the period 1998–2002. This is divided by donor GDP.
      ii) Contributions to the multilateral fund under the Montreal Protocol, as a share of GDP (50%). The multilateral fund is meant to help developing countries phase out consumption of ozone-depleting substances. The measure is total 2000 and 2001 contributions as a share of GDP.
3) Contributions to international efforts—technology (17%). When rich countries develop or deploy technologies that are more environmentally sustainable, they help push global industry down learning curves, reducing prices. Thus they create a sort of global public good that makes it easier for poorer counties to develop sustainably.
   a) R&D spending/GDP on energy efficiency and renewables (50%). Six countries were assigned a zero here for lack of data—in effect, penalizing non-reporting.
   b) Deployment of new technologies—net wind power capacity additions/PPP GDP (50%)

Table 9 summarizes the top level of the hierarchy in the environment component and the resulting composite score. Three large and relatively sparsely populated countries, Australia, Canada and the United States do worst overall, largely because of their low scores on emissions of greenhouse gases per capita, the most heavily weighted portion of the heavily weighted component. Several countries in Europe that have large programs supporting development of wind

technology stand out in the subcomponent on contributions to international technological efforts, enough in he case of Spain and Germany to lift them near the top of the standings.

Table 9. Summary of Environment Component

	Depletion of shared commons (67% of score)	Contributions to international efforts--governmental cooperation (17% of score)		Contributions to international efforts—technology (17% of score)		**Overall environment score**
		Raw score	On depletion-of-shared-commons scale	Raw score	On depletion-of-shared-commons scale	
Australia	–7.5	3.3	–7.1	0.8	–6.7	–7.3
Austria	–3.3	5.0	–4.9	0.7	–6.7	–4.1
Belgium	–4.5	5.5	–4.4	0.6	–6.7	–4.9
Canada	–8.8	6.1	–3.7	3.6	–5.6	–7.4
Denmark	–5.2	5.5	–4.4	13.4	–1.7	–4.5
Finland	–4.9	6.7	–2.9	12.0	–2.2	–4.1
France	–3.4	3.3	–7.1	0.1	–6.9	–4.6
Germany	–3.9	5.4	–4.5	13.5	–1.7	–3.6
Greece	–4.3	3.4	–7.0	5.0	–5.0	–4.9
Ireland	–7.8	3.5	–6.9	0.5	–6.8	–7.5
Italy	–3.3	4.0	–6.3	3.3	–5.7	–4.2
Japan	–5.9	5.9	–3.9	6.0	–4.6	–5.4
Netherlands	–4.4	6.8	–2.7	10.4	–2.9	–3.9
New Zealand	–6.2	6.0	–3.7	1.0	–6.6	–5.9
Norway	–7.3	6.5	–3.1	1.8	–6.3	–6.4
Portugal	–3.4	4.0	–6.2	1.7	–6.3	–4.3
Spain	–3.8	5.1	–4.9	14.4	–1.3	–3.5
Sweden	–3.3	7.6	–1.8	2.6	–6.0	–3.5
Switzerland	–1.9	5.7	–4.1	8.7	–3.6	–2.5
United Kingdom	–3.7	4.7	–5.4	0.7	–6.7	–4.5
United States	–8.2	0.9	–10.1	4.5	–5.2	–8.0
Average	–5.0	5.0	–5.0	5.0	–5.0	–5.0
Standard deviation	1.9	1.5	1.9	4.8	1.9	1.5

Investment

Events in the 1990s made obvious how the ebbs and flows of international investment affect developing countries. The role of rich-country *policies* in these movements is less obvious. Because of the importance of international investment, and because governments do restrict, guide, and stimulate it in formal and tacit ways—more to the point, have the ability to do so—we concluded that it is worthwhile to cover investment in the index.

Williamson and Catlin (2002) recommend building this component from three variables:

1) Net foreign direct investment to developing nations, as a share of source-country GDP.
2) Government restrictions on the amount that public or private pension funds can invest in foreign countries generally, or in developing countries in particular.
3) Financing by donor export credit agencies (ECA), measured as credits extended as a share of exports.

In the Williamson and Catlin paper, countries get 0, 1, or 2 points for each variable, and the sum is their overall score.

The first variable is an indicator more of outcome than policy. But we take it as the best available proxy for policies that support FDI to developing countries (or the absence of such policies). Whether net portfolio flows ought also be counted is a controversial question. Ideally, portfolio flows increase investment and growth in developing countries too. On the other hand, they are implicated in recent financial crises.[17] There is some recognition of the potential value of portfolio flows built into the score associated with whether such investments are limited by restrictions on pension funds.

We modified the Williamson and Catlin approach in several ways. First, we dropped the ECA measure out of concern that ECAs, whose programs tend to be designed to benefit rich country exporters, too often distort trade, finance projects with serious social or environmental side effects, and contribute to unsustainable debt build-up (Roodman, 2000).

We also modified the FDI component, again out of concern about the harm that FDI sometimes does. While General Electric modernized a light bulb factory in Hungary, Royal Dutch/Shell indirectly financed corruption and exploitation in Nigeria. We dispensed with the two-point grading system and used actual ratios of FDI to source-country GDP. Data for Greece, Ireland, and New Zealand are not available from the OECD source, so we assigned them a 0, in effect penalizing them for not reporting to the OECD. Because the time series are volatile, we averaged over 1999–2001.

Then to provide a rough proxy for the quality of FDI, we discounted the FDI figures according to the source country's score on Transparency International's Bribe Payers Index. The BPI assesses the propensity of corporations from 21 nations to bribe abroad. Results in the BPI come from a 15-country survey commissioned by TI of 835 individuals, such as officials at banks, accounting firms, and law offices, who are expected to be knowledgeable about business practices in their countries. TI scored the 21 countries asked about on a 0–10 scale, a 10 indicating no perceived tendency to bribe (TI, 2002). In the CDI investment component, a perfect 10 on the BPI leads to no discount on the FDI score, while a 5 leads to a 50 percent discount, and so on.

Fourteen of TI's 21 countries are among the 21 countries we rated. We estimated the values for the remaining 7 countries with a missing variables technique. We regressed the available BPI scores on the other five components of the index, and used that to predict the missing values.

[17] In any event we lack data on portfolio flows by source and destination country. The issue is however whether it makes sense to incorporate portfolio flows at all. It does seem to us that the priority in terms of policies of the rich countries that are friendly to development should go to encouraging direct investment.

After standardizing the FDI and pension restriction variables to have mean 5, we averaged them in a 2-to-1 ratio. (See Table 10.)

Table 10. Summary of Investment Component

	FDI (67% of score)				Pension (33%of score)		
	FDI/GDP, 1999-2001	Bribe Payers Index[1]	Corruption-discounted FDI/GDP	Corruption-discounted FDI, standardized	Raw	Standardized	**Overall investment score**
Australia	-0.33%	8.5	-0.28%	-1.9	2.0	11.7	2.6
Austria	1.14%	8.2	0.93%	6.5	0.0	0.0	4.3
Belgium	0.62%	7.8	0.49%	3.5	0.0	0.0	2.4
Canada	0.43%	8.1	0.35%	2.4	1.0	5.8	3.6
Denmark	0.44%	*9.8*	0.44%	2.5	0.0	0.0	1.7
Finland	0.77%	*5.5*	0.42%	4.4	0.0	0.0	2.9
France	0.77%	5.5	0.42%	4.4	0.0	0.0	2.9
Germany	0.61%	6.3	0.38%	3.4	0.0	0.0	2.3
Greece	0.00%	*5.0*	0.00%	0.0	0.0	0.0	0.0
Ireland	0.00%	*8.0*	0.00%	0.0	2.0	11.7	3.9
Italy	0.15%	4.1	0.06%	0.8	1.0	5.8	2.5
Japan	0.20%	5.3	0.10%	1.1	2.0	11.7	4.6
Netherlands	1.67%	7.8	1.31%	9.5	2.0	11.7	10.2
N. Zealand	0.00%	*8.3*	0.00%	0.0	2.0	11.7	3.9
Norway	0.53%	*10.4*	0.55%	3.0	2.0	11.7	5.9
Portugal	3.45%	*4.6*	1.71%	19.6	1.0	5.8	15.0
Spain	3.62%	5.8	2.10%	20.6	0.0	0.0	13.7
Sweden	0.79%	8.4	0.67%	4.5	0.0	0.0	3.0
Switzerland	2.77%	8.4	2.33%	15.8	0.0	0.0	10.5
U.K.	0.47%	6.9	0.32%	2.7	2.0	11.7	5.7
U.S.	0.38%	5.3	0.20%	2.2	1.0	5.8	3.4
Average	0.88%	6.9	0.58%	5.0	0.9	5.0	5.0

[1]Italicized scores were estimated using a missing variables technique described in text.

Migration

Migration is one of the thorniest topics covered in the index. The effects of migration and migration policy on development have not been as extensively studied as those of aid and trade polices. There is no widely accepted framework for analysis from the perspective of development, and little empirical evidence of the impact of out-migration on development in the sending countries. In addition, there are data problems, including lack of comprehensive information on remittances and illegal immigration, and lack of internationally comparable information on rich countries' migration policies.

On balance, we conclude that migration advances development in source countries because it "provides immigrants with access to labor markets and higher wages which, in turn, increase the potential for individual immigrants to remit money or goods to the sending country . . .and enables migrants to establish migrant networks, which encourage continuous and expanding economic relations between sending and receiving countries" (Hamilton and Grieco, 2002).

In addition, freer flows of people, like freer flows of goods, should contribute to global convergence in factor markets. The easier it is for a Vietnamese woman to get a job in Japan, the more Nike will have to pay her to keep her sewing clothes in its Vietnam factories. Emigration of workers that are unskilled (by rich-world standards) should increase the wages of those who do not leave. That argues for exploring how to factor in *discrimination* in immigration policies against lower-skill workers. This makes particular sense to the extent that immigration of highly skilled people from poor countries constitutes a transfer from the taxpayers of poor countries who invested in the skill formation of their emigrating citizens, to the taxpayers of rich countries. But lack of information and a conceptual framework for analyzing and comparing complex and varied immigration policies forced us to put this on the agenda of future research.[18]

The two indicators in our migration component are essentially those proposed by Hamilton and Grieco (2002). The main one is the number of legal immigrants accepted per year from developing countries, divided by receiving-country population. Estimates of illegal migration would also be relevant were they available, since even illegal migration may be influenced by tacit government decisions about how strongly to enforce policies on the books. On the other hand, excluding illegal migration from the index penalizes countries that do not formally legitimize large illegal populations and so expose them to more exploitation.

The migration component gives 90 percent weight to the legal migration flow measure. The other 10 percent goes to an indicator of the aid rich countries render refugees. Our indicator here is a simpler version of an indicator recently published by the U.N. High Commissioner for Refugees (2002). The CGD version is computed as total of three quantities, all taken over receiving-country GDP: the number of refugees hosted domestically; the number of other people "of concern" to UNHCR, such as those internally displaced; and the number of asylum applications taken.

Table 11 summarizes the migration component.

[18] The IMF's *Balance of Payments Statistics Yearbook* reports inflows and outflows of worker remittances by country and quarter. But the data are missing for many countries. And the inflow numbers are not disaggregated by source, while the outflow numbers are not disaggregated by destination, making it hard to measure flows from individual rich counties to developing countries as a group.

Table 11. Summary of Migration Component

Country	Legal migrant inflows/1000 population	Migrant inflows, standardized (90% of score)	Refuge burden sharing, standardized (10% of score)	**Overall migration score**
Australia	5	4.8	3.4	4.7
Austria	9	8.7	3.8	8.2
Belgium	6	5.5	7.0	5.6
Canada	8	8.1	4.0	7.7
Denmark	5	5.0	10.8	5.6
Finland	2	1.5	2.5	1.6
France	1	1.0	1.8	1.0
Germany	11	10.3	9.7	10.3
Greece	2	2.0	1.3	2.0
Ireland	6	5.7	4.8	5.6
Italy	1	1.4	0.5	1.3
Japan	2	2.2	0.0	2.0
Netherlands	5	4.9	12.3	5.6
New Zealand	13	12.3	2.3	11.3
Norway	6	5.6	8.0	5.8
Portugal	1	1.4	0.1	1.3
Spain	3	2.4	0.3	2.2
Sweden	4	3.8	15.7	5.0
Switzerland	12	11.4	10.4	11.3
United Kingdom	4	3.9	4.4	3.9
United States	3	3.0	1.9	2.9
Average	5	5.0	5.0	5.0

Note: For Ireland, the total number of non-DAC immigrants may include immigrants from Canada, Australia, New Zealand, and Japan. For Japan, it may include immigrants from Australia, Austria, Belgium, Denmark, Finland, France, Greece, Ireland, Italy, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, and Switzerland. For Norway, it may include immigrants from Canada, Australia, New Zealand, and Japan.

Peacekeeping

Security—internal stability and freedom from fear of external attack—is a prerequisite for development. Sometimes a nation's security is enhanced by the actions of other nations. But one person's security enhancement may be another's destabilizing intervention (consider the U.S. invasion of Iraq), so choosing what to measure for a security component would be inherently controversial. The paper by O'Hanlon (2002) lays out a set of options along a spectrum from least to most controversial. Least are the dues rich countries pay to support United Nations peacekeeping operations. Perhaps most controversial would be U.S. navy expenditures to keep sea-lanes open for trade. Four options seemed most appropriate for the index:

1) Contributions to U.N.-run peacekeeping operations—both direct financial payments and unreimbursed costs of troop participation in such missions.
2) Contributions to missions approved by the United Nations but conducted by another entity, whether a single state or another organization such as NATO
3) The costs of maintaining forces available for peacekeeping or humanitarian operations, including training, equipment, etc.
4) Security aid—spending on U.N.-approved efforts to build up a country's security forces, as in Kosovo, Palestine, and Afghanistan, or aid explicitly designed for peacekeeping-related purposes.

We succeeded in obtaining good data for parts of items 1) and 2). So while we had hoped to develop a broader index on "security," but were forced to measure just peacekeeping, and so named this component accordingly. We hope to rectify this shortcoming in a future edition.

We used two years of data to smooth volatility. From the U.N. Department of Peacekeeping Operations (2000, 2001a, 2001b, 2002), we collected data on countries' financial contributions to the U.N. peacekeeping budget, as well as counts of personnel seconded to those operations for 2000 and 2001. From the U.S. Department of Defense (2002), we collected contemporaneous information on total personnel contributed to both U.N. and selected non-U.N. operations (such as the ongoing peacekeeping effort in Kosovo). This source excludes European nations that are not in NATO, including Austria, Finland, Ireland, Sweden, and Switzerland, and also excludes Australia and New Zealand.

We valued personnel contributions at $10,000 per person per month—with two caveats. First, we subtracted $1,000/month for personnel contributed to U.N. operations, since the U.N. pays them that much from its own budget. Second, we used purchasing power parities to convert the figure of $10,000 (or $9,000) to currencies of donor nations other than the United States, since the costs of paying and equipping personnel may be dominated by non-tradables.

We summed the financial and personnel contributions, divided them into donor GDP, and averaged over 2000–01. (See Table 12.)

Table 12. Summary of Security Component

	U.N. peacekeeping contributions ($)		Personnel for U.N. operations		Personnel for non-U.N. operations		Personnel ($ terms)		**Peacekeeping score:** Contributions/ GDP (%)
	2000	2001	2000	2001	2000	2001	2000	2001	
Australia	39,825,413	55,166,279	1629	1529	0	0	143,601,308	121,307,522	0.0474
Austria	13,505,925	29,760,719	731	503	0	0	70,897,260	47,060,545	0.0427
Belgium	25,623,240	36,849,945	17	17	994	994	101,600,792	98,647,209	0.0578
Canada	75,987,973	90,351,956	568	295	1,438	1,711	193,896,178	185,732,305	0.0400
Denmark	18,381,478	25,293,649	306	103	982	1,185	171,366,057	168,908,778	0.1181
Finland	15,460,925	17,780,047	723	79	0	0	75,583,089	8,038,880	0.0481
France	142,242,908	229,583,759	498	483	8,079	8,094	957,297,964	922,216,592	0.0867
Germany	265,802,141	334,274,490	481	515	7,643	7,609	907,483,139	880,958,646	0.0637
Greece	4,367,236	12,391,991	40	24	2,003	2,019	163,119,777	164,779,068	0.1505
Ireland	5,800,736	9,644,324	782	355	0	0	72,108,632	32,327,591	0.0622
Italy	130,468,031	147,333,039	276	320	8,228	8,184	826,518,513	804,799,535	0.0882
Japan	214,449,573	470,058,103	30	30	0	0	4,765,836	4,097,155	0.0078
Netherlands	40,156,467	56,555,036	946	68	623	1,501	162,948,321	171,404,356	0.0582
N. Zealand	5,944,303	8,211,325	723	692	0	0	52,257,034	46,399,778	0.1149
Norway	16,133,074	21,635,657	75	78	1,169	1,166	184,235,971	181,355,159	0.1233
Portugal	849,629	8,319,818	990	1148	684	526	118,335,299	115,850,465	0.1140
Spain	27,256,089	47,096,050	195	206	2,530	2,519	243,359,721	238,961,923	0.0490
Sweden	29,261,091	35,745,499	152	133	0	0	17,874,483	13,941,243	0.0222
Switzerland	0	0	34	35	0	0	4,395,964	4,496,588	0.0018
U.K.	162,560,781	232,271,364	594	714	4,836	4,716	669,821,882	633,779,741	0.0602
U.S.	658,614,976	1,429,324,538	885	750	10,253	10,388	1,398,866,700	1,397,920,680	0.0244

Section 4. Overall Results and Sensitivity Tests

In order to compute overall scores, we needed to standardize the scores on each component on a common scale. Initially, as described earlier, scores on each component were scaled so that the highest score on the "good" indicators gets a 9 and the lowest on the "bad" gets a –9; then we added 10 to the "bad" indicators. A country's overall score is the average of its component scores. (See Table 13.)

Not too surprisingly, most of the Nordics and the Netherlands do well, buoyed by generally large aid flows, high contributions to peacekeeping, and lower pollution rates. The exception is Norway, whose huge agricultural tariffs pull it down overall.

Among the G–7, only Germany scores firmly in the top half. The two largest nations of the group, Japan and the United States come in last. Japan suffers from poor scores on aid, migration, and peacekeeping. As for the United States, it suffers from low scores in every category except trade policy, where it leads the group. Even its contributions to the security of developing nations, through peacekeeping—an area where we thought it might shine—appear small once normalized against its GDP.

Table 13. The Commitment to Development Index: Scores

Country	Aid	Trade	Environ-ment	Invest-ment	Migration	Peace-keeping	Aver-age	Rank
Australia	1.7	7.2	1.8	1.6	3.7	2.8	3.2	19
Austria	2.8	6.8	5.4	2.6	6.5	2.6	4.4	9
Belgium	3.5	6.7	4.5	1.4	4.5	3.5	4.0	12
Canada	1.7	6.6	1.7	2.1	6.1	2.4	3.4	18
Denmark	9.0	6.8	5.0	1.0	4.4	7.1	5.5	2
Finland	3.0	6.8	5.4	1.7	1.3	2.9	3.5	17
France	3.1	6.8	4.9	1.7	0.8	5.2	3.8	14
Germany	2.1	6.8	6.0	1.4	8.1	3.8	4.7	6
Greece	1.5	6.7	4.6	0.0	1.6	9.0	3.9	13
Ireland	2.6	6.6	1.6	2.3	4.5	3.7	3.6	16
Italy	1.4	7.0	5.3	1.5	1.1	5.3	3.6	15
Japan	1.2	4.6	4.0	2.8	1.5	0.5	2.4	21
Netherlands	6.9	7.0	5.7	6.1	4.5	3.5	5.6	1
New Zealand	1.7	7.2	3.4	2.3	9.0	6.9	5.1	4
Norway	6.6	1.0	2.8	3.5	4.6	7.4	4.3	10
Portugal	2.2	6.9	5.1	9.0	1.0	6.8	5.2	3
Spain	2.4	6.8	6.0	8.2	1.8	2.9	4.7	7
Sweden	7.0	6.9	6.1	1.8	3.9	1.3	4.5	8
Switzerland	3.3	4.0	7.2	6.3	9.0	0.1	5.0	5
United Kingdom	3.0	6.9	5.0	3.4	3.1	3.6	4.2	11
United States	0.8	7.7	1.0	2.0	2.3	1.5	2.6	20
Average	3.2	6.4	4.4	3.0	4.0	3.9	4.1	
Lowest	0.8	1.0	1.0	0.0	0.8	0.1	2.4	
Highest	9.0	7.7	7.2	9.0	9.0	9.0	5.6	

We tested the sensitivity of these results to several assumptions.

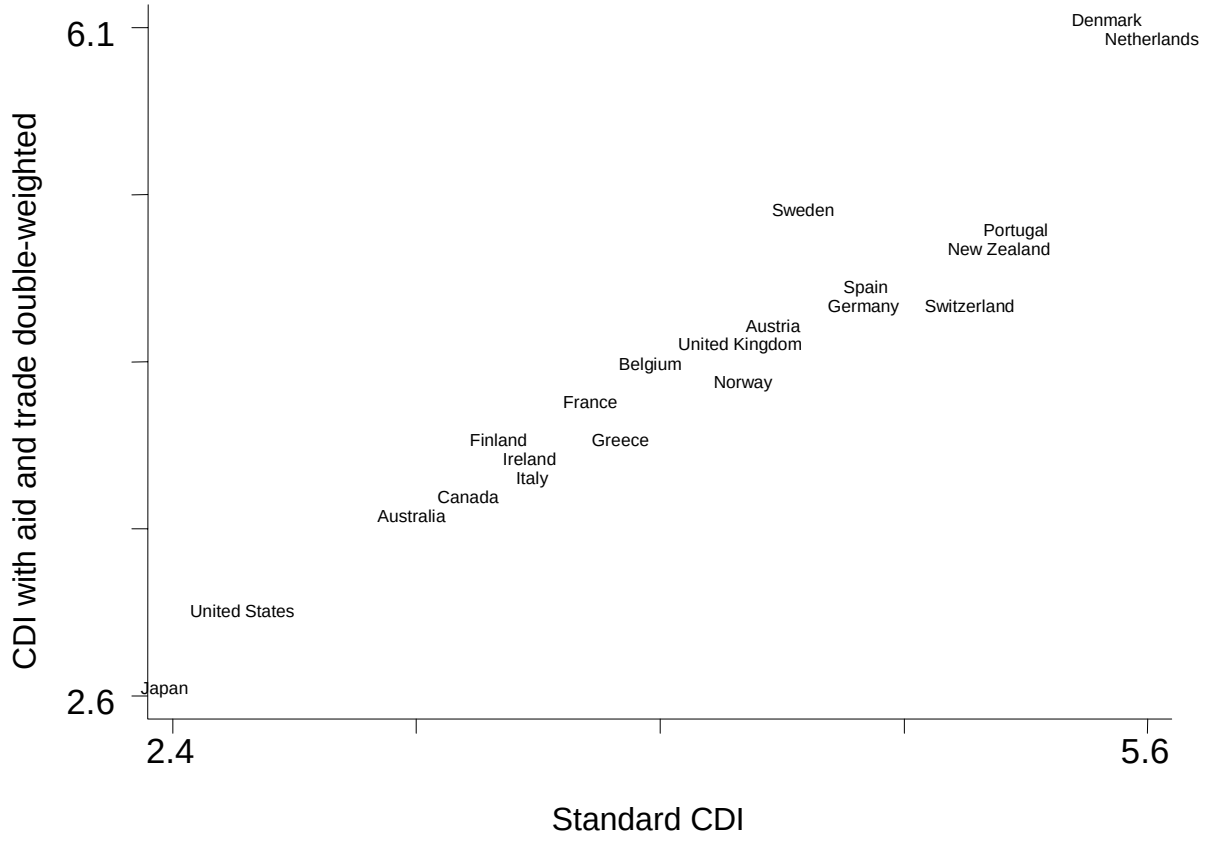
Doubling aid and trade. First, we modified the overall index by double-weighting aid and trade. We tried this for several reasons: 1) aid reflects the most explicit and conscious decision to address the needs of developing countries; 2) trade policies probably have the most direct impact; and 3) we are the most confident that the concepts in these two components are linked well to what are formidable and complete databases.

The scores of Denmark and Sweden, high aid countries, and the United States, a high trade country, increase most with this change. Declines are slighter and more widespread. New Zealand, Portugal, and Switzerland, which are particularly weak in aid and trade, lose most. (See Table 14 and Figure 2.)

Table 14. Sensitivity Test: Doubling Aid and Trade

	Standard CDI	CDI with aid and trade double-weighted
Australia	3.2	3.5
Austria	4.4	4.5
Belgium	4.0	4.3
Canada	3.4	3.6
Denmark	5.5	6.1
Finland	3.5	3.9
France	3.8	4.1
Germany	4.7	4.6
Greece	3.9	3.9
Ireland	3.6	3.8
Italy	3.6	3.7
Japan	2.4	2.6
Netherlands	5.6	6.0
New Zealand	5.1	4.9
Norway	4.3	4.2
Portugal	5.2	5.0
Spain	4.7	4.7
Sweden	4.5	5.1
Switzerland	5.0	4.6
United Kingdom	4.2	4.4
United States	2.6	3.0

Figure 2. Standard CDI versus CDI with Aid and Trade Double-weighted



Raising weights on individual components. We investigated more systematically the effect of raising weights on individual components.[19] We generated 54 non-standard versions of the CDI: first with the weight on aid raised to 2, then 3, and so on up to 10 (while weights on the other components were held at 1), then the same for trade, and then the other components. For each version we calculated the correlation of overall scores with the standard CDI, and the average absolute change in rank among scored countries. Figure 3 and Figure 4 show the results. For most of the components, the index proves reasonably stable despite large overweighting. Except for trade, even tenfold overweighting yields a score correlation of 0.57–0.76. The index proves more sensitive to the weighting on trade because this component's scores are so idiosyncratic, with the United States ranked first, and the 14 scored EU members tightly bunched. The correlation for tenfold overweighting is 0.36. Similar results pertain for average absolute rank changes.

[19] We are indebted to Michael Clemens for proposing this approach.

Figure 3. Correlation of Standard CDI with Versions with Higher Weight Placed on One Component at a Time

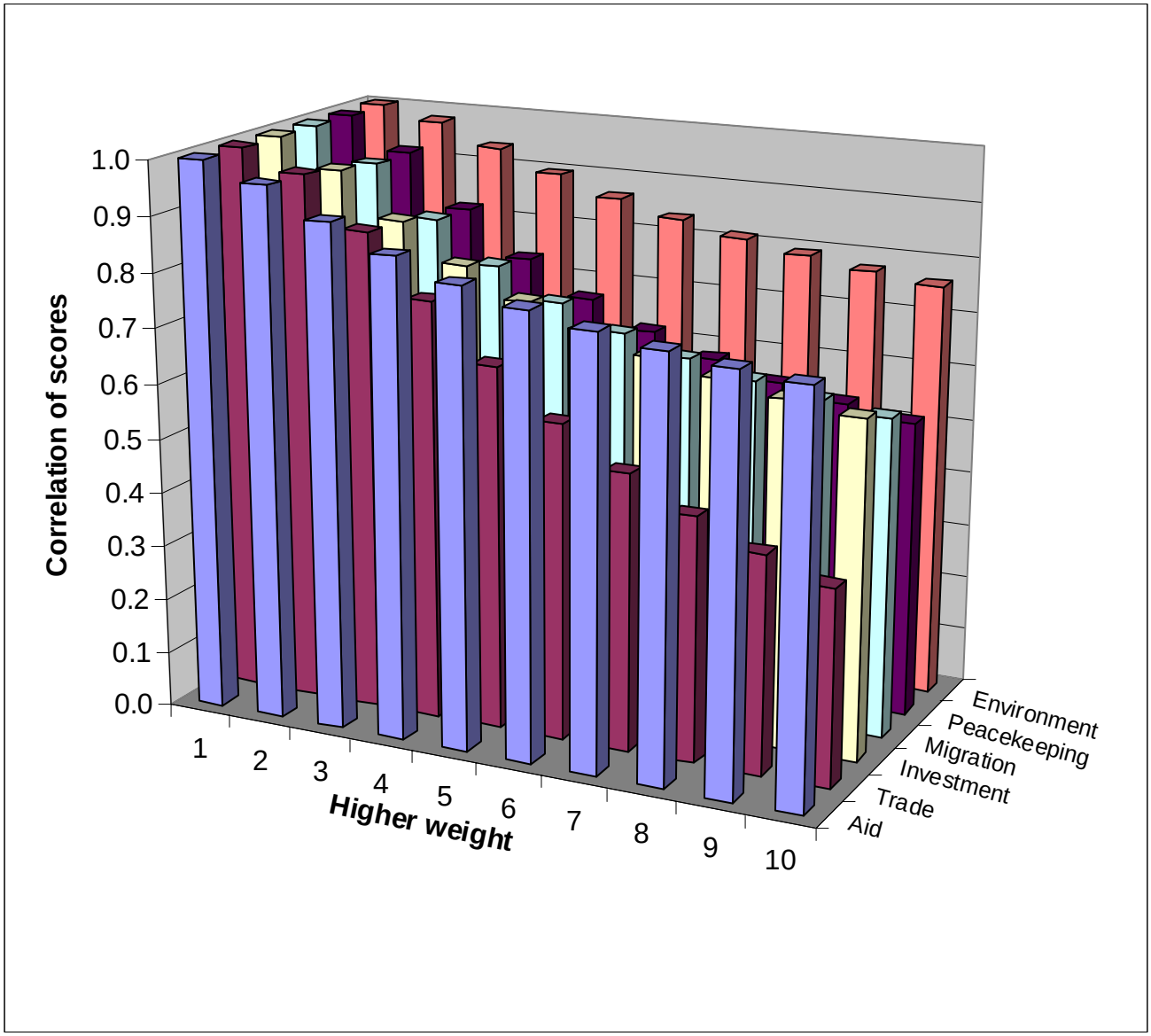
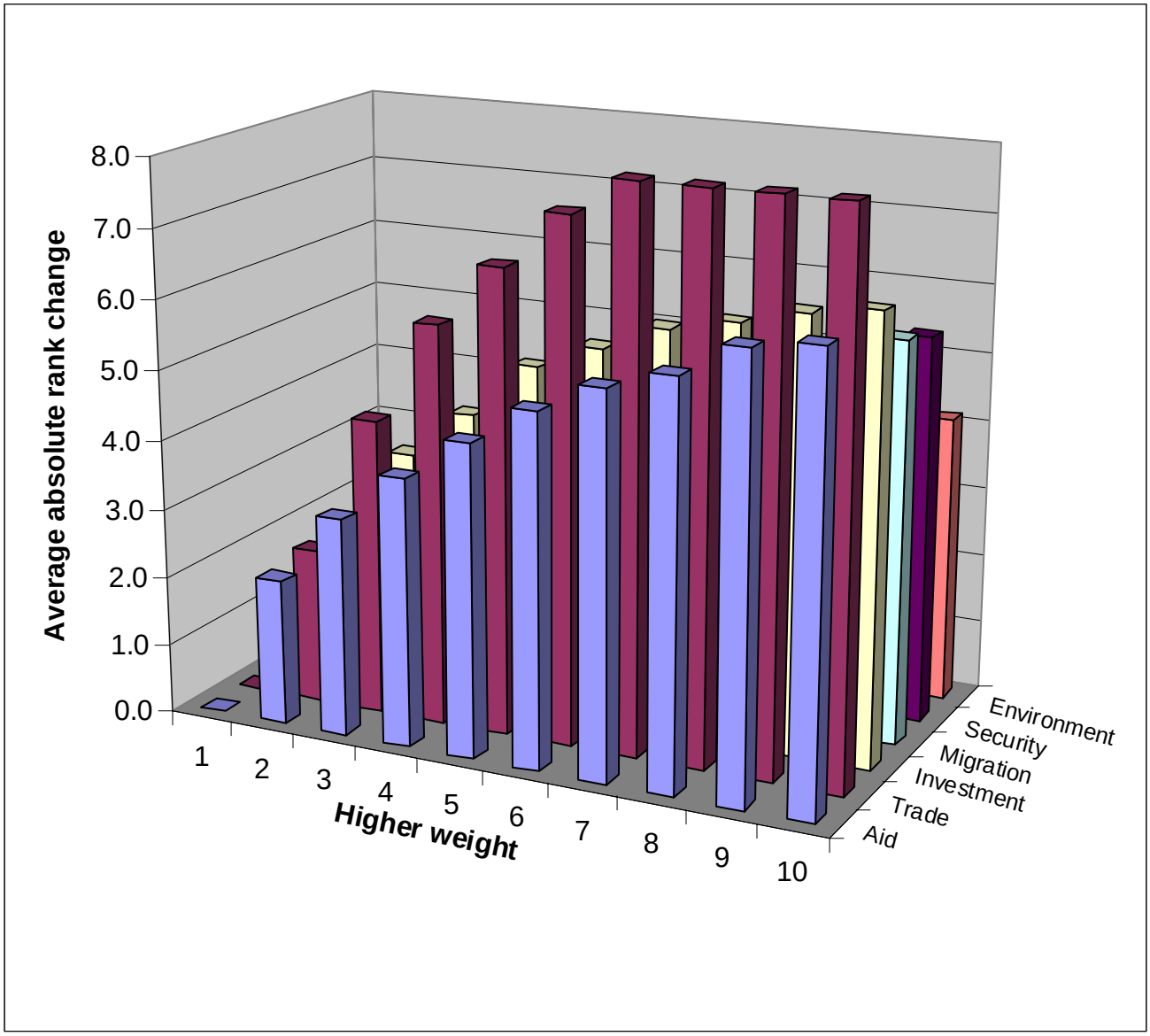


Figure 4. Average Absolute Change in CDI Rank when Higher Weight Placed on One Component at a Time



Then we performed two sensitivity tests on the definition of selectivity in the aid component—a definition that could become a particularly controversial part of the overall index.[20]

Ranging recipient weights from 0.0 to 1.0. In the CDI aid component, recall, selectivity weights range from 0.5 to 1.0. Aid to the most "deserving" country, with GDP/capita and high governance for its GDP/capita, is counted at face value (abstracting from the discounts for tying and administrative costs). Aid to the least "deserving" country still gets 50% weight, so that sheer quantity of aid still plays a major role in the aid score. In a sense, the score depends 50-50 on quantity and quality.

[20] Roodman (2003a) describes these and additional sensitivity tests in more detail.

In the event, the average selectivity scores for bilateral donors (weighted by aid to each recipient) mostly cluster around 0.76. (See Table 2.) In part because donors differ rather little on the selectivity measure, differences in quantity dominate the overall results. So in the first sensitivity test, we standardized the recipient weights to range from 0.0 to 1.0 instead of 0.5 to 1.0, in order to amplify the importance of what variability there is in selectivity. Aid to Tanzania was still counted in full, but aid to Russia received zero rather than 50% weight. This naturally reduced overall scores, but relative scores, broadened the spread on selectivity, hardly changed, as shown by the small changes in standardized scores. (See Table 15.)

Table 15. Sensitivity Test: Widening Range of Selectivity Weights in Aid Component

	Recipient weights ranging 0.5–1.0 (standard)			Recipient weights ranging 0.0–1.0		
Country	Average recipient weight	Modified ODA/GDP	Standardized score	Average recipient weight	Modified ODA/GDP	Standardized score
		(%)			(%)	
Australia	0.74	0.15	1.7	0.47	0.10	1.6
Austria	0.74	0.24	2.8	0.48	0.16	2.5
Belgium	0.81	0.30	3.5	0.62	0.22	3.4
Canada	0.74	0.15	1.7	0.48	0.11	1.7
Denmark	0.79	0.77	9.0	0.59	0.58	9.0
Finland	0.75	0.25	3.0	0.50	0.18	2.8
France	0.72	0.27	3.1	0.44	0.18	2.8
Germany	0.76	0.18	2.1	0.52	0.12	1.9
Greece	0.66	0.13	1.5	0.33	0.07	1.1
Ireland	0.85	0.22	2.6	0.70	0.17	2.6
Italy	0.86	0.12	1.4	0.71	0.08	1.2
Japan	0.79	0.10	1.2	0.58	0.08	1.2
Netherlands	0.77	0.60	6.9	0.53	0.43	6.7
New Zealand	0.76	0.15	1.7	0.52	0.10	1.6
Norway	0.77	0.57	6.6	0.54	0.44	6.8
Portugal	0.77	0.19	2.2	0.53	0.13	2.0
Spain	0.71	0.20	2.4	0.42	0.13	2.0
Sweden	0.76	0.60	7.0	0.52	0.45	7.0
Switzerland	0.76	0.28	3.3	0.52	0.22	3.4
United Kingdom	0.84	0.26	3.0	0.68	0.20	3.1
United States	0.69	0.07	0.8	0.39	0.05	0.8

Factoring recipient policies into selectivity. Next, we experimented with modifying the definition of selectivity to reflect recipients' economic policies as well as their governance and income. The conclusion of the influential paper by Burnside and Dollar (2000) that "aid has had a more positive impact on growth in good policy environments" has become conventional wisdom. Indeed, for most authors, "aid selectivity" means selectivity for countries with "good" policies (openness to trade, low inflation and budget deficit, etc.), not good governance.

The technique was similar to that used to incorporate governance scores. We regressed the Burnside and Dollar policy index (defined as 1.28 + 6.85*budget surplus/GDP – 1.40 * inflation + 2.16 * Sachs-Warner openness variable) against log PPP GDP/capita. For the Sachs-

Warner variable, we used an update to 1998 from Easterly, Levine, and Roodman (2003). The residuals from the regression constituted countries' policy scores—their policy levels controlling for income. We used the slope of the regression line to translate these scores into the log PPP GDP/capita scale, and added them to the already computed raw weights that reflect income and governance. We then standardized the weights to the 0.5–1.0 scale. Again, the overall aid scores are little changed. (See Table 16.)

Factoring in private charitable flows from the United States. A recent argument from the U.S. government in defense of its aid policies is that the United States, while a relatively stingy supplier of official aid, is a huge source of private charitable contributions to developing countries (USAID, 2003), which ought to be weighed in any comparison of donors. Much of this flow is tax deductible and/or tax exempt in the United States, and so is a credit to U.S. policy. The U.S. Agency for International Development estimates these flows at $15.6–23.7 billion per year (USAID, 2003, p. 146).

To judge the importance of this consideration, we experimented with treating these flows as if they were an increment to aid—in the case of the United States *only*. We treated them as aid that is completely untied and allocated with the same administrative cost and selectivity as official U.S. aid. The effect was to raise U.S. quality-adjusted aid/GDP from 0.07% to 0.17–0.22%, and its standardized aid score from 0.8 to 1.9–2.5. That raised its overall score from 2.6 to 2.7–2.8—and left its rank unchanged at 20.

Table 16. Sensitivity Test: Grading for Selectivity for Policies as Well as Governance and Low Income

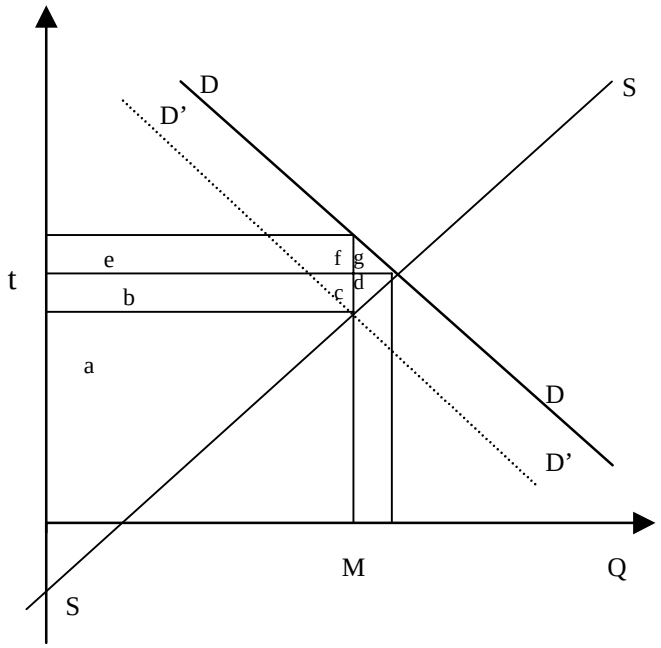
Country	Selectivity score reflects governance and GDP/capita (standard)			Selectivity score reflects policies, governance, and GDP/capita		
	Average recipient weight	Modified ODA/GDP	Standardized score	Average recipient weight	Modified ODA/GDP	Standardized score
		(%)			(%)	
Australia	0.74	0.15	1.7	0.83	0.16	1.8
Austria	0.74	0.24	2.8	0.79	0.26	2.8
Belgium	0.81	0.30	3.5	0.87	0.32	3.6
Canada	0.74	0.15	1.7	0.82	0.16	1.7
Denmark	0.79	0.77	9.0	0.84	0.82	9.0
Finland	0.75	0.25	3.0	0.80	0.27	3.0
France	0.72	0.27	3.1	0.82	0.30	3.3
Germany	0.76	0.18	2.1	0.83	0.20	2.2
Greece	0.66	0.13	1.5	0.80	0.14	1.6
Ireland	0.85	0.22	2.6	0.93	0.24	2.6
Italy	0.86	0.12	1.4	0.99	0.13	1.4
Japan	0.79	0.10	1.2	0.82	0.11	1.2
Netherlands	0.77	0.60	6.9	0.85	0.64	7.0
New Zealand	0.76	0.15	1.7	0.86	0.16	1.8
Norway	0.77	0.57	6.6	0.85	0.61	6.7
Portugal	0.77	0.19	2.2	0.73	0.19	2.1
Spain	0.71	0.20	2.4	0.85	0.23	2.6
Sweden	0.76	0.60	7.0	0.82	0.64	7.0
Switzerland	0.76	0.28	3.3	0.80	0.30	3.2
United Kingdom	0.84	0.26	3.0	0.85	0.27	3.0
United States	0.69	0.07	0.8	0.78	0.07	0.8

Appendix. Aggregation of Protection Levels across Sectors

In his proposal for an Aggregate Measure of Protection (AMP), Cline (2002) first estimates levels of protection in each of four major sectors, then aggregates the levels into a single measure of protection. The CDI trade component draws heavily on Cline's proposals, but departs in some respects, including the method of aggregating across sectors. The method used in the CDI is arguably more direct.

The starting point for our approach is Annex II of Cline (2002). There, Cline derives a formula for the reduction in exporter's producer surplus caused by a tariff. (See Figure A–1.)

Figure A–1. Supply and Demand for an Import from a Developing Country



In this diagram, line DD is the demand curve in the absence of protection, line D'D' is the demand curve in its presence, and SS is the supply curve. *t* is the ad valorem tariff and *M* is the observed level of imports under protection. The increase in producer surplus, *S*, caused by removal of protection is the sum of areas b, c, and d. Letting α and β be the absolute values of the elasticities of demand and supply, Cline shows that this area can be estimated as:

$$S = M \frac{t\alpha}{\beta + \alpha}[1 + \frac{\beta}{2}\frac{t\alpha}{\beta + \alpha}]. \quad (1)$$

This expression is quadratic in *t*, at base because high tariffs hurt exporters doubly, reducing both the price and quantity of their output. Cline notes that unless *t* is high, the quadratic term is small. However, it turns out that for agriculture, levels of protection are quite high (reaching 340% for Norway), so this quadratic term can matter.

We generalize the above picture to multiple sectors. For simplicity, we assume that the absolute elasticities of supply and demand, α and β, are the same for all sectors. In the generalization, there are protection levels t_i, observed import levels M_i, and protection-induced losses in producer surplus S_i. In this partial equilibrium context, we estimate the total harm done by protection as the sum of the harms in each sector:

$$S = \sum S_i = \sum M_i \frac{t_i \alpha}{\beta + \alpha}[1 + \frac{\beta}{2}\frac{t_i \alpha}{\beta + \alpha}].$$

We then define the aggregate measure of protection to be the *uniform* tariff *t* that would reduce exporters' surplus by just as much as the observed set of protection levels. Our task then is to solve for *t* in:

$$\sum M_i \frac{t\alpha}{\beta + \alpha}[1 + \frac{\beta}{2}\frac{t\alpha}{\beta + \alpha}] = \sum M_i \frac{t_i \alpha}{\beta + \alpha}[1 + \frac{\beta}{2}\frac{t_i \alpha}{\beta + \alpha}].$$

(The two sides of the equation differ only in that *t* is indexed on the right side.) Let $M = \sum M_i$ and $\phi_i = \frac{M_i}{M}$. Dividing the above equation by *M*, canceling terms, and rearranging gives:

$$t[1 + \frac{1}{2}\frac{t\alpha\beta}{\beta + \alpha}] = \sum \phi_i t_i [1 + \frac{1}{2}\frac{t_i \alpha\beta}{\beta + \alpha}],$$

Now let $Q = \alpha\beta/(\alpha + \beta)$, an expression that occurs on both sides of the equation.[21] Substituting this in yields:

$$t[1 + \frac{1}{2}tQ] = \sum \phi_i t_i [1 + \frac{1}{2}t_i Q],$$

Using the quadratic equation to solve this for *t*, it works out that:

$$t = \frac{1}{Q}\left(\sqrt{1 + 2Q\sum \phi_i t_i \left(1 + \frac{Qt_i}{2}\right)} - 1\right).$$

Using the Taylor expansion for $\sqrt{1+x}$, it can be shown that at low tariff levels (as the $t_i \to 0$), this formula converges to the simple weighted average of the tariffs, $\sum \phi_i t_i$.

Now the φ_i and t_i are observed variables. So to estimate *t* using this equation, we make one more assumption, about the value of *Q*. We take it to be 0.5, which it is under the simple assumption that $\alpha = \beta = 1$. Thus we calculate:

$$t = 2\left(\sqrt{1 + \sum \phi_i t_i \left(1 + \frac{t_i}{4}\right)} - 1\right).$$

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[21] Q can also be written:

$$\frac{1}{\frac{1}{\alpha} + \frac{1}{\beta}}.$$

It is the reciprocal of the difference in slope between the demand and supply curves. (Recall that α is the absolute value of the elasticity of demand, which is negative.) It represents the proportionate equilibrium change in exports actually supplied with respect to the tariff level, as Cline shows: $\Delta M/M = t\alpha\beta/(\alpha + \beta)$.

This is the formula for the last column of Table 6.

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