Comparing Sustainable Development Aid and Need

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Abstract

The proper allocation of foreign aid is likely to be of critical importance to its efficacy. In this paper, I present an analysis to test the hypothesis that official development assistance is allocated based on need in terms of deficit on sustainable development indicators. Within the framework of sustainable development priorities, I analyze data from over a hundred countries from 2012-2017 for multilateral and bilateral disbursements and 26 indicators. Using a novel mismatch index, I identify average misallocations of about 2% of the world total for countries, representing dozens of billions of dollars in aggregate, and observe little change after the 2015 enactment of the SDGs. I also check Spearman rank coefficient measures which indicate a poor fit, especially for indicators new to the SDG agenda. In regression analysis, I find a positive relation between aid and need and that the quality of institutions and domestic resource mobilization is associated with aid while democracy is not. Finally, I identify and discuss disproportionate nations, mainly large population and middle-income nations. I offer several explanations and potential extensions.

Introduction

The efficacy of foreign aid, specifically "official development assistance" on the prospects of nations and individuals is a hotly debated question. Sachs, Easterly, and others have noted both the ability of aid to deliver transformative social change, while also outlining serious concerns such as dependency and ulterior motives (J. Sachs 2014). If aid truly is to be most effective, however, of critical importance is the question of its correct allocation. One fair general principle with a relevant and intuitive basis for the evaluation of allocation is that aid should go to countries that have the greatest need for it. For example, in late 2019 the World Bank came under fire for assistance to China, which some argue, as an upper middle income country, did not "need" loans (Runde 2019).

In this paper, I explore any differences between multilateral and bilateral official development assistance allocations and "need" in terms of deficits in performance for the Sustainable Development Goals. There is a history of such analysis for poverty, the Millennium Development Goals, and in fragmented sectors covered by the goals. Here, however, I examine the current global sustainable development agenda by contributing a systematic analysis.

I make use of newly released data from the OECD's SDG Financing Lab which uses machine learning to link multidimensional aid data to SDGs via textual analysis of projects and covers all nations available in the Development Assistance Committee's Creditor Reporting System from 2012 to 2017. To get a sense of need I use indicators relevant to the SDGs found in UN and World Bank macro data for a similar time span. These indicators are carefully selected to get a sense of the absolute scale of challenges on an aggregate or population-wide scale.

In terms of data analysis, I begin by computing a mismatch index between shares of aid and need and track this index across years and indicators. Average mismatch is consistently above 1% and on average

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about 2%, which adds up to large deviations in aggregate across all countries of many billions of dollars. Indicators give heterogenous results. I find little change over time in mismatch even after 2015 SDG enactment. Taking a less subjective and ordinal, rather than cardinally robust approach to mismatch I also check a raw ranking of nations with Spearman Correlation Coefficients. The fit for gender, governance, and later goals not present in the Millennium Development Goals worsens. In a regression specification, I check the ability of need to predict aid while also accounting for several other factors behind aid decisions such as the strength of policy and institutions in recipient countries. The sign for need shares is usually positive and significant, and institutions and domestic resources often appear to matter, while revenue mobilization does not. Finally, I examine cases of notable outliers in terms of situations of large disproportionalities and any potential explanations. These are often middle income and large countries (India and China), with several notable aid darlings (Turkey, Vietnam, and others).

The results provide interesting insight into how funding priorities relate to need. They do not necessarily make a judgement about where aid should go, but instead check the judgement that is already implicitly made. I leave open the possibility of several other methods of aid allocation with potential explanatory power such as country distribution and formulas. Further future explorations include changes in variables such as weighing indices by population, tests of allocation according to SDG targets, mismatch interpreted as a percentage of aid received by a recipient, causal analysis, and alternative regression specifications.

Literature Review

A large amount of work has been done on the efficiency of aid to eradicate poverty. Early work was done by Collier and Dollar, who used a series of regressions to determine the effect of aid on growth, and of growth on poverty alleviation under a headcount ratio, average poverty gap, or squared poverty gap (Dollar and Collier 1999). Results suggested that the poverty efficient allocation, accounting for policy and governance, was unambiguously under or over the actual allocation for 52/59 countries, suggesting a large mismatch. Other work focusing on poverty found that ODA per poor person is lowest where poverty is greatest (United Nations, Development Initiatives, and UK Aid 2015). The concern for need in a variety of sectors covered in this paper is not the same as that of poverty efficiency based on growth for aid allocations. However, under a reasonable assumption of declining marginal efficacy or impact for aid, the concepts can become quite similar.

Aside from work on poverty, previous work has been done on the relevance of Millennium Development Goals using Tobit models to account for non-linear relationships between indicators and aid in the form of multilateral and bilateral commitments (Thiele, Nunnenkamp, and Dreher 2007). Controls were implemented for per capita income and governance, and systems with population and equal weightings for countries were considered. Out of MDG indicators considered in the areas of hunger, education, health, sanitation, and environment, only undernourishment and HIV/AIDs prevalence were found to influence respective aid allocations.

However, the Millennium Development Goals were seen by some to focus too much on improvements for poor countries, (J. D. Sachs 2012), so in 2015 a broader and more holistic range of priorities in the Sustainable Development Goals was established. Additional goals relative to the SDGs which can now be evaluated include those on growth and infrastructure and institutions, and sustainability considerations

have been integrated into other targets. I consider the SDG agenda in a new time period and focus on aid disbursements rather than commitments.

There has also been fragmentary and non-systematic exploration of allocations and need for individual sectors or sustainable development goal areas, with mixed findings. For example, the allocation of food aid (in line with SDG 2 concerning hunger) has been shown to be driven by not just demand, but also supply side factors (Qian and Nunn 2015). Health aid has been found to be responsive to country needs in terms of child and infant mortality and HIV prevalence through a larger number of projects and average aid value by donor (Lee and Lim 2014). A regional analysis of water and sanitation ODA commitments versus the share of global population without improved sources found potential overfinancing in Western Asia and North Africa and potential underfinancing in Central and Southeaster Asia (UN-Water and World Health Organization 2017). Gender gaps in health and education have been found to be associated with larger allocations of aid in those sectors and overall (Dreher, Gehring, and Klasen 2015). In my work I instead try to take a more systematic approach for each of the goals. One key advantage is that of comparability between goals and priorities in terms of the level of matching.

Finally, detached from any particular development goals, past work has also examined bilateral sectoral allocations of aid across the sectors of food, health, humanitarian aid, transport, communications, energy, education, and debt relief from the 1970s to 2000s (Kasuga 2008). Need was determined for each country and sector on a quantile basis with 20 quantiles for performance on World Development Indicators. Recipient aid was found to generally fit recipient needs well using Spearman's rank coefficients which do not assume that the relationship between aid and need is linear (similar to the check of ranking in this paper). Food, health, and STD control aid were relatively well allocated, but education and debt relief were not. I use updated SDG sectors, cover multilateral aid and more bilateral agencies, and test assumptions more complex than rank ordering over a different time period.

Data

My main source for data on foreign aid is that of the OECD Development Assistance Committee's Creditor Reporting System (OECD 2020). Specifically, I make use of compilations of CRS data completed by the OECD's SDG Financing Lab (OECD 2020), which makes use of machine learning (textual analysis) of projects to sort data on aid into SDG categories. The lab tracks aid to numerous developing countries from 2012-2017, and overall 76 percent of all CRS projects have been linked to at least one SDG (Pincet, Okabe, and Pawelczyk 2019).

One key advantage of the methodology used by the Lab is an allowance for the multidimensionality of aid with respect to goals, rather than simple sectoral allocations used in earlier work. This perspective allows for the development of goals such as the reduction of inequality which may not fall into traditional sectors, or gender equality, which may be a secondary benefit for certain projects. For this paper, I focus on official development assistance (from the public sector), as it is the most likely to be influenced by the sustainable development goals and targeted based on need. Although ODA, and particularly bilateral assistance may have a political motive, private finance is likely to have a profit motive, and ODA may be a better fit to sustainable development priorities. I also focus on flows rather than net aid, which does not appear to be a necessary distinction due to the Lab's coverage only of a large amount of developing nations. The lab provides data on ODA gross disbursements and

commitments, but here I focus on disbursements since this represents the actual amount distributed rather than just merely what is promised.

In choosing metrics to represent SDG need, I mostly draw inspiration from the official indicators monitored by the UN Statistics Division (United Nations Statistics Division 2019). Considering this list, I attempt to choose indicators which adequately represent the scale of the problem for need in dollar terms for each goal (Table 1). They include costs, financing gaps, or population sizes. In some cases, the use of indices is unavoidable, particularly for goals relating to inequality or for more abstract cases such as gender and governance performance. Data for these topics is less interpretable and aggregable.

Table 1: Aggregable Indicators Relevant to Sustainable Development Goals

Sustainable Development Goal	Primary Indicator	Other Indicator
SDG 1: No Poverty	Cost to Solve Ext. Poverty with Perfect Targeting	Count of Ext. Poor
SDG 2: Zero Hunger	Count of Undernourished	
SDG 3: Good Health and Well-being	Health Spending Shortfall from High Income Per Capita Levels	
SDG 4: Quality Education	Govt Spending on Ed Shortfall from High Inc PC Levels	Count of Illiterate
SDG 5: Gender Equality	UN HDI Gender Inequality Index	WB Women, Business and the Law Index
SDG 6: Clean Water and Sanitation	Population Without Safely Managed Drinking Water	Population Without Safely Managed Sanitation
SDG 7: Affordable and Clean Energy	Population Without Access to Electricity	
SDG 8: Decent Work and Economic Growth	Number of Unemployed (ILO)	
SDG 9: Industry, Innovation and Infrastructure	Investment in Transport Shortfall from High Income Per Capita Levels	Investment in Energy Shortfall from High Income Per Capita Levels
SDG 10: Reduced Inequality	Gini Index	
SDG 11: Sustainable Cities and Communities	Urban Population in Slums	Economic Loss due to Disasters
SDG 12: Responsible Consumption and Production	Emissions per GDP	
SDG 13: Climate Action	Non-Renewable Energy Share of Total Electricity Output	
SDG 14: Life Below Water	Percent Marine Protected Areas Shortfall from High Inc PC Levels	
SDG 15: Life on Land	Percent Terrestrial Protected Areas Shortfall from High Inc PC Levels (and land area itself)	
SDG 16: Peace and Justice Strong Institutions	Internally Displaced Persons by Violence	WGI Public Sector and Institutions Index

SDG 17: Partnerships to Achieve the Goals	Domestic Resource Mobilization Index/Efficiency of Revenue Mobilization Score	Statistical Capacity Score

For most indicators I use data compiled by the World Bank on the Open Data platform (World Bank 2020). I make use of UNStat data for information on undernourishment and GDP loss due to disasters (United Nations Statistics Division 2019). For gender data I use both the UN HDI's Gender Inequality component and the World Bank's Women Business and the Law index, available separately (United Nations Development Program 2019; World Bank 2020). As regression controls, I use World Bank information on World Governance Indicators for Public Sector Institutions and Domestic Revenue Mobilization, also from Open Data. Finally, to represent democracy, I use the Polity IV combined revised polity score (Polity Project 2019).

A table of the summary statistics in long format is available as appendix Table A1. Note should be given to data availability. Aid observations from the OECD are available for about 130-150 countries for all years and sectors. Fortunately, basics such as levels of GDP and population needed for other calculations have similar availability. Poverty observations are available for around 40 countries every year and other items such as transport and energy have even less data, but on the other hand constructed indices such as those for gender and governance have near-perfect availability; numerous indicators fall in between. More data may be interpolated or extrapolated (even making use of years outside of 2012-2017), but preliminary analysis (of at least mismatch covered in the section below) suggests similar results.

Methodology & Results

The first measure of the relationship between aid and "need" that I present is that of a mean mismatch index. For each aggregable indicator in Table 1, I begin by computing the share of worldwide need in that indicator for each country and year. I then use data on SDG financing from the OECD to compute shares of total ODA disbursements for each sustainable development goal for each country and year. Matching each indicator to the relevant SDG aid category, I compute the following index across countries for each year:

$$Absolute\ Mismatch\ (Indicator, Year) = Mean|Share\ of\ aid - Share\ of\ need|$$

The use of absolute value masks the direction of any misallocation, but other formulas may also be calculated, such as those for the mean squared mismatch (weighing larger deviations more), and raw deviation (without absolute value adjustment) which may be useful for examining particular cases, but not for aggregation. Attention in computation is also given to missing values, as I compute shares only over countries for which both need and aid data are available to avoid distortion. As a final note, the index is a mean and not a sum since such a procedure would lead to bias towards low mismatch for indicators with large amounts of missing data and would be more difficult to interpret.

A benefit of the mismatch index is that it provides a quantifiable value for the level of allocations departing from what one would expect based on a match of aid and need shares. The maximum total absolute misallocation would be a level of 200% of all global aid if, for example, one recipient had all global need, but another recipient got all global aid. Such a figure could be easily dollarized. The below

table provides a basic sketch of the scale of percentages present in dollar terms.[1] Here we can get some sense of the billions of dollars at stake every year from even small misallocations.

Table 2: Average Annual ODA Disbursements by SDG, Possible Mismatch in Dollar Terms Calculation

SDG	Average Aggregate ODA Disbursements (millions USD)	Avg. Amount Represented By 1% Avg. Absolute Mismatch * 40 countries[2] (millions USD)	Avg. Amount Represented By 1% Avg. Absolute Mismatch * 140 countries[3] (millions USD)
1	5179	2071.6	7250.6
2	13301	5320.4	18621.4
3	16909	6763.6	23672.6
4	11278	4511.2	15789.2
5	2120	848	2968
6	7246	2898.4	10144.4
7	9677	3870.8	13547.8
8	8192	3276.8	11468.8
9	14873	5949.2	20822.2
10	4948	1979.2	6927.2
11	8309	3323.6	11632.6
12	2021	808.4	2829.4
13	3050	1220	4270
14	872	348.8	1220.8
15	2546	1018.4	3564.4
16	12746	5098.4	17844.4
17	8628	3451.2	12079.2
Total	131895	52758	184653

Figures 1-3 depict the mean absolute mismatch measure in share/percentage terms for the 26 indicators initially considered across all countries over time. Missing data is excluded.[4]

Figure 1: Mean Absolute Mismatch, Indicators 1-9

[1] At the time of writing, work to calculate and present dollar figures for indicators, countries, and years was still underway (contact the author if interested).

[2] The assumption of 40 countries is chosen as an approximate figure for the number of poverty observations available each year: hence it is more towards a lower bound for this dollar figure, as many indicators have observations for more nations in every year.

[3] The assumption of 140 countries is chosen as the number of countries with OECD aid data as well as any population data (basically any World Bank data): hence it is more towards an upper bound for this dollar figure.

[4] Figures A1-A3 in the appendix also plot minimum mismatch, always close to zero, and maximum mismatch, which varies wildly by indicator and year and produces axes which are more difficult to interpret.

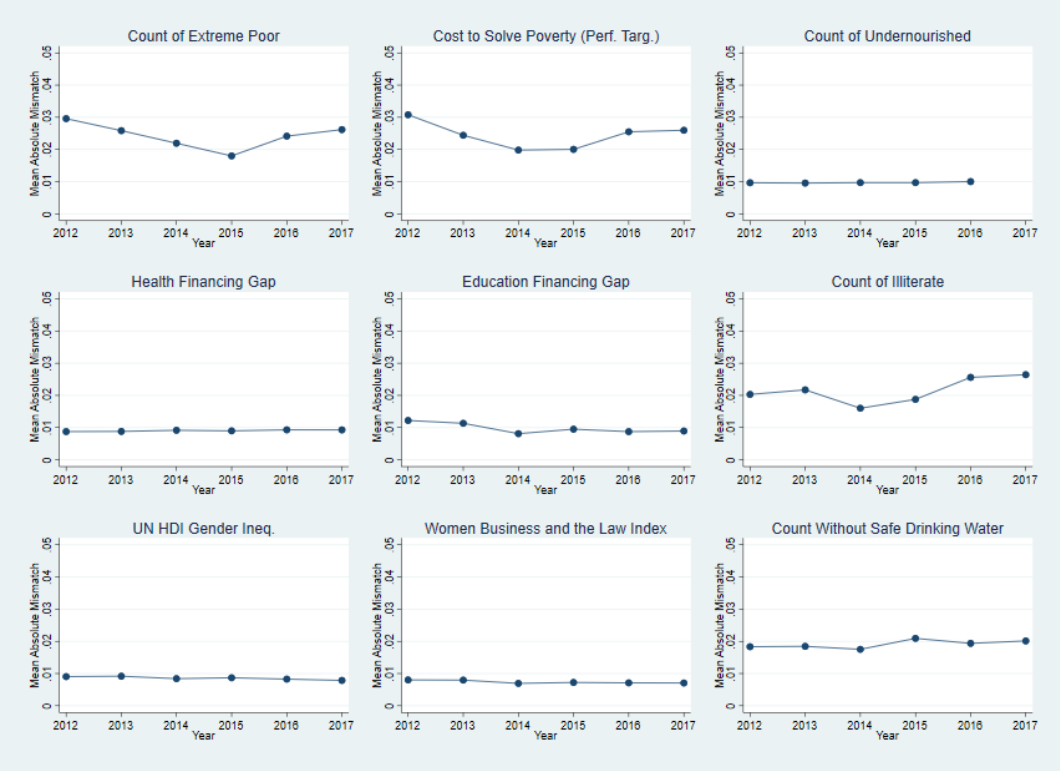


Figure 2: Mean Absolute Mismatch, Indicators 10-18

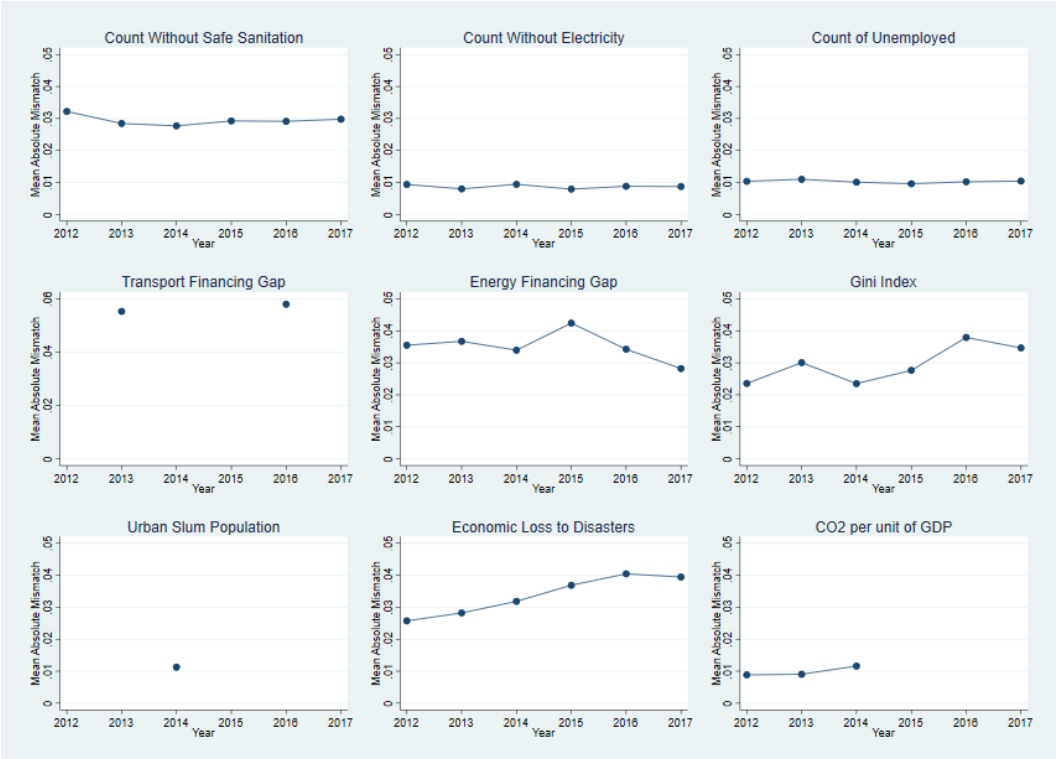
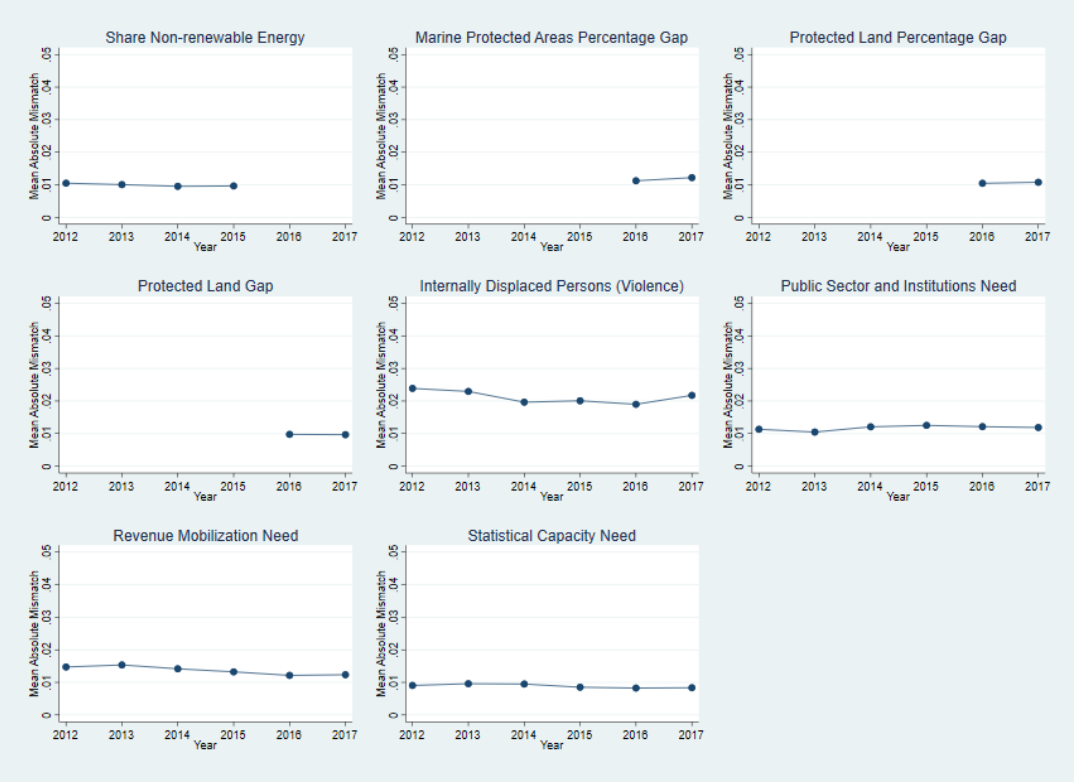


Figure 3: Mean Absolute Mismatch, Indicators 19-26



Three clear classes of fit appear to emerge. Indicators with a mean absolute mismatch of above or around three percent include numbers of individuals without safe sanitation, energy (infrastructure) financing gaps from rich country levels, the Gini index in recent years, and economic loss to disasters (particularly in recent years). Sanitation may be a less salient and politically attractive goal compared to drinking water, which leads to a poorer fit. The energy financing indicator notably includes private sector investment, which may not form as good of a fit as public spending. The Gini index is rather difficult to conceptualize as a target for aid funding with a need share interpretation, and inequality may be seen as an internal political issue. Mismatch on loss due to disasters appears to be rising overtime, a concerning trend, although this result and the one for transport financing (the worst fit) may be the product of fairly poor data availability.

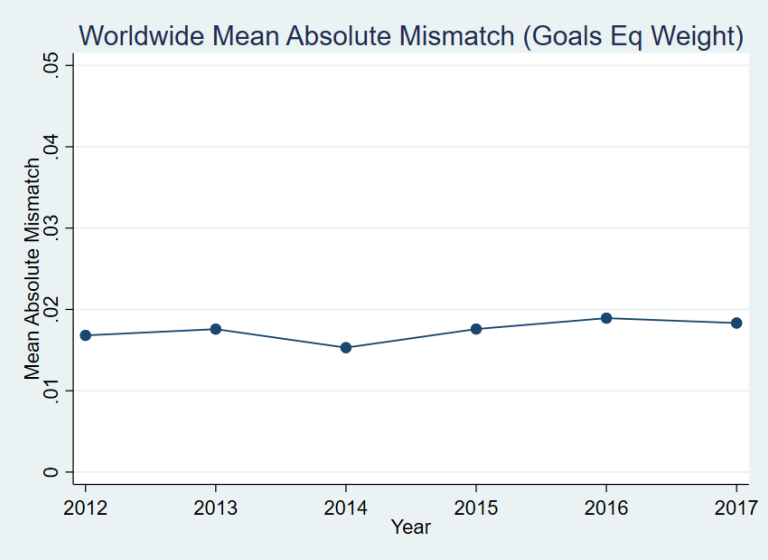
More indicators form a next class, with absolute mismatch around two percentage points. For both poverty indicators, the count of extreme poor and cost to solve poverty, mismatch fell to around two percent in 2015, the year of passage for the sustainable development agenda, but has since increased back to around three percent, perhaps suggesting shifting priorities. The fit for count of illiterate is for some reason substantially worse than that for education financing gaps, and mismatch is growing. Another moderate fit is the count without safe drinking water, a surprising result due to the potential salience of this goal but also one in line with previous work (UN-Water and World Health Organization 2017). Finally, the fit is also moderate for the count of internally displaced persons due to violence, but this may be due to a broad definition for the relevant goal of peace, justice, and strong institutions.

Among the best fit indicators in terms of mismatch are undernourishment, health and education financing, gender inequality, count without electricity, unemployed, urban slum population, CO2 per unit of GDP, non-renewables and protected areas shares, and scores on governance indices. Along with

earlier literature (Kasuga 2008), food and health aid appear to be well matched. In contrast to this work, however, education financing is well matched, although fit to illiteracy was poorer. Gender aid is also well matched in line with past research (Dreher, Gehring, and Klasen 2015). Fit is surprisingly good for other areas not covered in past literature, such as energy, unemployment (aid being for infrastructure), urban slums, and environmental and governance variables, although some of these results (particularly for governance) may be driven by the structure of the indices used, which are not well suited to aggregation.

Figure 4 allows for a step back and a closer examination of the dynamics of mean mismatch across the period studied. Equal weighting for the mean was given to each of the 17 Sustainable Development Goals.[5] No clear trend or pattern emerges, and it appears that the global mean has been relatively constant over time. A slight dip for 2014 could represent some sort of enthusiasm for Sustainable Development Priorities in the run-up to the launch of the global goals, but such a phenomenon is far from evident. The world has much work to do if reducing mismatch is a global target. Mean levels of about two percent of the global total appear to be persistent for all countries, and this level represents a large amount of aid in aggregate.

Figure 4: Worldwide Mean Absolute Mismatch, Equal Weight for Each Sustainable Development Goal



The calculation of mismatch indices implicitly suggests an ideal linear relationship (with a coefficient of 1) between aid and need shares, an assumption which may be overly restrictive. A weaker assumption is that of ordinality, merely that countries with larger shares of need should receive larger shares of need. To quantify this assumption, in the spirit of past literature (Kasuga 2008), I make use of a Spearman's rank correlation measure. This calculates a coefficient between country aid and need for each indicator in a given year. In Figures 5-7, I plot these coefficients across time.

[5] See appendix Figure A4 for a graph also including the minimum and maximum, Figures A5 and A6 for equal weighting for each indicator.

Figure 5: Spearman's Correlation, Indicators 1-9

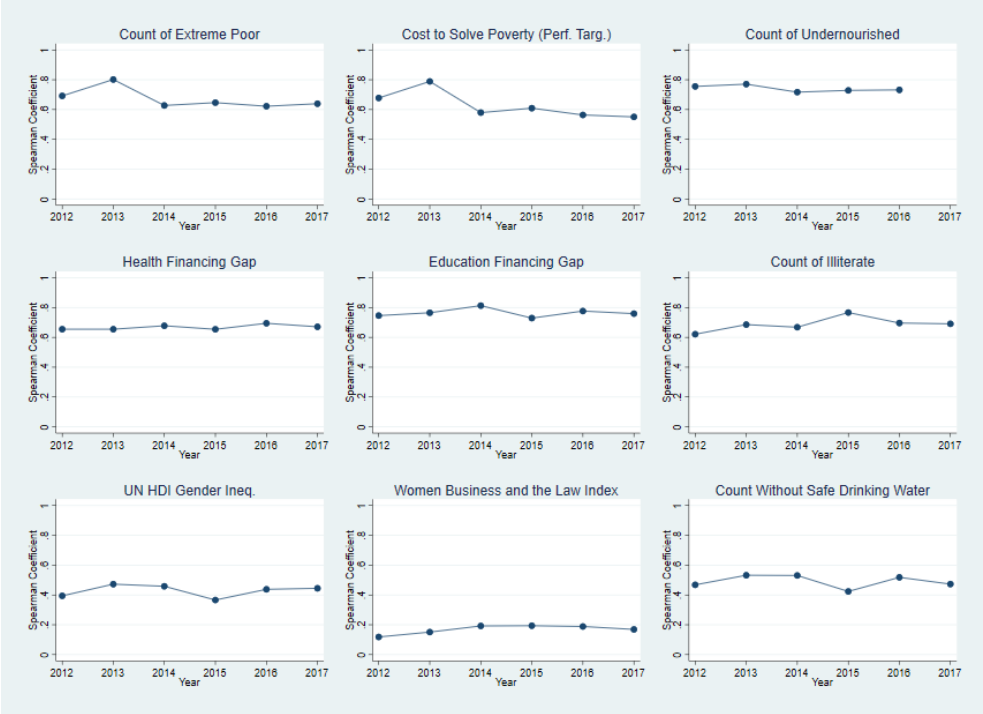


Figure 6: Spearman Correlation, Indicators 10-18

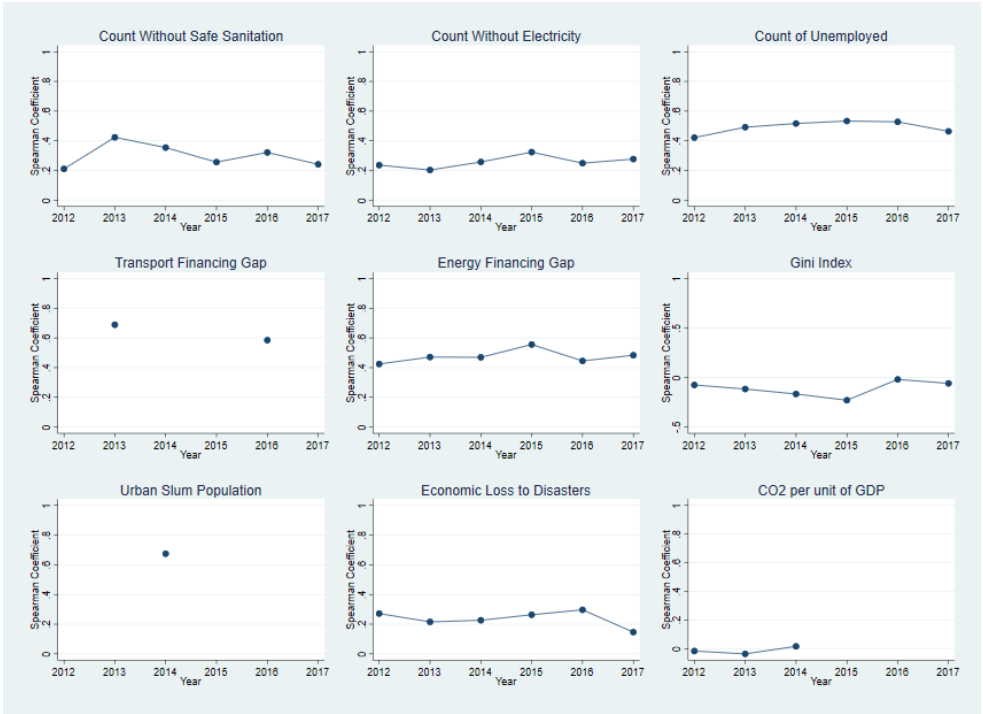
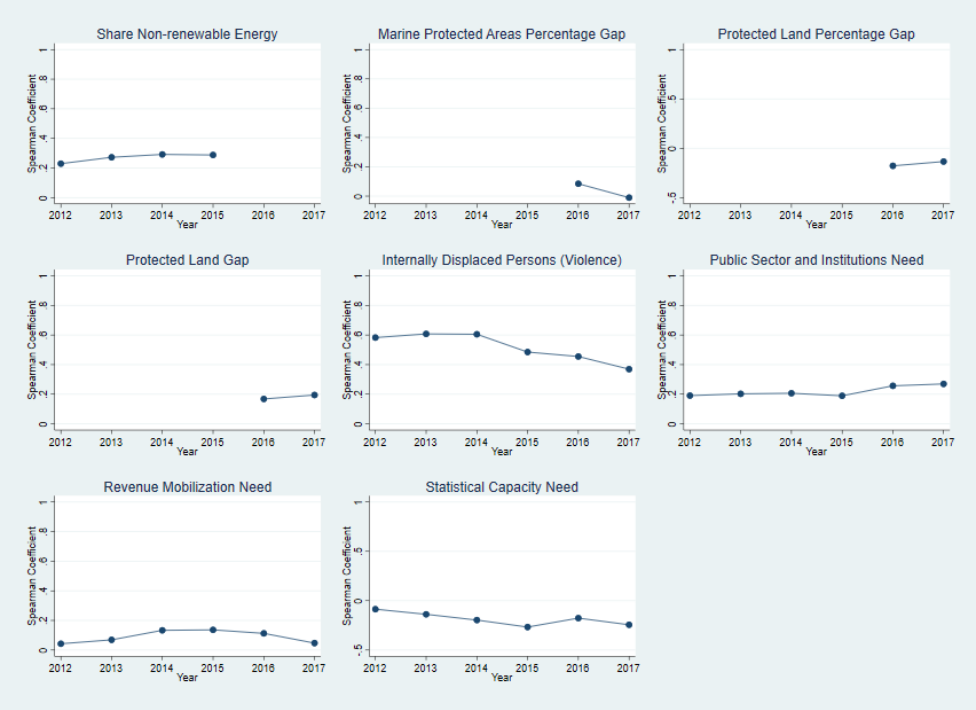


Figure 7: Spearman Correlation, Indicators 19-26



Matching rank correlation results in previous literature, food aid is particularly well allocated, with a strong correspondence with rankings on count of undernourished (Kasuga 2008). The closest correspondence, however, probably is that of education financing, with a coefficient of about 0.7 to 0.8, with illiteracy doing similarly well. Despite moderate levels of mean mismatch, poverty aid is very well allocated in rank terms, with both metrics consistently above a coefficient of 0.5 and reaching particularly high levels in 2013, before the Sustainable Development Era. Health financing continues to appear to be well allocated. Despite limited data availability, allocations are surprisingly good for both transport financing and urban development linked to slum populations, a contrary finding to high mismatch for transport.

Indicators with moderate correlation coefficients of around 0.5 include the UNHDI Gender Index, population without safe drinking water, unemployed population, energy financing, and the count of internally displaced persons. A poorer fit for gender than the mismatch index seems to better support a narrative of gender as a secondary rather than primary focus for many projects; allocation related to the World Bank's Women, Business, and the Law Index has an even lower coefficient. Drinking water again outperforms sanitation. The fit for unemployed is unexpectedly good considering the relevant goals focus on infrastructure, and a similar case applies for internally displaced persons despite a broad goal focus of peace, justice, and strong institutions (although a downward trend is notable). Energy financing gaps on aggregate appear to have a better fit than access to electricity or the share of nonrenewables despite or perhaps as a product of limited data.

Low correlations are somewhat expected for the Gini index, economic loss due to disasters, and governance. Of interest are the several near zero or negative coefficients for CO2 per unit of GDP, protected marine areas gap, and revenue mobilization. A Kuznets curve style explanation may apply to CO2 emissions which may be higher for middle income nations that also receive less aid. An explanation

for marine areas does not come as easily. Revenue mobilization appears to have low levels of mismatch, admittedly perhaps due to the construction of the index, but a contradictory low coefficient may better indicate a reality in which domestic resources are treated as more of a complement than substitute for aid.

OLS regressions of shares of aid on shares of need, particularly when including controls for the quality of country institutions and capacity reveal other interesting insights (appendix Table A2-27).[6] Most indicators are positively signed and significant for at least 5%, with the notable exceptions of the Gini Index, CO2 emissions, non-renewable energy, marine protected areas, and statistical capacity. Urban slum populations significantly inform aid shares only when accounting for democracy, institutions, and revenue mobilization. Protected land gaps from rich country levels display a negative relationship, with more protected land leading to more aid. This may be driven by effects such as a need for higher maintenance funding or more compensation to match opportunity costs in cases such as, for example, the protection of the Amazon.

Regressions also indicate the importance of democratization, institutions, and domestic revenue mobilization for aid. Democracy is a relatively weak influence, with a significant but extremely small positive effect for gender aid, a negative sign for transport aid (perhaps a result of Chinese investment), and a somewhat positive sign for internally displaced persons. Institutions appear to matter for some indicators, generally with a positive sign. Institutional quality drives poverty aid less than need, but unemployment aid more than need. It is also associated with electricity financing. Better institutions counterintuitively reduce aid for health. Domestic revenue mobilization generally tends to complement aid, with clear signs for food aid, health financing, sanitation, and disaster vulnerability.

Finally, a tracking of disproportionate cases in terms of absolute mismatch helps put a face on the landscape of sustainable development focused aid financing (contact the author for relevant Excel files). For this analysis, I compile all cases with absolute mismatch figures of larger than 10%.

Several general insights emerge from the tracking of disproportionate cases (for full details, see Appendix Note A1). By construction, the choice of 10% benchmark leads to focus on middle income countries, where shares of aid and need are large and where data is most readily available. Relative aid darlings include Turkey, Vietnam, Egypt, Afghanistan, and Pakistan. Turkey and Pakistan, likely nations of strategic importance appear to be overfinanced for poverty and illiteracy.

Due to the general population- or size-weighted nature of the indicators chosen, India and China receive persistent under allocations of aid across numerous categories. These include poverty, energy, health, hunger, sanitation (for China), population without electricity (for India), urban slums (for China), transport, education, and unemployment. In addition, indicators for poverty show a lot of distortion with an underfunded Brazil (in addition to an underfunded DRC and Indonesia and overfunded Colombia, Ghana, and Tanzania in some years). As BRICS nations, it is possible that India, China, and Brazil are seen as highly capable of mobilizing domestic resources; indeed many of the indicators for

[6] For this project, an explicit choice was made to exclude fixed effects and capture raw association (OLS) in regression, given that country/time characteristics can be left as an unexplained or non-need-based factor in allocations and that such characteristics are likely to absorb excessive variation on such a short time scale. Preliminary analysis showed fixed effects reduced need share's significance (contact the author for results).

which aid did not measure up to need for these nations showed positive coefficients in regression for the domestic resource mobilization score.

Several interesting single cases are observable as distortionary events. Jordan, a nation with relatively little need in terms of count without water or sanitation has received massive water/marine aid allocations, likely counted as the result of the ongoing Red-Dead Sea Project. Brazil seems to drive an interesting phenomenon in the protected lands gap metric: although Brazil has large amounts of protected land (likely the Amazon), it receives a large amount of aid. The interpretation of a protected land gap needing more aid (presumably to convert unprotected land to protected status) may be inaccurate. In this case it is possible that growing protected lands necessitates larger continuous flows of aid to either maintain areas or compensate for the opportunity cost of development. Finally, Colombia has consistently experienced a large economic loss due to disasters but receives little aid. This could be due to natural factors such as landslides or the FARC rebellion.

The fit for climate indicators, gender indicators, governance indicators, and Gini coefficients is particularly poor, suggesting difficult interpretation. Egypt received large allocations for climate aid in 2012 and 2014, possibly loosely related to the Arab Spring. Nonrenewables based financing shows perhaps logical large aid allocations for India, China, Brazil, and a less logical one for Vietnam, but without actual energy figures, need shares are hard to interpret. Notable is a large allocation for Pakistan on gender projects relative to that county's size but making judgements about the depth of inequality is difficult. In other cases, the relevance of indicators to goals presents a problem. Large peace, justice, and strong institutions (SDG 16) focused aid goes to Afghanistan (itself receiving over 10%), Chad, Ivory Coast, and Myanmar, perhaps with good reason, but this is a poor fit for revenue mobilization as opposed to public sector and institutions scores. A similar case applies for SDG 17 "partnerships" aid in the billions to ivory coast, Egypt, Myanmar, Serbia, representing over 10% of world totals. These items could represent peacebuilding projects, but the fit for statistical capacity is poor.

Conclusion

In summary, the general fit for most indicators appears to be mediocre. When multiplied across dozens and perhaps up to over a hundred countries, an average mismatch of even 1% suggests massive misallocation towards a maximum possible of 200%. Spearman correlations below 0.5 for many indicators and down to below zero for some suggest problems even with a generous rank ordering assumption. As shown in preliminary calculations, the aid involved may reach dozens of billions. Nonetheless, most regression cases show positive relationships, and there are rarely more than a handful of countries with disproportionality more than 10% of the global total (although this is a generous cut-off).

The finding of a mediocre fit for aid to need on specific indicators is not particularly surprising. A common practice for the allocation of Official Development Assistance is the distribution of funds on a country basis; amounts are often determined for each country, and then themes or sectors (which correspond to development goals) are chosen (Paulo, Janus, and Holzapfel 2017). In this case, one would not expect perfect allocation among countries, but at least within countries aid may be likely to flow to sectors with relevant need. The findings of this paper and others may inform debate about reforms and changes to this approach.

One feature of the SDGs is their intent to cover both developed and developing nations, particularly on items such as climate. This project covered only developing nations found in OECD aid data, and it is possible for some goals that little concern is given to foreign aid as a tool in general used in these developing nations, particularly relative to other tools such as the promotion of policy change or greater respect to sovereignty in the reduction of inequality. Another key assumption to note is that the fungibility of aid is expected to be limited; if aid is considered fungible by donors, little attention may be given to sectors of allocation.

However, in other cases one might expect the fit of aid to need to perform better. Several international organizations use formulas and allocation methods which seem to focus on need to allocate official aid under their purview. Recipients of certain funds must broadly meet certain loose criteria. The World Bank determines eligibility for IDA resources using indicators such income per capita, population size, and other measures of country performance (World Bank 2020). The European Cohesion fund within the EU is for states with GNI under 90% of the EU average (Kołodziejski 2020). In some cases, more nuanced and direct consideration of needs through indicators is utilized. UNICEF prioritizes nations with great humanitarian need and uses formulas including the size of the child population and the under-five mortality rate (UNICEF 2013). Although these methodologies vary by organization, and it is difficult to measure adherence to them, they at least demonstrate that some sense of need appears to be present, particularly for multilateral aid allocation.

Another lesson clear from the data is that there is significant heterogeneity by goal and indicator. Mismatch shows very good fit for later goals and food, health and education, a fair fit for poverty, and the poorest fit for middle goals (growth, inequality, energy, sanitation). Spearman coefficients show best fits for low number goals and poorer fits for higher numbered ones (excepting sanitation and transport; CO2 has a negative coefficient). Broadly, low number goals excepting poverty have the best fits, middle and later goals show poorer fits (except for internally displaced persons), and gender, governance, and CO2 look poor in rank but not mismatch terms.

One general hypothesis supported appears to be that it has taken time (at least through 2017) for countries to adjust development priorities to the new sustainable development agenda made official in 2015. Better fit of aid to need for lower goals suggests that focus has remained on priorities carried over from the millennium development agenda, except for gender and environmental sustainability in the broadest terms (see Figure 8). Across all indicators, there is no clear trend in mismatch over time, and Spearman coefficients appear to be decreasing if anything (notably for internally displaced persons, economic loss due to disasters, and statistical capacity). There does not appear to be any break point in 2015 with the adoption of the sustainable development goals, although further statistical analysis should be conducted to further confirm this point, perhaps making use of tools such as a Chow test in regression.

Figure 8: From MDGs to SDGs

Source: (Nakatani 2016)

The regression analyses conducted offer some glimpse into the factors that matter for aid for sustainable development priorities. A significant and positive OLS coefficient for need is demonstrated for most indicators. Institutions and revenue mobilization matter for a few goals, while democracy largely does not. But the R^2 in regressions is frequently almost always under 0.2 in even the most complete specifications (for updated regression tables containing R^2s, contact the author). Hence the capture of all variation in shares of aid by shares of need remains elusive, and other factors should be considered.

The literature offers numerous alternative explanations for factors informing the allocation of aid that go beyond the institutional, democratic, and domestic resource factors considered, and which might be quantified in future regressions. There may other factors which inform aid's perceived efficacy. For example, aid may be used as a reward (or complement) for good policy (Collier and Dollar 2004). Bilateral aid is often not dispersed according to need, but rather according to political and strategic considerations (Alesina and Dollar 1998). Yet another school of thought suggests aid should aim mostly for the equalization of global opportunities, rather than just merely conditions as might be suggested by need based on many of the indicators tested (Nadeau and Lewis-Beck 2001).

Finally, a key insight from the disproportionate country analysis was that large deviations came mostly from middle income nations. Among the countries covered in the OECD aid dataset, middle income countries may be the most likely to have indicator data available and are thus be more likely to be flagged as disproportionate. Nevertheless, other substantial arguments are also compelling. One potential explanation is that of a slow adjustment to middle income status by donors which leads to overallocation to many (such as Vietnam and Turkey) but does not necessarily explain underallocation to others (India and China). Middle income nations also tend to have large populations and economies, so another explanation comes from the political economy structure of the United Nations. The United Nations is very much a collection of states with equal sovereignty (for example, General Assembly and Security Council votes are one per nation), rather than a more direct democratic organ giving authority based on population (although there have been proposals to reform this). Such motivations may carry over into the sustainable development goals or into general country strategy concerning the allocation of aid related to them, if they are even a salient factor. Whichever hypothesis may apply, policy makers should pay close attention when considering allocating large sums of money to middle income countries which may have relatively large or small needs, and further work should be done to test explanations, perhaps through controlled regression.

Another means of interpreting disproportionate country cases is through and implied efficiency framework. If aid, for example, is being allocated to maximize benefit for recipients, then (making reference to Note A1 in the appendix) since the DRC possesses 34% of cost to solve poverty need but only 2% of poverty aid, it could be assumed that perhaps aid is 17 times more effective. This seems implausible; in admittedly extreme cases like this, we find further support for the hypothesis that aid is informed by factors other than raw need.

The completion of this project leaves the possibility for much deeper exploration in several areas. Much more could be done even making use of the same data, and more indicators could be added to the analysis or the construction of existing indicators could be adjusted. For health, original intent was that of including measures such as the life expectancy at birth shortfall from high income levels, and maternal and child mortality in number of deaths, but unfortunately, such as population of mothers/children relevant appear to be missing from World Bank data. Nonrenewable energy shares could be converted into aggregate terms or units of electricity with more data, and CO2 to raw emissions levels. For SDG 8, the addition of data on GDP per capita growth was considered but was found difficult to aggregate into a meaningful measure (although perhaps gaps from 2% per year or from high income levels could be utilized). Also considered was the weighing of Gini, governance, and gender indices by population rather than leaving them in the form of fixed scales with excessively equal weight for each country, but such a change might reduce interpretability. Need for these goals may be too difficult to aggregate in a share/index form, so perhaps more focus should be given more to Spearman coefficients.

Some other subjects of analysis may also be interesting. Although other literature has focused on the allocation of aid by sectors and countries in aggregate and on the analysis of specific donors, more work could be done on the testing of the relative relevance of each development goal and any possible revealed preferences. Another possibly more restrictive conceptualization of need to analyze would be direct deficits from the targets (in aggregate or percentage terms) associated with specific sustainable development goals (Ritchie and Mispy 2018). Finally, absolute mismatch might be computed as a percent of the share given for each individual country; 1% of all aid surely has a different meaning for a small versus a large recipient.

As is present in most analyses of aid, there is the caveat of potential reverse causality. It could be that aid leads to significant improvements on sustainable development indicators; “misallocations” to countries with little need are tremendous success stories. The time scales involved in such an interpretation and analysis of what we know about the efficacy of aid make such an explanation seem less plausible; an immediate (within a year) and large impact does not seem likely, but I leave the causal statistical analysis to rule out such a story completely to other work using instrumental variables and panel methods.

With the controls already implemented, new specifications could reduce any possible collinearity between, for example, democracy and institution scores. Nonlinear models could be used in line with past work and could test an assumption of declining marginal efficacy. Raw values of aid rather than shares could also be analyzed.

This project has hopefully revealed some interesting observations and potential lessons for the allocation of aid according to need in the sustainable development era. This conceptualization of need

does not necessarily need to be the normatively accepted one. But in any case, careful reflection on the allocation of aid such as that offered by this study is important.

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Appendix

Table A1: Summary Statistics, Variables in Long Format

	mean	sd	count
SI.POV.GINI	39.81255	8.022751	263
EN.ATM.CO2E.PP.GD.KD	.2392621	.1796158	401
VC.IDP.TOCV	717515.8	1369293	302
extPoorCt	2944790	8112045	263
costSolvePov	1599012	4630788	263
illiterate	7053372	1.50e+07	208
noSafeWater	1.57e+07	3.09e+07	306
noSafeSan	3.10e+07	8.16e+07	246
noElec	6977038	2.04e+07	840
uSlumPop	9039102	2.38e+07	83
unemployedCt	1110423	4011330	768
NRenShare	-.3342274	.342943	564
NPSI	.3886957	.0950039	460
NRM	.3113044	.1001221	460
NSCS	.3486855	.1654614	825
HfinGap	1.23e+11	4.63e+11	783
EfinGap	5.39e+10	1.75e+11	429
PLandPGap	.0871015	.0744512	276
PLandGap	42953.84	89855.78	272
PMrnPGap	.1309126	.0433065	205
TfinGap	1.14e+10	3.03e+10	50
EnfinGap	9.46e+09	3.92e+10	202
SN_ITK_DEFCN	6.517368	23.14222	570
VC_DSR_GDPLS	1.64e+09	1.29e+10	318
polity2	3.176136	5.638236	704
GI	.4585024	.1373504	633
WBLIndex	32.60662	15.4838	816

Figure A1. Max-mean min graphs: hard to read, largely driven by massive maximum fluctuations.

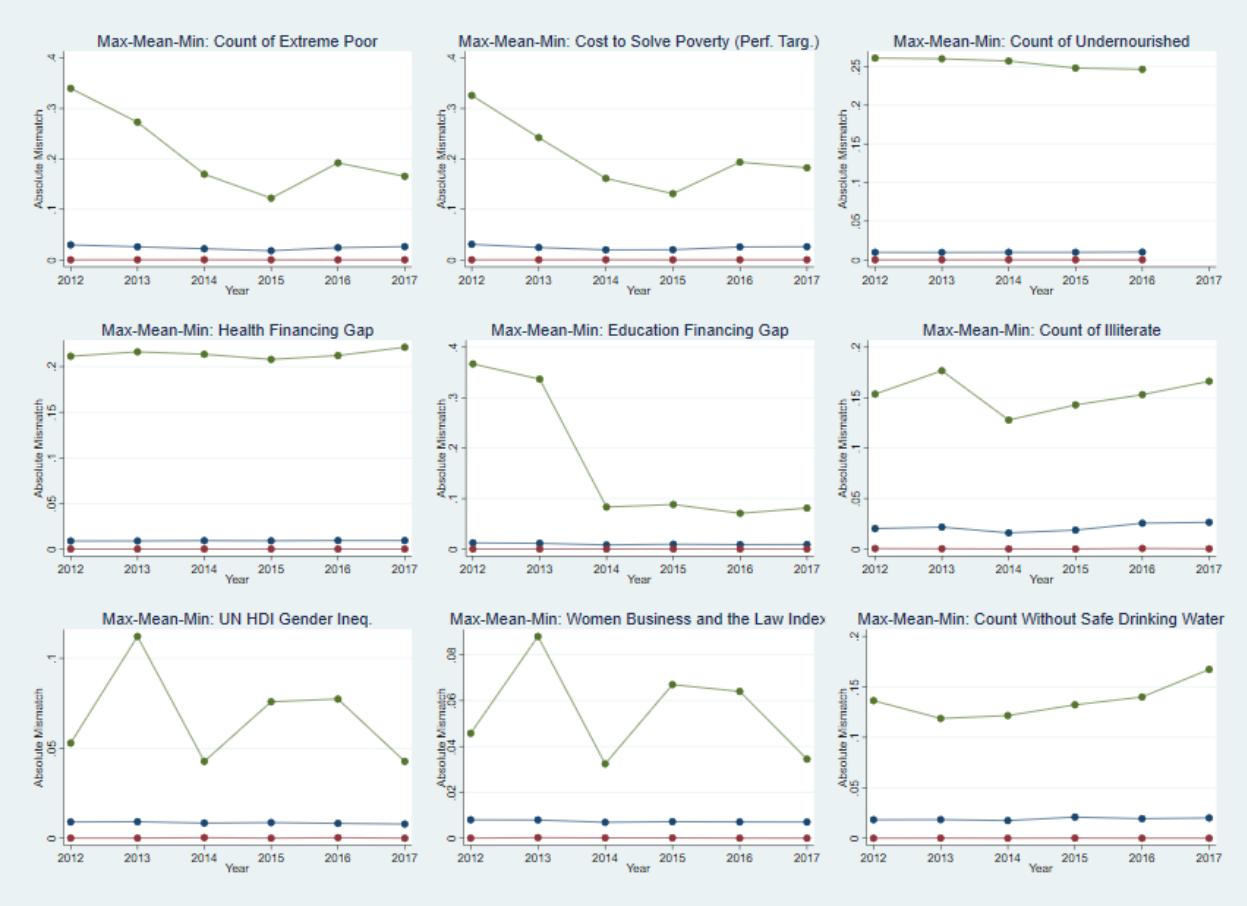


Figure A2. Max-mean min graphs: hard to read, largely driven by massive maximum fluctuations.

Figure A3. Max-mean min graphs: hard to read, largely driven by massive maximum fluctuations.

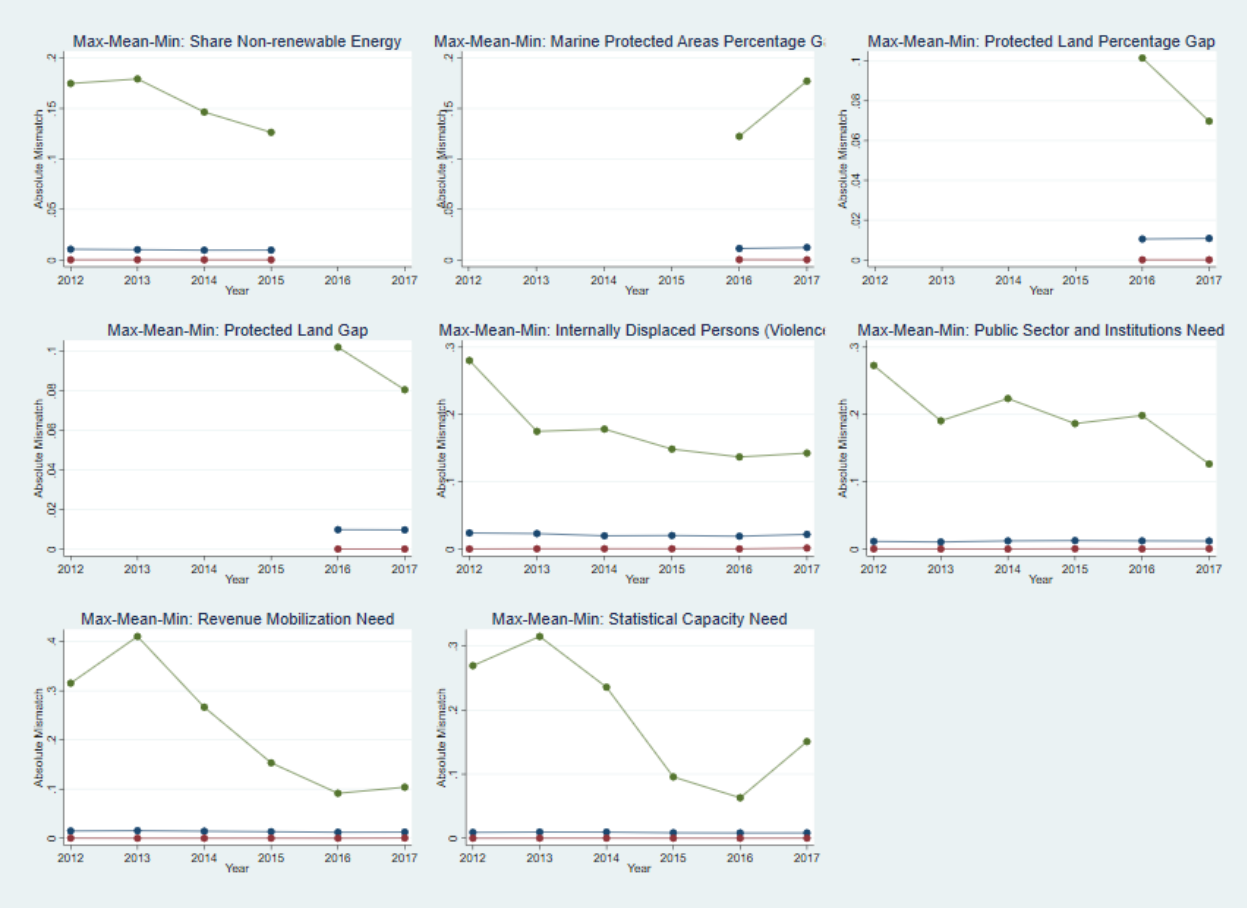


Figure A4: Max-Mean-Min Mismatch, Equal Weight for Goals

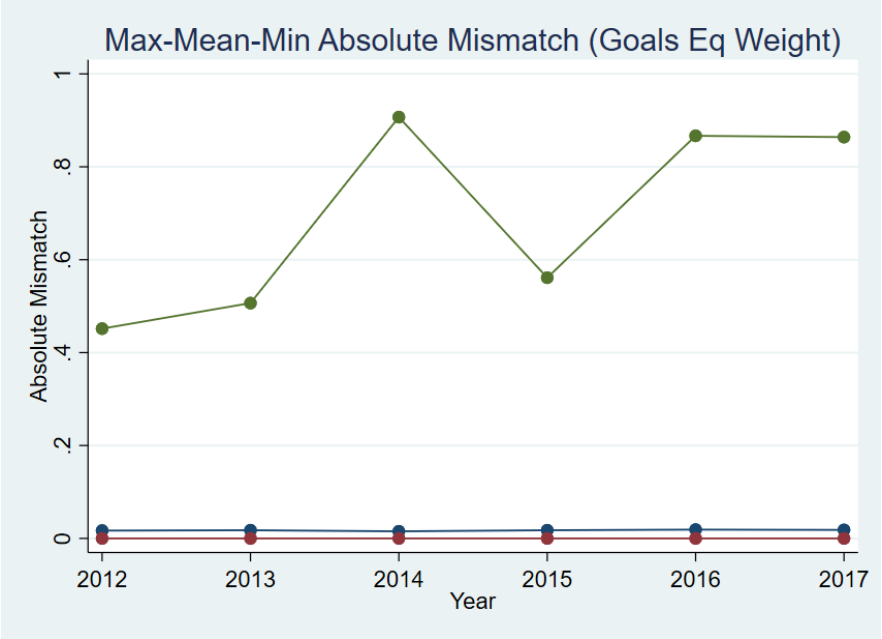


Figure A5: Mean Mismatch, Equal Weight for All Indicators

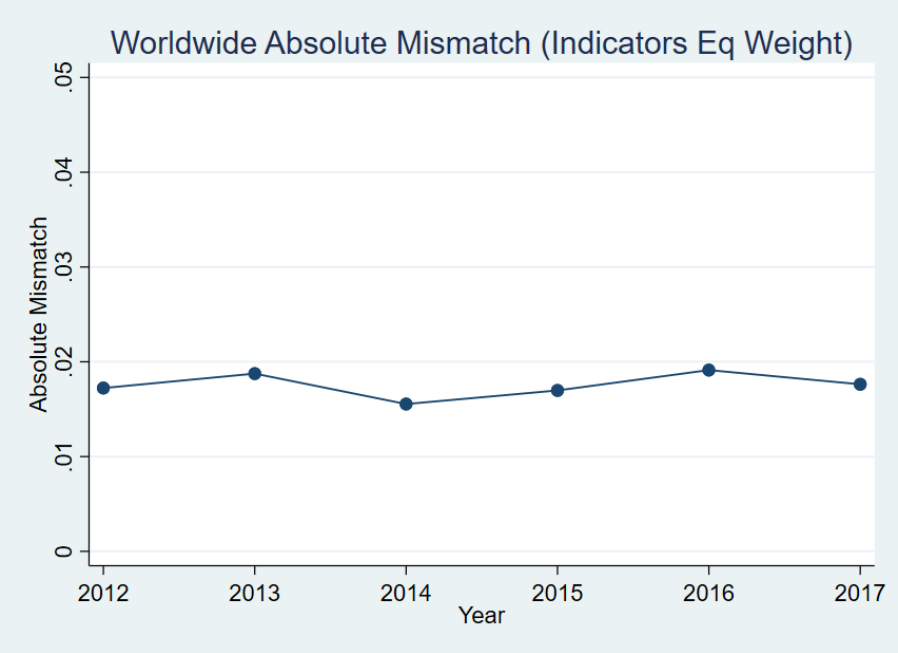
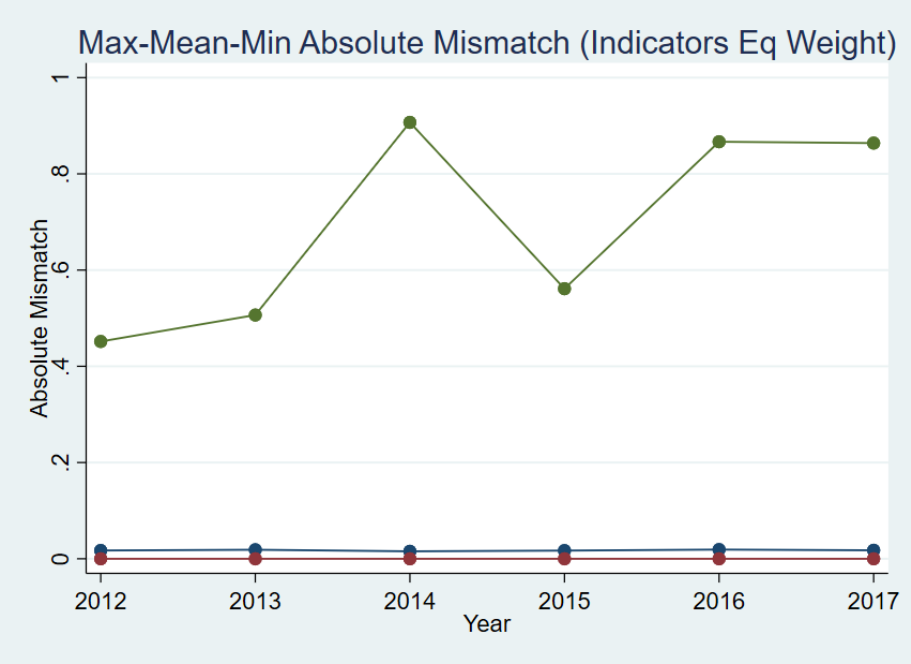


Figure A6: Max-Mean-Min Mismatch, Equal Weight for All Indicators



OLS Regression Results:

Table A2:

	(1)	(2)	(3)	(4)
	SDG 1 (Aid	SDG 1 (Aid	SDG 1 (Aid	SDG 1 (Aid

	Share)	Share)	Share)	Share)
Cost to Solve Poverty (Perf. Targ.) (Need Share)	0.370***	0.357***	0.394***	0.397***
	(4.00)	(3.75)	(3.86)	(3.70)
Polity (Revised) Combined Democracy Score		-0.000763	-0.00336	-0.00340
		(-1.11)	(-1.65)	(-1.68)
WGI Public Sector/Institutions score (higher = stronger)			0.191*	0.222*
			(2.24)	(2.45)
WGI Revenue Mobilization Score (higher = stronger)				-0.0422
				(-0.35)
Constant	0.0146***	0.0186***	-0.0789	-0.0684
	(5.65)	(3.44)	(-1.67)	(-1.01)
Observations	259	251	84	84

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A3:

	(1) SDG 1 (Aid Share)	(2) SDG 1 (Aid Share)	(3) SDG 1 (Aid Share)	(4) SDG 1 (Aid Share)
Count of Extreme Poor (Need Share)	0.385***	0.373***	0.571***	0.572***
	(3.97)	(3.75)	(5.12)	(5.01)
Polity (Revised) Combined Democracy Score		-0.000658	-0.00279	-0.00281
		(-0.95)	(-1.32)	(-1.34)
WGI Public Sector/Institutions score (higher =			0.187*	0.210*

stronger)				
			(2.27)	(2.37)
WGI Revenue Mobilization Score (higher = stronger)				-0.0304
				(-0.29)
Constant	0.0143***	0.0177***	-0.0830	-0.0753
	(5.66)	(3.34)	(-1.89)	(-1.27)
Observations	259	251	84	84

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A4:

	(1) SDG 2 (Aid Share)	(2) SDG 2 (Aid Share)	(3) SDG 2 (Aid Share)	(4) SDG 2 (Aid Share)
Count of Undernourished (Need Share)	0.0938***	0.0866***	0.181*	0.182*
	(4.54)	(4.33)	(2.24)	(2.20)
Polity (Revised) Combined Democracy Score		-0.000277*	-0.000441	-0.000406
		(-2.46)	(-1.77)	(-1.66)
WGI Public Sector/Institutions score (higher = stronger)			0.00651	-0.0210
			(0.49)	(-1.54)
WGI Revenue Mobilization Score (higher = stronger)				0.0322**
				(2.71)
Constant	0.00799***	0.00955***	0.0101	0.00434
	(15.36)	(11.98)	(1.32)	(0.53)
Observations	567	512	258	258

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A5:

	(1) SDG 3 (Aid Share)	(2) SDG 3 (Aid Share)	(3) SDG 3 (Aid Share)	(4) SDG 3 (Aid Share)
Health Financing Gap (Need Share)	0.126***	0.116***	0.329**	0.330**
	(5.73)	(5.62)	(2.75)	(2.68)
Polity (Revised) Combined Democracy Score		0.0000684	-0.0000741	-0.00000367
		(0.87)	(-0.48)	(-0.02)
WGI Public Sector/Institutions score (higher = stronger)			0.00556	-0.0243*
			(0.64)	(-2.50)
WGI Revenue Mobilization Score (higher = stronger)				0.0350**
				(2.92)
Constant	0.00676***	0.00762***	0.00822	0.00197
	(16.09)	(14.78)	(1.63)	(0.32)
Observations	776	651	349	349

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A6:

	(1) SDG 4 (Aid Share)	(2) SDG 4 (Aid Share)	(3) SDG 4 (Aid Share)	(4) SDG 4 (Aid Share)
Education Financing Gap (Need Share)	0.286**	0.286**	0.270*	0.271**
	(3.02)	(3.02)	(2.59)	(2.61)
Polity (Revised) Combined Democracy Score		-0.000226	-0.000104	-0.000143
		(-1.86)	(-0.55)	(-0.80)
WGI Public Sector/Institutions			-0.00732	0.00904

score (higher = stronger)				
			(-0.68)	(0.63)
WGI Revenue Mobilization Score (higher = stronger)				-0.0199
				(-1.07)
Constant	0.0100***	0.0108***	0.0173*	0.0211*
	(8.54)	(7.32)	(2.39)	(2.24)
Observations	428	379	234	234

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A7:

	(1) SDG 4 (Aid Share)	(2) SDG 4 (Aid Share)	(3) SDG 4 (Aid Share)	(4) SDG 4 (Aid Share)
Count of Illiterate (Need Share)	0.516***	0.533***	0.545***	0.555***
	(12.43)	(12.84)	(11.96)	(11.94)
Polity (Revised) Combined Democracy Score		-0.0000808	0.000149	0.000214
		(-0.28)	(0.48)	(0.66)
WGI Public Sector/Institutions score (higher = stronger)			0.00398	-0.0231
			(0.15)	(-0.90)
WGI Revenue Mobilization Score (higher = stronger)				0.0386
				(1.24)
Constant	0.0140***	0.0120***	0.00618	-0.00464
	(7.35)	(4.94)	(0.36)	(-0.21)
Observations	208	192	70	70

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A8:

	(1) SDG 5 (Aid Share)	(2) SDG 5 (Aid Share)	(3) SDG 5 (Aid Share)	(4) SDG 5 (Aid Share)
UN HDI Gender Ineq. (Need Share)	1.796***	1.803***	1.628***	1.629***
	(10.24)	(10.08)	(5.03)	(5.04)
Polity (Revised) Combined Democracy Score		0.000116	0.000451*	0.000454**
		(1.50)	(2.49)	(2.61)
WGI Public Sector/Institutions score (higher = stronger)			-0.0166	-0.0185
			(-1.33)	(-1.06)
WGI Revenue Mobilization Score (higher = stronger)				0.00237
				(0.12)
Constant	-0.00757***	-0.00766***	0.00520	0.00465
	(-5.48)	(-5.18)	(0.53)	(0.41)
Observations	631	589	285	285

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A9:

	(1) SDG 5 (Aid Share)	(2) SDG 5 (Aid Share)	(3) SDG 5 (Aid Share)	(4) SDG 5 (Aid Share)
Women Business and the Law Index (Need Share)	0.872***	1.018***	1.281***	1.331***
	(6.23)	(5.82)	(3.97)	(4.30)
Polity (Revised) Combined Democracy Score		0.000290***	0.000322*	0.000357**
		(3.53)	(2.55)	(2.97)
WGI Public Sector/Institutions			0.00716	-0.00387

score (higher = stronger)				
			(0.77)	(-0.27)
WGI Revenue Mobilization Score (higher = stronger)				0.0137
				(1.10)
Constant	0.000960	-0.000243	-0.00426	-0.00747
	(1.04)	(-0.18)	(-0.59)	(-1.06)
Observations	797	690	370	370

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A10:

	(1) SDG 6 (Aid Share)	(2) SDG 6 (Aid Share)	(3) SDG 6 (Aid Share)	(4) SDG 6 (Aid Share)
Count Without Safe Drinking Water (Need Share)	0.298***	0.292***	0.339***	0.346***
	(8.00)	(8.19)	(8.69)	(8.88)
Polity (Revised) Combined Democracy Score		-0.000704**	-0.000476*	-0.000312
		(-2.98)	(-2.11)	(-1.36)
WGI Public Sector/Institutions score (higher = stronger)			0.000106	-0.0350
			(0.00)	(-1.55)
WGI Revenue Mobilization Score (higher = stronger)				0.0436
				(1.52)
Constant	0.0141***	0.0178***	0.0149	0.00611
	(10.09)	(8.35)	(1.07)	(0.36)
Observations	299	270	114	114

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A11:

	(1) SDG 6 (Aid Share)	(2) SDG 6 (Aid Share)	(3) SDG 6 (Aid Share)	(4) SDG 6 (Aid Share)
Count Without Safe Sanitation (Need Share)	0.0824***	0.0645*	0.646***	0.703***
	(3.80)	(2.35)	(7.61)	(7.44)
Polity (Revised) Combined Democracy Score		-0.000636	-0.000634	-0.000375
		(-1.35)	(-0.70)	(-0.50)
WGI Public Sector/Institutions score (higher = stronger)			0.0736	-0.0131
			(1.55)	(-0.37)
WGI Revenue Mobilization Score (higher = stronger)				0.120*
				(2.44)
Constant	0.0227***	0.0262***	-0.0277	-0.0599
	(11.83)	(7.18)	(-1.04)	(-1.53)
Observations	243	219	56	56

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A12:

	(1) SDG 7 (Aid Share)	(2) SDG 7 (Aid Share)	(3) SDG 7 (Aid Share)	(4) SDG 7 (Aid Share)
Count Without Electricity (Need Share)	0.315***	0.306***	0.307***	0.307***
	(8.56)	(8.43)	(7.77)	(7.80)
Polity (Revised) Combined Democracy Score		-0.000230	-0.000333	-0.000342
		(-1.84)	(-1.64)	(-1.72)

WGI Public Sector/Institutions score (higher = stronger)			0.0288***	0.0326**
			(3.83)	(2.85)
WGI Revenue Mobilization Score (higher = stronger)				-0.00435
				(-0.36)
Constant	0.00505***	0.00664***	-0.0119**	-0.0112*
	(9.80)	(7.30)	(-3.21)	(-2.45)
Observations	814	687	364	364

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A13:

	(1) SDG 8 (Aid Share)	(2) SDG 8 (Aid Share)	(3) SDG 8 (Aid Share)	(4) SDG 8 (Aid Share)
Count of Unemployed (Need Share)	0.0927**	0.0878**	0.174*	0.174*
	(3.00)	(2.87)	(2.17)	(2.21)
Polity (Revised) Combined Democracy Score		-0.0000348	-0.000378	-0.000411
		(-0.24)	(-1.56)	(-1.61)
WGI Public Sector/Institutions score (higher = stronger)			0.0244***	0.0391***
			(3.86)	(3.32)
WGI Revenue Mobilization Score (higher = stronger)				-0.0168
				(-1.26)
Constant	0.00711***	0.00763***	-0.00575	-0.00304
	(10.03)	(7.12)	(-1.38)	(-0.54)
Observations	766	690	358	358

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A14:

	(1) SDG 9 (Aid Share)	(2) SDG 9 (Aid Share)	(3) SDG 9 (Aid Share)	(4) SDG 9 (Aid Share)
Transport Financing Gap (Need Share)	0.297	0.255	0.520***	0.512***
	(1.53)	(1.05)	(9.56)	(16.84)
Polity (Revised) Combined Democracy Score		-0.00300	-0.0180***	-0.0179***
		(-0.61)	(-10.94)	(-18.08)
WGI Public Sector/Institutions score (higher = stronger)			0.188	-0.0904
			(1.01)	(-0.53)
WGI Revenue Mobilization Score (higher = stronger)				0.363
				(2.36)
Constant	0.0370**	0.0549	0.00944	-0.0764
	(2.81)	(1.47)	(0.08)	(-1.36)
Observations	38	38	10	10

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A15:

	(1) SDG 9 (Aid Share)	(2) SDG 9 (Aid Share)	(3) SDG 9 (Aid Share)	(4) SDG 9 (Aid Share)
Energy Financing Gap (Need Share)	0.209**	0.198**	0.351***	0.352***
	(3.06)	(2.65)	(3.94)	(3.88)
Polity (Revised) Combined Democracy Score		-0.000800	-0.00214	-0.00214

		(-0.93)	(-1.38)	(-1.38)
WGI Public Sector/Institutions score (higher = stronger)			0.115	0.0950
			(1.32)	(1.17)
WGI Revenue Mobilization Score (higher = stronger)				0.0233
				(0.34)
Constant	0.0235***	0.0278***	-0.0399	-0.0433
	(9.34)	(4.74)	(-0.81)	(-0.79)
Observations	202	197	70	70

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A16:

	(1) SDG 10 (Aid Share)	(2) SDG 10 (Aid Share)	(3) SDG 10 (Aid Share)	(4) SDG 10 (Aid Share)
Gini Index (Need Share)	-0.651	-0.0764	-1.293	-0.826
	(-1.03)	(-0.08)	(-1.61)	(-1.50)
Polity (Revised) Combined Democracy Score		-0.00175	-0.000964	-0.00105
		(-1.50)	(-0.83)	(-0.95)
WGI Public Sector/Institutions score (higher = stronger)			-0.0638	0.0192
			(-0.85)	(0.27)
WGI Revenue Mobilization Score (higher = stronger)				-0.109
				(-0.83)
Constant	0.0390**	0.0336*	0.101	0.116
	(2.66)	(2.05)	(1.66)	(1.51)
Observations	254	248	82	82

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A17:

	(1) SDG 11 (Aid Share)	(2) SDG 11 (Aid Share)	(3) SDG 11 (Aid Share)	(4) SDG 11 (Aid Share)
Urban Slum Population (Need Share)	0.327	0.325	0.518***	0.525***
	(1.26)	(1.25)	(4.59)	(4.25)
Polity (Revised) Combined Democracy Score		0.0000705	-0.000928	-0.000928
		(0.10)	(-0.96)	(-0.95)
WGI Public Sector/Institutions score (higher = stronger)			0.0628	0.0542
			(1.46)	(1.45)
WGI Revenue Mobilization Score (higher = stronger)				0.00877
				(0.39)
Constant	0.00811**	0.00825*	-0.0295	-0.0303
	(3.13)	(2.05)	(-1.36)	(-1.32)
Observations	83	80	49	49

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A18:

	(1) SDG 11 (Aid Share)	(2) SDG 11 (Aid Share)	(3) SDG 11 (Aid Share)	(4) SDG 11 (Aid Share)
Economic Loss to Disasters (Need Share)	0.0136	0.0113	0.159***	0.170***
	(1.28)	(1.04)	(5.45)	(4.58)
Polity (Revised)		0.0000229	-0.0000758	-0.00000552

Combined Democracy Score		(0.06)	(-0.18)	(-0.01)
WGI Public Sector/Institutions score (higher = stronger)			0.0837***	0.0109
			(4.28)	(0.28)
WGI Revenue Mobilization Score (higher = stronger)				0.0923*
				(2.34)
Constant	0.0188***	0.0200***	-0.0318**	-0.0522***
	(10.02)	(7.57)	(-2.85)	(-4.18)
Observations	314	294	157	157

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A19:

	(1) SDG 12 (Aid Share)	(2) SDG 12 (Aid Share)	(3) SDG 12 (Aid Share)	(4) SDG 12 (Aid Share)
CO2 per unit of GDP (Need Share)	0.233*	0.203	0.158	0.138
	(2.01)	(1.50)	(1.02)	(0.88)
Polity (Revised) Combined Democracy Score		-0.000795	-0.000583	-0.000562
		(-1.70)	(-1.65)	(-1.61)
WGI Public Sector/Institutions score (higher = stronger)			0.0275*	0.0123
			(2.27)	(1.12)
WGI Revenue Mobilization Score (higher = stronger)				0.0174*
				(2.28)
Constant	0.00617***	0.00973**	-0.00990	-0.0125

	(3.50)	(2.75)	(-1.50)	(-1.75)
Observations	373	324	177	177

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A20:

	(1) SDG 13 (Aid Share)	(2) SDG 13 (Aid Share)	(3) SDG 13 (Aid Share)	(4) SDG 13 (Aid Share)
Share Non-renewable Energy (Need Share)	0.127	0.0178	-0.0992	-0.142
	(1.41)	(0.17)	(-0.87)	(-1.15)
Polity (Revised) Combined Democracy Score		0.000120	-0.000689	-0.000649
		(0.53)	(-1.64)	(-1.55)
WGI Public Sector/Institutions score (higher = stronger)			0.0565**	0.0311
			(3.05)	(1.72)
WGI Revenue Mobilization Score (higher = stronger)				0.0287
				(1.87)
Constant	0.00630***	0.00787***	-0.0234**	-0.0275**
	(6.14)	(5.56)	(-2.66)	(-2.81)
Observations	554	460	247	247

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A21:

	(1) SDG 14 (Aid Share)	(2) SDG 14 (Aid Share)	(3) SDG 14 (Aid Share)	(4) SDG 14 (Aid Share)
Marine Protected Areas Percentage Gap (Need Share)	0.0882	0.0941	-0.324	-0.333
	(0.19)	(0.17)	(-0.64)	(-0.61)

Polity (Revised) Combined Democracy Score		-0.000684	-0.000159	-0.000176
		(-1.58)	(-0.65)	(-0.61)
WGI Public Sector/Institutions score (higher = stronger)			0.0328	0.0367
			(1.72)	(0.99)
WGI Revenue Mobilization Score (higher = stronger)				-0.00413
				(-0.13)
Constant	0.00955	0.0134*	-0.00456	-0.00389
	(1.87)	(2.04)	(-0.47)	(-0.33)
Observations	191	160	67	67

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A22:

	(1) SDG 15 (Aid Share)	(2) SDG 15 (Aid Share)	(3) SDG 15 (Aid Share)	(4) SDG 15 (Aid Share)
Protected Land Percentage Gap (Need Share)	-0.225	-0.293	-0.306*	-0.324*
	(-1.61)	(-1.83)	(-2.51)	(-2.55)
Polity (Revised) Combined Democracy Score		-0.000108	-0.000378	-0.000301
		(-0.52)	(-1.80)	(-1.36)
WGI Public Sector/Institutions score (higher = stronger)			0.0319**	0.0137
			(3.06)	(0.83)
WGI Revenue Mobilization Score (higher = stronger)				0.0212
				(1.33)

Constant	0.00911***	0.0110***	-0.00785	-0.0116
	(6.15)	(5.87)	(-1.53)	(-1.97)
Observations	269	233	118	118

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A23:

	(1) SDG 15 (Aid Share)	(2) SDG 15 (Aid Share)	(3) SDG 15 (Aid Share)	(4) SDG 15 (Aid Share)
Protected Land Gap (Need Share)	0.230*	0.207*	0.0486	0.0340
	(2.48)	(2.16)	(0.42)	(0.28)
Polity (Revised) Combined Democracy Score		0.0000342	-0.000390	-0.000328
		(0.17)	(-1.70)	(-1.40)
WGI Public Sector/Institutions score (higher = stronger)			0.0373**	0.0218
			(2.84)	(1.31)
WGI Revenue Mobilization Score (higher = stronger)				0.0186
				(1.22)
Constant	0.00581***	0.00673***	-0.0135*	-0.0171*
	(6.23)	(4.79)	(-1.98)	(-2.21)
Observations	265	229	114	114

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A24:

	(1) SDG 16 (Aid Share)	(2) SDG 16 (Aid Share)	(3) SDG 16 (Aid Share)	(4) SDG 16 (Aid Share)
Internally Displaced Persons (Violence) (Need Share)	0.185***	0.202***	0.280***	0.282***

	(6.89)	(8.58)	(3.83)	(3.90)
Polity (Revised) Combined Democracy Score		0.000584**	0.000824**	0.000741*
		(2.97)	(2.84)	(2.57)
WGI Public Sector/Institutions score (higher = stronger)			-0.0270	0.00449
			(-1.95)	(0.16)
WGI Revenue Mobilization Score (higher = stronger)				-0.0321
				(-1.46)
Constant	0.0163***	0.0124***	0.0288**	0.0320***
	(10.20)	(7.83)	(3.10)	(3.51)
Observations	301	280	166	166

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A25:

	(1) SDG 16 (Aid Share)	(2) SDG 16 (Aid Share)	(3) SDG 16 (Aid Share)	(4) SDG 16 (Aid Share)
Public Sector and Institutions Need (Need Share)	1.874***	1.482***	5.711	5.888*
	(4.61)	(4.07)	(1.92)	(1.97)
Polity (Revised) Combined Democracy Score		0.000218	0.000186	0.000114
		(1.26)	(1.02)	(0.61)
WGI Public Sector/Institutions score (higher = stronger)			0.145	0.177
			(1.52)	(1.78)
WGI Revenue Mobilization Score				-0.0294*

(higher = stronger)				
				(-2.46)
Constant	-0.0114**	-0.00623	-0.150	-0.151
	(-2.70)	(-1.63)	(-1.56)	(-1.58)
Observations	460	370	370	370

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A26:

	(1) SDG 17 (Aid Share)	(2) SDG 17 (Aid Share)	(3) SDG 17 (Aid Share)	(4) SDG 17 (Aid Share)
Revenue Mobilization Need (Need Share)	0.928**	0.941**	1.260*	4.324
	(3.20)	(3.01)	(2.22)	(0.86)
Polity (Revised) Combined Democracy Score		-0.000483	-0.000555	-0.000565
		(-1.36)	(-1.37)	(-1.42)
WGI Public Sector/Institutions score (higher = stronger)			0.0184	0.0166
			(0.85)	(0.75)
WGI Revenue Mobilization Score (higher = stronger)				0.131
				(0.59)
Constant	0.000944	0.00337	-0.0117	-0.141
	(0.32)	(1.16)	(-0.64)	(-0.65)
Observations	460	370	370	370

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A27:

	(1) SDG 17 (Aid Share)	(2) SDG 17 (Aid Share)	(3) SDG 17 (Aid Share)	(4) SDG 17 (Aid Share)
Statistical Capacity	-0.312	-0.254	0.0917	0.115

Need (Need Share)				
	(-1.48)	(-0.97)	(0.27)	(0.33)
Polity (Revised) Combined Democracy Score		-0.000289	-0.000260	-0.000339
		(-1.83)	(-1.07)	(-1.23)
WGI Public Sector/Institutions score (higher = stronger)			-0.0155	0.0128
			(-1.73)	(0.69)
WGI Revenue Mobilization Score (higher = stronger)				-0.0321
				(-1.87)
Constant	0.00961***	0.0104***	0.0180**	0.0231***
	(5.57)	(4.36)	(2.64)	(3.36)
Observations	819	694	368	368

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note A1: Disproportionate Countries, Sectors, and Years

- Egypt, CO2 and climate aid in 2012 and 2014. Tremendous shares of aid, but very low shares of need (practically zero percent). Emissions per GDP are very low, but millions/billions dispensed. This could have been funding tied to the events of the Arab Spring
- Cost to solve poverty- Brazil represents 17% of need worldwide, but almost no aid (about zero percent). Similar statistics for China, almost a quarter of costs. Middle income countries with large populations tend to be ignored. These are BRICS nations sometimes considered to be advanced in terms of development, perhaps capable of mobilizing domestic resources. But the trend may also fall in the other direction from some middle-income nations: Colombia received 20% of aid in 2014, but only had about 2% of need. The DRC saw a massive disparity in 2012, possessing 34% of need but receiving only 2% of aid- institutional characteristics are likely to have played a key factor in this situation. In 2012 Ghana received nearly 20% of aid among the countries counted but possesses about 1% of need, and a similar case applied for Vietnam; for Malawi the and Uganda the reverse is true. Pakistan and Turkey, strategically important allies for certain nations received tremendous shares despite very few extreme poor. In 2017, Tanzania made up nearly half of all need but received only about a quarter of aid.
- In sum- much disparity in the middle income. Perhaps donor behavior has not yet adjusted to the new middle income status of these nations.
- Practically the same results hold for poverty headcounts, although Indonesia also emerges as an underfinanced nation. Except for 2013, when it received 10% of aid on about 20% of need, the

gap is often extremely large, with receipts of only a few percent of aid for around 20% of the global headcount of covered nations in 2016 and 2017.

- Education financing- India in 2012/2013 was about half of all ed shortfall worldwide yet received 3-5% of aid. On illiterate populations, however, Pakistan and Ethiopia see large need but have shortfalls of 10% or more, while Bangladesh and Turkey may be somewhat overfinanced.
- Energy financing gaps- Large populations in China and India suggest persistently large need shares in 30-40% terms. China receives almost no energy aid; India receives between 5 and 10 percent of the global cut. Morocco, Turkey, and Vietnam all received large chunks of energy finance (10-20%) despite almost no need; in fact, the first two spent about as much per capita as high-income nations.
- Health- India and China largely underfinanced. Despite representing nearly half of all financing need they each receive under 10% of aid
- Similar story for undernourishment
- Water- Jordan receives nearly 10% of water allocations in 2015-2017 despite negligible need in terms of access. This could represent Red Sea projects. Nigeria faces massive underfinancing of nearly 10% of aid, despite hundreds of billions without safe water. Similar figures apply for Pakistan.
- Sanitation- China represents between a third and a half of all those worldwide without safe sanitation but gets under 10% of aid. Jordan is again overallocated, along with Tanzania but only for the year of 2013.
- Population without access to electricity- Egypt and Vietnam are large winners of aid at India's expense, with practically no need. India has about a quarter of global individual need for electricity.
- Gender Inequality- Pakistan receives a lot of aid, though need is relatively low based on the index. This is the only very disproportionate nation.
- Internally displaced persons- Afghanistan receives much institution/security aid but has relatively few IDPS (under 5% of world total) compared to Syria and Colombia, each with 10-20% of world total but low single digit shares of aid.
- Disaster aid- not a perfect match since the relevant sustainable development goals also includes infrastructure. However, notable are massive shares of loss for Colombia in all years studied- over 50% of that recorded. Also of note is a lag in aid for Nepal. Nepal saw the largest need share in 2015 of over 30% (April 2015 earthquake), but did not get over 10% of aid until 2016.
- Slum populations- China massively underfinanced with a 20% gap. Vietnam may be somewhat overfinanced with over 10% of aid but only about 1% of need.
- Unemployment- overallocation to Turkey, Myanmar, Egypt: 10x that of India and China. Again, under allocation to very large India and China with huge masses of unemployed, together nearly half of world total.
- Transport financing- large under allocation to China and India, overallocation to Turkey and Vietnam.
- Inequality- not expected to be a good fit, especially not population weighted, but large allocations for Ethiopia, Iraq, Pakistan (2013, 2015), turkey (2014-2017), Uganda, Ukraine, West Bank.
- Marine areas- much aid to Jordan and Morocco, despite zero and relatively little gap in protected areas from rich country levels. Possibly the result of large water projects.

- Protected Land- very low gap for Brazil (lots of protected land) but very large allocations- 10% or more. Here the indicator should perhaps be reversed for large maintenance or opportunity costs.
- Non-renewables- logical large aid allocations for India, China, Brazil, and a less logical one for Vietnam. Without actual energy figures, need shares are hard to interpret.
- Statistical capacity- “partnerships” aid in the billions to ivory coast, Egypt, Myanmar, Serbia of over 10% of world totals. This could represent peacebuilding, but the fit for statistical capacity is poor.
- Revenue mobilization- large peace justice and strong institutions aid goes to Afghanistan, Chad, Ivory Coast, and Myanmar, again a poor fit.
- Public sector and Institutions Scores- Afghanistan always receives massive allocations far in excess of 10% of aid, but the case for such high relative need is unclear.