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ANALYSIS

The Commitment to Development Index: An Information Theory approach

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ABSTRACT

Using statistical model selection criteria rooted in Information Theory which penalise complexity we show that there is little justification for relaxing the equal weights assumption underlying the Center for Global Development's, Commitment to Development Index (CDI). The CDI is a composite index which combines metrics of aid, trade, investment, migration, environment, security and technology. A survey of researchers recently concluded that the CDI should not weight each of these six components equally. Specifically, it suggested that: trade and investment should be weighted higher; migration and aid should be weighted lower; with peacekeeping and environment not statistically different from equal weights. Generating hypothetical data around the weights proposed by the results of this survey we test an equally weighted CDI against two unequally weighted alternatives. Although the unequally weighted alternatives provide a superior goodness-of-fit to these hypothetical datasets, this is more than counteracted by the increased model complexity associated with these unequally weighted models according to most model selection criteria. The results of our analysis suggest that the CDI should not diverge from its equal weights assumption.

1. Introduction

Composite indices of environment and development receive attention in the academic literature in order to elucidate: whether or not they include the right components; whether these components are mathematically related to one another in the best way; how changes to the components or the way they are related to one another changes the results (often rankings) produced by the indices; and thus whether or not the indices do what they set out to do — adequately convey a particular message in a simpler, more easily digestible form compared to, instead, referring to an array of non-aggregated indicators.

The Center for Global Development (CDG) is a non-profit think-tank established in 2001. The CDG first published its Commitment to Development Index (CDI) in *Foreign Policy Magazine* (FPM, 2003) and CDIs have since appeared in 2004, 2005 and 2006; presumably they will appear in future years as well. Therefore the CDI is a relative newcomer to the world of composite indices compared to, say, the United Nations Development Programme's (UNDP) Human Development Index (HDI) which first appeared in 1990 (UNDP, 1990) and is now a well established indicator published every year.

Saltelli (2007) contends that an impetus for the creation of composite indices like the CDI is the demand for statistic-based narratives from the economically literate press. Whether via the press or not, the CDI could act as a yardstick for governmental and non-governmental organizations concerned with progress or lack of progress with respect to

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different aspects of development. There is some evidence to suggest that the CDI is being used as such a yardstick in the European Union (EU) because the CDI from 2004 appears in the 2006 EU Donor Atlas which aims to "derive rational and optimal redeployment of [...] activities and methods [related to development assistance]" (European Commission, 2006).

The CDI aims to measure, as the name suggests, how committed rich countries are to advancing the development of poorer countries. These 'rich' countries are defined in terms of 21 Organisation for Economic Co-operation and Development (OECD) countries. In 2003, the CDI assessed the commitment of these rich countries in terms of six different policy areas: aid; trade; investment; migration; peacekeeping; and environment. Importantly, it did this by attaching equal weights to each of these six components (Eq. (1)).

$$\begin{aligned}\mathrm{CDI} = {} & (\alpha \cdot \text{Aid Score}) + (\alpha \cdot \text{Trade Score}) + (\alpha \cdot \text{Investment Score}) \\ & + (\alpha \cdot \text{Migration Score}) + (\alpha \cdot \text{Peacekeeping Score}) \\ & + (\alpha \cdot \text{Environment Score}) \end{aligned} \quad (1)$$

where

$\alpha = 0.167$

$6(\alpha) = 1$

Comprehensive technical details about the construction of the CDI and the calculation of the scores in the six different policy areas in 2003 are available (Birdsall and Roodman, 2003). Following the calculation of CDIs, these 21 countries can then be ranked in order of how committed, or not, they are to advancing development. Although this equal weights assumption holds for CDIs published in subsequent years, other changes are apparent e.g. in 2005 the CDI comprises seven different policy areas instead of six.

As well as annual publication of CDIs in FPM, the CGD's website also publishes CDI results (CGD, 2006). Each year, the results from previous years are updated on the CGD's website based on, for example, improvements in the methodology for calculating the components of the index or, as alluded to above, changes in the way the index is specified in terms of which policy areas it includes. However, original results from previous years (using the methodology of that particular year) are also available from the website. We focus here on the CDI published in 2003 using the original methodology from 2003 which calculated the CDI based on six, not seven, policy areas (CDG, 2003) because we want to test the validity of a suggestion that the CDI should diverge from its equal weights assumption according to the results of a survey of researchers in 2003 which used the CDI from that year (Chowdhury and Squire, 2005).

Chowdhury and Squire (2005) surveyed 105 researchers in 60 different countries (from a population of 1547) in order to determine the weights they thought should be applied to the different components of both the CDI and the HDI. For the HDI the weights suggested by the survey were not statistically different from an equal weights assumption. For the CDI most of the weights suggested by the survey were statistically different from an equal weights assumption. Specifically the survey suggested that: trade and investment should be weighted higher; migration and aid should be weighted lower; with peacekeeping and environment not statistically different from equal weights (Table 1).

In this paper we use statistical model selection criteria rooted in Information Theory which penalise complexity in order to determine whether or not there is justification for differentiating the CDIs weights as per the suggestion in Chowdhury and Squire (2005). Therefore we outline a methodology (Section 2) present the results obtained from using this methodology (Section 3) and finally discuss and draw conclusions from this analysis (Section 4) which illustrate how our findings could be important to an array of different composite indices, not just the CDI.

2. Methodology

Historically, the performance of different models has been quantified using goodness-of-fit statistics such as R^2 or the residual sum of squares (RSS); the higher the value of the former and the lower the value of the latter indicates a closer agreement between model predictions and observations (i.e. data). Statistical model selection criteria rooted in Information Theory include a goodness-of-fit component via the maximum likelihood function which is akin to RSS but, additionally, they also penalise complexity. The rationale for penalising complexity can be viewed in terms of 'assumptions': The more complex a model, the more assumptions it makes and, unsurprisingly, assumptions don't always turn out to be correct and as such should be limited. To give an example in context, differentiating the weights associated with the CDI based on the results of the survey discussed above would assume that those who responded to the survey were fully aware of what they were doing (specifically, what they were weighting). As Chowdhury and Squire (2005) note: "[...] though in our survey instrument we provided short definitions of each of the components included in each of the indices, some of the respondents might have been confused between flow and policy (e.g., trade flow versus trade policy)".

Put differently, although more complex models often provide a closer fit to a particular dataset, not least because an increasing number of model parameters are adjusted for exactly this purpose, this improvement to one dataset won't always generalise to other datasets.

Table 1 – Weights for the 2003 Commitment to Development Index's components based on a survey of 105 researchers in 60 countries (Chowdhury and Squire, 2005)[a]

Aid	SE (+/–)	Trade	SE (+/–)	Investment	SE (+/–)	Migration	SE (+/–)	Peacekeeping	SE (+/–)	Environment	SE (+/–)
0.142*	0.0057	0.204*	0.0047	0.193*	0.0050	0.137*	0.0053	0.157	0.0056	0.163	0.0048

[a] An asterisk indicates a weight which is statistically different from an equal weights assumption. Equal weights would be 1/6 = 0.166 for each of the six components. Abbreviation: Standard Error (SE).