Freie Universität Berlin

The Good Governance Indicators of the Millennium Challenge Account

How many dimensions are really being measured

Martin Knoll
Petra Zloczysti

School of Business & Economics
Discussion Paper

Economics

2011/2

The Good Governance Indicators of the Millennium Challenge Account: How many dimensions are really being measured?

Martin Knoll,[*] Petra Zloczysti[†]

Abstract

This paper assesses the validity of the perception-based governance indicators used by the US Millennium Challenge Account (MCA) for aid allocation decisions. By conducting Explanatory and Confirmatory Factor Analysis of data from 1996 to 2009, we find that although the MCA purports to measure seven distinct dimensions of governance, only two discrete underlying dimensions, the 'participatory dimension of governance' and the 'overall quality of governance,' can be identified. Our results also show that some of the doubts that have been raised concerning the validity of perception-based governance indicators are less warranted when the indicators are applied exclusively to developing countries.

Acknowledgement: The authors are particularly grateful to Irwin Collier, Justine Röhmel, Lucais Sewell, Jutta Bolt, and Farina Casselmann. The views expressed and remaining errors are the authors' responsibility.

Keywords: Aid Allocation, Governance Indicators, Factor Analysis, MCA

JEL Classification: C38, F35, O10, O51

Word count: 8,382

[*] Corresponding author: Freie Universität Berlin, John F. Kennedy Institute, Lansstrasse 7–9, 14195 Berlin, Germany. E-mail: martin.knoll@fu-berlin.de

[†] German Institute for Economic Research (DIW) and Freie Universität Berlin

1. Introduction

In 2003, the Bush administration launched the US Millennium Challenge Account (MCA), an innovative development assistance program whose aid allocation mechanism is largely based on a competitive assessment of developing countries' governance performance. In contrast to the donor agencies who, in response to the aid effectiveness debate, implemented new or modified existing aid programs in order to encourage improved governance under existing partnership frameworks, the MCA made good governance an explicit and rigid precondition for the granting of aid to developing countries. The MCA is the first and only bilateral aid agency that has adopted a competitive aid allocation mechanism which explicitly relies on a set of publicly available governance indicators.

With the MCA's increasing significance – the program has since its foundation in 2003 committed nine billion US dollars in grants to 18 developing countries – an extensive debate on its modalities of delivery has ensued. Various aspects, such as the strictly bilateral approach to program implementation without participation in donor harmonization efforts on the ground; its ambiguous relationship to existing US aid agencies such as USAID; and the issue of funding volumes and the absorptive capacities of recipient countries, have been abundantly analyzed and discussed (see for example Sperling and Hart, 2003; Clemens and Radelet, 2003).

Yet little attention has been devoted thus far to a key question: Are the perception-based governance indicators used by the MCA conceptually valid, robust, and therefore appropriate for making aid-allocation decisions? In light of the general debate that has emerged on whether perception-based governance indicators satisfactorily measure and distinguish between various dimensions of governance, this question is particularly salient (Langbein and Knack, 2010; Thomas, 2009; Arndt and Oman, 2006).

This paper discusses the validity of the MCA's governance assessment framework. In particular, it explores the merits of the argument often voiced in the literature that the perception-based governance indicators used by the MCA fail to distinguish between various dimensions of governance, especially in the case of developing countries. Using standard statistical techniques to detect latent variables, including Explanatory and Confirmatory Factor Analysis, we find that while the MCA ostensibly measures seven distinct dimensions of governance, only two distinct underlying dimensions – namely, the perceived *participatory dimension of governance* and the perceived *overall quality of governance* – can be identified. Our results suggest that the general doubts that have been voiced concerning these indicators – in particular the singular dimensionality of perception-based governance indicators are less warranted when the indicators are applied exclusively to developing countries.

The following section reviews the current debate on the reliability and validity of perception-based governance indicators. Section 3 provides an overview on the MCA's program modalities and its allocation mechanism. Section 4 assesses empirically to what extent the MCA's specific indicator-based method for measuring the quality of governance is reliable, robust and conceptually valid.

2. Literature Review

While issues such as institutional development, democratic legitimacy, and accountability were of ancillary importance to geo-political and geo-strategic considerations for aid allocation during the Cold War era, in the 1990s *good governance* emerged as the new *sine qua non* of development cooperation (for example Dornboos, 2001; Hermes and Lensink, 2001; Chhotray and Hulme, 2009). The seminal paper by Burnside and Dollar (2000), which identified a strong relationship between sound policies and economic growth, as well as an abundance of subsequent research provided the empirical grounds for a realignment of aid

allocation mechanisms towards explicit or implicit conditionality on good governance (for example Berthélemy and Tichit, 2004; Burnside and Dollar, 2004; Arndt and Oman, 2006).

In recent years, the supply of governance indicators has risen exponentially in line with the development community's growing demand for a quantifiable operationalisation of the governance concept. The World Bank Institute suggests that there are currently more than 140 sets of indicators available, comprising several thousand individual quantitative measures (World Bank Institute, 2006). The best-known indicators are those provided by the World Bank, the World Bank Institute, the International Country Risk Guide, Freedom House, the Heritage Foundation, and Transparency International. Because of their extensive country coverage, sophisticated statistical methodology, and excellent methodological documentation, the indicators provided by the World Wide Governance Project of the World Bank Institute have in recent years advanced to become the most widely used and quoted governance indicators (Kaufmann et al., 1999a; 1999b; 2004; 2005; 2007; 2008; Arndt, 2010).[1]

Recent research has discussed several aspects of conceptual and technical limitations of perception-based governance indicators in general, and the World Wide Governance Indicators (WGIs) in particular. Kurtz and Schrank (2007) suggest that the dominant measures of governance, in particular the WGIs, are problematic and suffer from perceptual biases and adverse selection in sampling. Similarly, Thomas (2009) argues that due to a lack of empirical evidence in support of their construct validity, the WGIs are in effect an elaborate but unsupported hypothesis. Langbein and Knack (2010) generally question the ability of the WGIs to measure distinct underlying concepts and present empirical evidence of strong content overlap and a tautological construct.

Due to a lack of alternatives, these perception-based indicators are nevertheless used for ranking countries and for subsequent aid allocation (Kaufmann et al., 2002); the most prominent example being the MCA. Accordingly, the question is naturally raised as to

whether these indicators are suitable for assessing policy performance in developing countries.

While the existing literature focuses to large extent on the overall properties of governance indicators (for example Kurtz and Schrank, 2007; Langbein and Knack, 2010), the present paper seeks to make a unique contribution by assessing to what extent the application of these indicators to developing countries yields reliable and robust conclusions in terms of dimensionality and measurement reliability. In this way, our analysis, which specifically examines the MCA's aid allocation mechanisms, aims to provide important insights into the dimensionality and validity of governance assessments of Low Income Countries (LICs).

3. The Millennium Challenge Account

3.1 Scale and Scope

At the 2002 UN Financing for Development Conference, President G.W. Bush announced the establishment of a new Millennium Challenge Account to provide an additional five billion dollars per year in grants to developing countries. In the words of the President, aid would be disbursed to those countries that *govern justly*, *invest in their people*, and *encourage economic freedom*.[2] Aside from the amount of aid promised, the most notable aspect of the MCA program is its competitive allocation process, which uses predefined and transparent governance measures to determine country eligibility. This means that the MCA's allocation policy is clearly segregated from US foreign policy objectives; an aspect that has received considerable attention (Radelet, 2002a; 2002b; OECD, 2003). Furthermore, the program displays a commitment to strengthening recipient ownership and accountability by assigning developing countries the lead in program development and implementation. This has been perceived as a progress towards delivering on the commitments to provide more effective aid made by the international donor community at Monterrey.

Table 1: MCA Appropriations in USD Billions

	2004	2005	2006	2007	2008	2009
MCA funds requested by the President	1.300	2.500	3.000	3.000	3.000	2.225
MCA funds appropriated by Congress	0.994	1.488	1.752	1.752	1.752	1.486
U.S. International Development and Humanitarian Assistance*	13.807	17.696	16.693	15.524	14.074	22.095
MCA funds as a percentage of U.S. International Development and Humanitarian Assistance	7.20	8.41	10.50	11.29	12.45	6.73

* According to outlays of functions and sub-functions of the Office of Management and Budget of the White House. This includes funding for bilateral development programs such as USAID, the MCA, the Global HIV/AIDS Fund, assistance to transition countries, contributions to multilateral organizations, the Child Survival and Disease Program, humanitarian aid, emergency relief, migration and refugee assistance, and efforts to combat the drug trade.

Source: Tarnoff, 2009 and The White House, (2010).

Although the original commitment of an additional five billion US dollars per year has never been met, the scale of MCA funds is significant in both absolute and relative terms (Table 1). In 2008, funds appropriated under the new program amounted to 1.75 billion US dollars and accounted for approximately 12.5 per cent of US core development assistance, as classified under the budgetary sub-function International Development and Humanitarian Assistance (IDHA).[3]

This is a substantial figure, considering that a large share of US assistance subsumed under the IDHA function is dedicated to emergency relief or tied to reconstruction programs from the military interventions in Afghanistan and Iraq. Since fiscal year 2004, a total of 9.22 billion US dollars has been appropriated to the MCA from the US federal budget.[4] So far, 18 recipient countries have received funding through so-called Millennium Challenge Compacts.[5]

In order to realize the MCA's transformational potential and encourage recipient countries to implement projects and programs critical to their economic and social development, the MCA

intended to place its assistance among the top aid donors in eligible countries (Nowels, 2006). Over the last five years the financial value of compact programs has constantly increased. While the compact agreements signed in 2005 averaged around 180 million US dollars, more recent programs have been significantly larger in size, with commitments in 2008 reaching an average of approximately 450 million US dollars. In several heavily-aided developing countries that receive significant amounts of aid, including Burkina Faso, Ghana, Mozambique, and Tanzania, the MCA has become one of the largest bilateral development assistance programs (Tarnoff, 2009; OECD/DAC CRS, 2010).

3.2 The MCA's Allocation Methodology

Recipient countries are selected based on three-step procedure:[6]

(i) Each year *candidate countries* are identified according to GNI per capita thresholds, as defined by the World Bank's International Development Association (IDA) for Low Income Countries (LICs) and Lower Middle Income Countries (LMICs).[7] Countries subject to legal provisions prohibiting assistance by US legislation are excluded (Millennium Challenge Act of 2003 Sec. 606(a) (1) (b)).

(ii) On the basis of a range of third-party indicators (17 at present), grouped into three broad policy dimensions – *ruling justly*, *investing in people*, and *economic freedom* – the MCA's board subsequently determines which of these *candidate countries* are generally eligible for MCA assistance (Table 2).[8] To qualify for funding, countries must perform above the median in the first governance indicator under the *ruling justly* category (the World Bank Institute's *Control of Corruption* indicator) in relation to their peers, i.e. other LICs or LMICs, and score above the median in at least half of the indicators under each of the three policy categories.[9]

(iii) Finally, *eligible countries* may prepare and negotiate compact program proposals.

Table 2: Indicators used in 2009

Category	Indicator	Type/Remarks	Source
Ruling Justly	WGI Control of Corruption (WGI CC)*	Perception-based composite indicator measuring the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as 'capture' of the state by elites and private interests.	World Bank Institute (WGI Project)
	WGI Government Effectiveness (WGI GE)*	Perception-based composite indicator measuring the quality of public services, the quality of the civil service, and the degree of its independence from political pressures, the quality of policy formulation, and implementation, and the credibility of the government's commitment to such policies	
	WGI Rule of Law (WGI RL)*	Perception-based composite indicator measuring the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence.	
	WGI Voice and Accountability (WGI VA)*	Perception-based composite indicator measuring citizens' ability to participate in selecting their government, freedom of expression, freedom of association, and a free media.	
	Political Rights (FH PRI)	Perception-based indicators consisting of three (FH PRI) and four (FH CLI) sub-categories measuring on a 40 (FH PRI) and 60 (FH CLI) point scale to what extent universal political rights and civil liberties can be freely exercised. Assessment is undertaken by selected analysts and affiliated advisers.	Freedom House
	Civil Liberties (FH CLI)		
Investing in People	Immunization Rates	Un-weighted average of (third dose of diphtheria toxoid, tetanus toxoid, and pertussis vaccine) DPT3 and measles immunization rates.	WHO
	Public Expenditure on Primary Education	Total expenditures on primary education by government divided by GDP	UNESCO's Institute of Statistics (UIS) National Governments (secondary source)
	Public Health Expenditure	Measures General Government Health Expenditure (GGHE) as share in GDP	WHO
	Primary Girls' Education Completion Rate	Gross intake ratio to last grade of primary education for females, measuring the total number of new female entrants in the last grade of primary education, regardless of age, as a share of the total female population of theoretical entrance age.	UIS
	Natural Resource Management	Index indicator calculated as un-weighted average from Eco-Region Protection, access to clean water and sanitation, and child mortality	CIESIN and YCLEP
Economic Freedom	Inflation Rate	Measures annual percentage change averages in consumer prices for the year. Hurdle currently set at 15 per cent.	IMF World Economic Outlook
	Fiscal Policy	Share of central government's budget deficit including the consolidated public sector in GDP, averaged over a three-year period.	IMF World Economic Outlook and National Governments
	Trade Policy	Composite indicator measuring scale of tariff and non-tariff trade barriers relative to all other countries using average tariff rates and a non-tariff barrier penalty scale.[10]	Heritage Foundation
	WGI Regulatory Quality* (WGI RQ)	Perception-based composite governance indicator measuring the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.	World Bank Institute
	Business Start-Up	Index indicator ranging from 0 to 1 calculated from the un-weighted average of the two index sub-indicators 'number of days to start a business' and 'cost of starting a business' as percentage of GNI per capita.	IFC
	Land Rights and Access	Weighted average calculated from IFAD's Access to Land indicator (50 per cent) and IFC's indicators measuring the days and the costs to register property (25 per cent each).	IFAD and IFC

* Definitions taken from Kaufmann et al., (2007).

Selection of eligible countries depends in large part on their perceived *good governance* performance: The *ruling justly* category consists solely of indicators measuring governance *outcomes*.[11] Furthermore, one of the six governance indicators in this category, the Control of Corruption indicator, serves as an absolute hurdle. Thus, in an extreme case, a candidate country may perform well on 16 of the 17 indicators, but fall below the median on the Control of Corruption indicator, thus become ineligible for aid (Radelet, 2002b). In total, seven of the 17 MCA policy measures are governance indicators.

Two of the seven indicators, the Civil Liberties Indicator (CLI) and the Political Rights Indicator (PRI), are compiled by the conservative Washington-based think tank Freedom House (FH). According to Freedom House's methodological note, the FH PRI aims to map the quality of the electoral process, the degree of political pluralism and participation, as well as the functioning of government. The FH CLI seeks to measure country performance in the following three sub-categories: freedom of expression and belief; associational, organizational rights and rule of law; and personal autonomy and individual rights.[12] Coverage currently includes 193 countries and 15 territories.

The remaining five indicators in the ruling justly categories are published by the World Bank Institute under its Worldwide Governance Indicators (WGIs) project.[13] The WGIs are composed of several hundred sub-indicators drawn from 37 different data sources. According to the authors, these indicators capture the fundamental dimensions of governance:

— Control of Corruption (WGI CC; extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as capture of the state by elites and private interests);

— Voice and Accountability (WGI VA; the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media);

— Regulatory Quality (WGI RQ; the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development),

— Rule of Law (WGI RL; extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence); and

— Government Effectiveness (WGI GE; quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies).[14]

As with the FH indicators, the WGIs are entirely based on perceptual data and currently cover 203 countries and territories from 1996 to 2009.[15]

3.3 The MCA's Governance Concept

The MCA's selective and competitive allocation methodology was strongly influenced by the international development discourse of the late 1990s (Chhotray and Hulme, 2009). While Good Governance emerged as a mainstream concept in development cooperation and research, evidence suggested that conventional policy conditionality had because of its ineffectiveness in inducing institutional, political, and economic reforms yielded dissatisfying results (Lockwood, 2005; Van de Walle, 2005). For this reason, ex-post selectivity (meaning the allocation of development assistance to countries which have already shown credible ownership and commitment towards comprehensive reforms) evolved as a new guiding

principle for the allocation of development assistance (World Bank, 1998; Burnside and Dollar, 2000). The competitive aid allocation mechanism established under the MCA reflects and incorporates the principle of ex-post selectivity.

Another factor affecting the MCA's allocation scheme is public opinion in the US (Chhotray and Hulme, 2009). With civil society, influential NGOs and media taking a much more critical stance towards public aid monies than in Europe, the new aid program has been premised on a tightly supervised and deductive framework to ensure domestic accountability and the regular provision of evidence on the proper use of funds to the public.

Under the institutional economic theory that informs the aid programs of the World Bank and other leading development agencies, governance is understood as a set of institutional rules for the coordination of social, political, and economic activities, rules that determine and/or shape a country's ability to develop and generate economic growth (Benz et al., 2007). Yet while institutional economics are per se positivistic, perception-based governance indicators composed of third-party *expert assessments* and *expert polls* do not represent a form of *de jure* or *de facto* assessment, but instead draw on a universalistic, normative governance concept whose determinates are explicitly invariant across political, cultural, and sociological contexts, i.e. across countries as well as over time (Chhotray and Hulme, 2009).

While the MCA justifies the use of governance indicators by appealing to the aforementioned research that suggests there is a positive relationship between good policies and growth on the one hand and the effectiveness of aid on the other, the MCA does not provide any empirical or analytical evidence that the seven governance indicators reflect or relate to this very abstract and broad concept of governance. As the reliability of the seven governance indicators depends on their validity and ability to discriminate effectively among the MCA's seven dimensions of governance, the lack of an explicit conceptual foundation seems particularly problematic. This is all the more true in light of recent research that has raised

considerable concerns about the reliability of perception-based governance indicators, particularly the WGIs.

4. Dimensionality of MCA's Governance Concept

To analyze whether the governance indicators used by the MCA depict one or perhaps several dimensions of governance, we use Explanatory Factor Analysis (EFA) to identify dominant underlying, unobservable variables. Based on these results, a causal model is set up and tested by means of Confirmatory Factor Analysis (CFA). The time frame for the analysis is determined by the availability of the indicators; it covers the years 1996 to 2009. Before turning to the empirical results, statistical relations between the indicators, either by cause or by definition, are highlighted.

4.1 Preliminaries

A certain lack of clarity in the MCA's governance concept is already apparent in the arbitrary and partially redundant classification framework. For example, FH CLI (Civil Liberties) and FH PRI (Political Rights) are used as two representative source indictors for the construction of the aggregated WGI VA (Voice and Accountability) (Kaufmann et al., 2008). All three indicators comprise measures of perceived freedom of expression and association, as well as the right to organize; FH PR and WGI VA both gauge the extent to which the political system incorporates meaningful participation of the citizenry in selecting the government and shaping its activities. The substantive overlap between the WGI VA, FH PRI, and FH CLI is thus significant. Furthermore, it shows that several sub-components of the WGIs in particular those of the WGI CC, WGI GE, WGI RL and WGI RQ are difficult to separate delineate accurately. The perceived enforceability of contracts, for example, is probably a dimension of both the WGI RL and WGI GE. Moreover, the perceived degree of effectiveness of

institutions such as general accounting offices or public audit services could be subsumed under both the WGI GE and WGI CC. Table 3 provides an indicative and incomplete overview of the classification congruence among the seven indicators. A high degree of substantive overlap (grey shaded fields) appears to exist between the WGI VA, FH PRI, and FH CLI as well as the WGI CC, WGI GE, WGI RL, and WGI RQ.

Simple bivariate correlations calculated from a sample covering nine years and a minimum of 185 countries (all countries sample) confirms this pattern. Two principle interdependent groups of variables with an extremely high bivariate correlation (above 90 per cent) can be distinguished:

— The first group includes the WGI CC, WGI GE, WGI RL, and WGI RQ,

— the second group comprises the two FH indicators and the WGI VA.

The same pattern can be found in the bivariate correlation matrix calculated from LICs (LIC sample), albeit with a significantly lower degree of correlation.

These results yield two preliminary indications: First, the indicators might be, as suggested by Langbein and Knack (2010), generally tautological or have difficulties in distinguishing between the seven dimensions they purport to measure. Second, as bivariate correlation patterns for LICs are much weaker, indicators seem to have heteroscedastic properties with respect to income since developed countries generally score high in all seven governance dimensions.[16] Accordingly, previous findings deducted from empirical analysis which did not discriminate between different country groups (that is LICs, LMICs) might have produced premature conclusions with regard to the dimensionality of the perception-based indicators, and of the WGIs in particular (Langbein and Knack, 2010).

Table 3: Classification Overlap among MCA's Governance Indicators

	FH CLI	FH PRI	WGI CC	WGI GE	WGI RL
FH PRI	Right to organise in political parties and groups				
WGI CC		FH PRI index includes assessment of corruption			
WGI GE			Existence and effectiveness of anticorruption policies and accounting institutions Corruption among public officials reduces institutional effectiveness and service delivery		
WGI RL	Existence of rule of law, protection of personal property rights, and equal treatment under the law		Existence and effectiveness of anticorruption laws Extent to which corruption and financial fraud is being persecuted	Accessibility of information on laws and regulations Adequate protection of property rights Enforceability of contracts Integrity of elections and political financing Independence of judiciary	
WGI RQ			Does corruption negatively impact the business environment and distort the economic and financial environment	Quality of public administration Administration of prices and market prices Ease of doing business Effectiveness of rules and regulations for market access Importance of the informal sector	Enforcement of the regulatory framework Government respect for contracts Settlement of economic disputes
WGI VA	Freedom to choose where to travel, reside, and work Freedom of assembly, association, and demonstration Independence of the media Freedom of expression Freedom to select a marriage partner, and determine whether or how many children to have	Free, fair, and regular elections with equal campaigning opportunities and an independent and credible electoral process Rights and participation of minority groups Transparency and accountability of the government	Freedom from pervasive government corruption Transparency and accountability in the public sector	Public access to information and government–citizen relations	Enforcement of political and participatory rights Accountability of policymakers and the judiciary

Source: Partly following Kaufmann et al. (2007)

Table 4: Bivariate correlation coefficients of MCA governance indicators, 1996–2009

All Countries							
	WGI CC	WGI GE	WGI RL	WGI RQ	WGI VA	FH CL	FH PR
WGI CC	1.000						
WGI GE	0.932	1.000					
WGI RL	0.939	0.936	1.000				
WGI RQ	0.856	0.916	0.881	1.000			
WGI VA	0.763	0.763	0.793	0.771	1.000		
FH CL	0.615	0.616	0.646	0.641	0.937	1.000	
FH PR	0.6668	0.666	0.704	0.690	0.947	0.937	1.000
Low Income Countries							
WGI CC	1.000						
WGI GE	0.676	1.000					
WGI RL	0.764	0.783	1.000				
WGI RQ	0.505	0.715	0.653	1.000			
WGI VA	0.391	0.464	0.536	0.532	1.000		
FH CL	0.301	0.363	0.428	0.424	0.915	1.000	
FH PR	0.331	0.392	0.466	0.485	0.897	0.868	1.000

Source: Own calculations.

4.2 Explanatory Factor Analysis

A method frequently used to test for construct validity and to control for underlying or unobservable source variables (that is abstract concepts) is Explanatory Factor Analysis, or EFA. This analytical method is based on the assumption that a set of observable variables is loaded by a number of underlying factors of which some are common and some are unique (Kim and Mueller, 1990; 1994). Hence, EFA provides an indication of the extent to which the variance of the seven indicators can be explained by separate, distinguishable dimensions (unique factors), and the extent to which variance is driven by a structure of common, indistinguishable dimensions (common factors). It is assumed that (i) common factors are

orthogonal, (ii) that unique factors are uncorrelated with each other, and (iii) that common factors are uncorrelated with the unique factors.

Starting with the sample covering all countries, our calculations identify one dominant factor that explains 80 per cent of the existing variance. The corresponding eigenvalue of this factor is 5.6, compared to 0.8 for the second (Table 5). The criteria applied to determine how many common factors to retain are taken from Kaiser (1974) and Jolliffe (2002). Kaiser recommends dropping factors with an eigenvalue smaller than one. Jolliffe (2002) suggests a cutoff of 0.7, as simulation studies find that Kaiser's criterion might in the presence of sampling errors lead to a situation in which the population eigenvalue is significantly higher than the sampling eigenvalue. As both criteria yield the same result, a one-factor model is appropriate in the all-country sample. This finding is in line with previous studies, for example Langbein and Knack (2010), who also emphasize that the WGI indicators in fact all measure the same basic concept.

Table 5: Explanatory Factor Analysis, All Countries, 1996–2009

Factors	Eigenvalue	Difference	Proportion	Cumulative
Factor 1	5.664	4.868	0.809	0.809
Factor 2	0.796	0.762	0.114	0.923
Factor 3	0.034	0.048	0.005	0.928
Observations				1,820

Source: Own calculations.

As MCA uses the governance indicators to identify good performers among the group of developing countries for purposes of aid allocation, the subsequent empirical analysis focuses on LICs. It yields a surprisingly clear-cut result: The assumption of a one-factor model is no longer valid. The explained variance of the first factor drops to 60 per cent and the eigenvalue of the second factor rises to 1.23 (Table 6). The second common factor explains 16 per cent of total variance. Overall, approximately 80 per cent of total sample variance can be explained

by two underlying factors. Both the Kaiser and Jolliffe criterion recommend sticking to a two-factor solution.

Table 6: Explanatory Factor Analysis, Low Income Countries, 1996–2009

Factors	Eigenvalue	Difference	Proportion	Cumulative
Factor 1	4.165	2.934	0.595	0.595
Factor 2	1.231	1.124	0.176	0.771
Factor 3	0.107	0.136	0.015	0.786
Observations				741

Source: Own calculations.

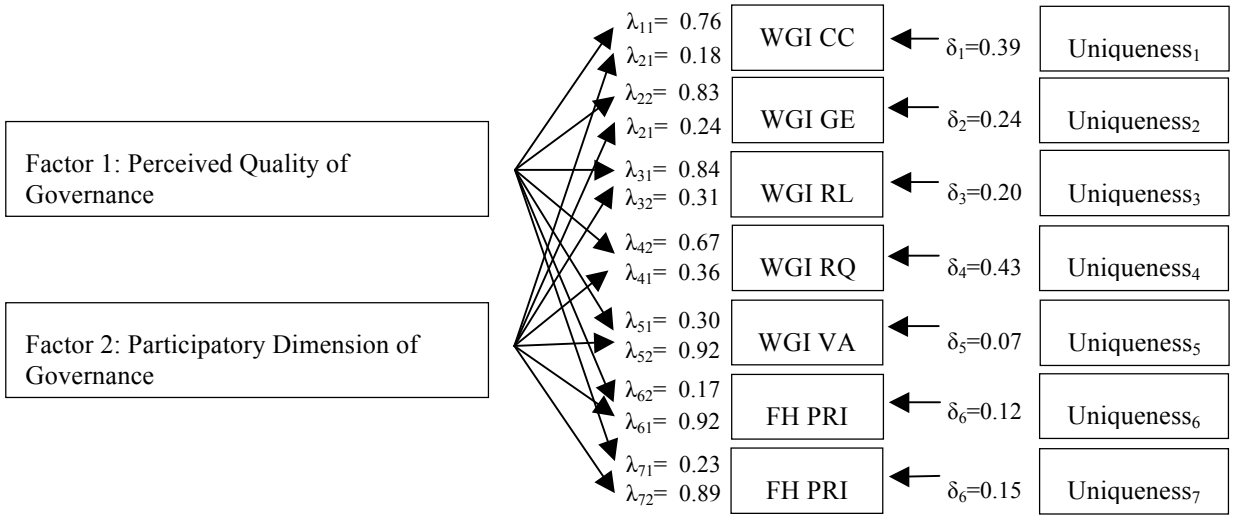
The EFA results do not significantly change when factors are determined for each year or for sub-periods between 1998 and 2007 (see Appendix IV and V). Furthermore, they are robust with respect to the factor extraction method used.[17] In the case of orthogonal factor analysis with standardized variables,[18] factor loadings are equivalent to correlations between factors and variables (Kim and Mueller, 1990).

As displayed in Figure 1, the factor loading and uniqueness pattern of the rotated solution confirms the hypothesis of two interdependent sets of indicators, each predominantly driven by one underlying factor:[19]

(i) The first set is loaded primarily by indicators measuring the perceived *quality and efficiency of government institutions*. These are WGI GE, WGI CC, WGI RL, and WGI RQ.

(ii) The second is mainly loaded by FH PRI, FH CLI, and WGI VA, reflecting the extent to which civil society and the citizenry is perceived to be in the position to control and monitor government institutions. This can be considered as the *participatory dimension of governance*.

Figure 1: Loading Pattern, Orthogonal Two Common Factor Model (LIC Sample)



Source: Own calculations.

These findings partly contradict the conclusions of Langbein and Knack (2010) who, based on a similar statistical analysis, comprising developed and developing countries, suggest that the WGIs generally fail to distinguish between different dimensions of governance and are a function of only one latent variable or underlying factor. The inclusion of developed countries with high across-the-board rankings probably results in a lower factor complexity, which is corroborated by the analysis covering the full sample. However, in case of the aid allocation, the concentration on a model tailored for LIC countries seems appropriate.

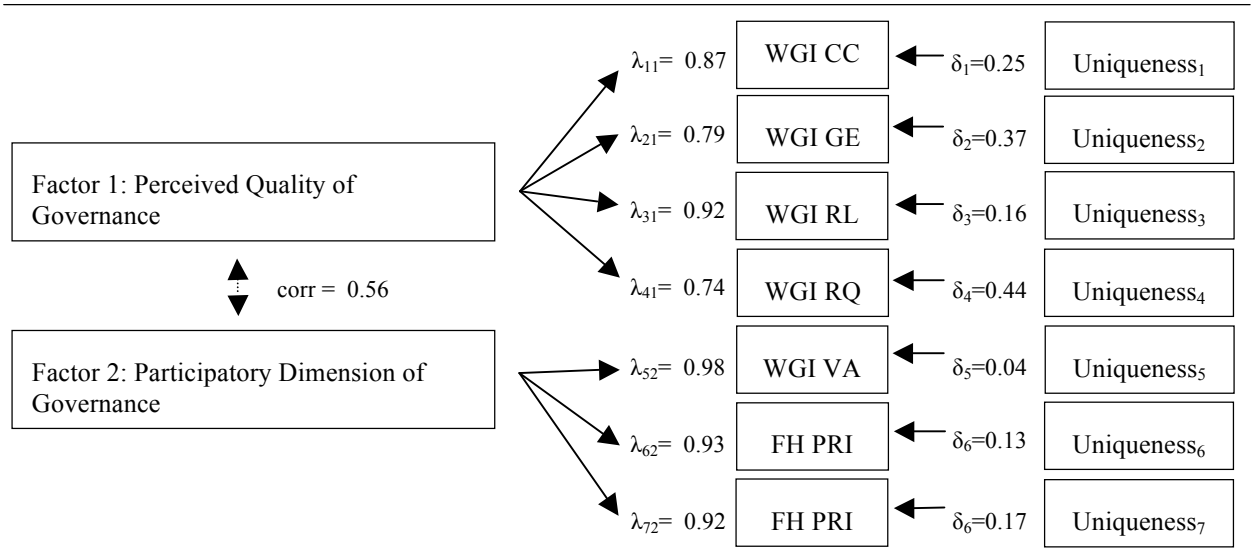
4.3 Confirmatory Factor Analysis

The EFA model with two common factors measuring the perceived *quality and efficiency of government institutions* and the perceived *participatory dimension of governance* provides well-interpretable and useful results. However, as EFA rests on several rigid assumptions (for example that all observed variables (indicators) are directly affected by all common factors and that common factors are uncorrelated) results should be subjected to further scrutiny, such as Confirmatory Factor Analysis (CFA). The CFA model structure of the observed and unobserved factors is identical to the one derived by EFA (two common factor model).[20]

Yet in contrast to EFA, which aims to determine the number of latent variables – that is the number of unobservable governance dimensions based on a set of assumptions about the latent variables' relation to the observables – CFA allows for different identified model specifications to be compared and tested, such as the number of common factors, correlated common factors, correlated errors, and different degrees of factor complexity.[21] The standard CFA estimation technique of Maximum Likelihood estimation gives standard errors for factor loadings and several fit criteria, such as the Root Mean Square Residual (RMSR), Comparative Fit Index (CFI), and Tucker-Lewis Index (TLI).

The loading structure of the best fitting CFA LIC model is shown in Figure 2. All factor loadings are significant at the one-per cent level. Confidence intervals for the point estimates are rather small (see Appendix VI). RMSR (0.02), CFI (0.95), and TLI (0.93) indicate an overall very good fit of the specification (Hair et al., 2006). Other loading specifications, in particular those with a single common factor, correlated errors, and a lower or higher factor complexity, had to be rejected due to inadequate fit or insignificant loading patterns.[22]

Figure 2: Loading Pattern CFA Model (LIC Sample)



Source: Own calculations.

While the strong CFA loading pattern confirms the two common factors result for LICs derived from EFA, it detects a significant positive correlation between the two unobservables. Accordingly, the perceived *overall quality and efficiency of government institutions* and the perceived *participatory dimension of government* have to be considered as discrete but related concepts that in the case of the MCA are measured through several similar proxies.

5. Conclusion

Whereas past research has focused on the conceptual characteristics of perception-based governance indicators in general, this paper provides a specific analysis of the MCA's application of governance indicators for aid allocation. Our research is of special interest to policy makers who rely on these indicators when making aid-allocation decisions.

From the results presented above, two principal conclusions can be drawn: First, our research shows that the meaningful use of quantitative perception-based governance indicators for the allocation of ODA to developing countries is a delicate and non-trivial undertaking. This is the case not only because of the difficulties in ranking point estimates in the presence of large measurement errors and relative peer-related, time-variant scaling – a topic that has been frequently discussed – but also, and more crucially, because of persisting uncertainties regarding measurement reliability and the conceptual validity of the selected measures. The seven indicators appear to have been selected in a somewhat arbitrary manner, in the absence of an effort to scrutinize their measurement validity and dimensionality. The result is a distorted and only ostensibly transparent allocation mechanism. Although the MCA uses seven indicators that purportedly measure different dimensions of governance, only two underlying governance concepts can be clearly identified – namely, the perceived *participatory dimension of governance* and the perceived *overall quality of governance.* To eliminate the most fundamental shortcomings, the indicators should be merged using

weighted factor scores in accordance with the identified dimensional pattern or redundant and congruent indicators should be dropped.

Second, the general doubts that have been raised in numerous papers concerning the validity of perception-based governance indicators such as the WGIs – particularly with regard to their singular dimensionality – appear less problematic insofar as the assessment of developing countries is concerned. The single dimensionality identified for the WGIs by Langbein and Knack (2010) is apparently to large extent caused by the heteroscedastic properties of the all-country sample. When excluding more developed countries who generally perform well across the board and produce little sample variance, a more nuanced picture emerges. Looking exclusively at the MCA's use of the WGIs to assess developing and least developed countries, a higher degree of common factorial causation is found.

Notes

[1] The Worldwide Governance Indicators were initially developed by Daniel Kaufmann, Aart Kraay, and Pablo Zido-Lobatón in 1999. Since 2003 the authors' team has been composed of Daniel Kaufmann, Aart Kraay, and Massimo Mastruzzi.

[2] See: Remarks to the United Nations Financing for Development Conference in Monterrey, Mexico, March 22, 2002.

[3] Data reported under this sub-function are not identical with OECD/DAC Official Development Assistance (ODA) figures as the two statistical concepts diverge significantly. A comparison of Official Development Assistance and U.S. Foreign Assistance Reporting can be found under http://gbk.eads.usaidallnet.gov/about/reporting_comparison.html.

[4] However, program disbursal is significantly behind schedule. By March 2009 only USD 1.2 billion had been released for projects and programs under implementation (Tarnoff, 2009).

[5] The countries are Armenia, Benin, Burkina Faso, Cape Verde, El Salvador, Georgia, Ghana, Honduras, Lesotho, Madagascar, Mali, Mongolia, Morocco, Mozambique, Namibia, Nicaragua, Tanzania, and Vanuatu.

[6] To encourage committed non-qualifying countries to improve their overall governance and service delivery performance the MCA also provides funding under so-called 'Threshold Programs'. Threshold Programs aim to help countries undertake institutional and policy reforms in areas where they have failed to meet MCA's performance criteria. According to current legislation, not more than 10 percent of overall MCA appropriations may be provided to Threshold Countries (Nowels, 2006).

[7] The definition follows the thresholds as defined in the World Bank's lending categories and not according to the analytical classifications of the World Development Indicators. In fiscal years 2004 and 2005, candidate status was restricted to LICs only.

[8] This refers to the list of indicators for fiscal year 2009. Indicators have been repeatedly revised and amended (MCA, 2004; 2005; 2006; 2007; 2008; 2009).

[9] The board is however left with substantial discretion in selecting eligible countries: 'A review of the history of the MCA selections suggests that the Board is guided by, but not entirely bound to, the outcome of the performance indicator review process; board members can apply discretion in their selection. Performance trends, missing or old date, and recent policy actions might come into play during selection deliberations.' Further: 'The Board also examines whether a country performs substantially below average on any single indicator and whether their selection was supported by supplemental information' (Tarnoff, 2009).

[10] The indicator draws on trade-weighted average tariff rates and penalty scores for non-tariff barriers (NTB). Weights are calculated based on the share of imports for each good. Penalty scores reflect the extent to which NTBs are used to impede imports of goods and services. See also http://www.heritage.org/index/Download.aspx.

[11] It is important to note that the indicators used here measure perceived governance outcomes and do not compare institutions which would require a deeper *de jure* analysis.

[12] Based on expert appraisals, a weighted scale ranging from 1 to 7 is computed for each of the two indicators. According to Freedom House, the sources used for computing the scores are selected and evaluated by a number of analysts and consultants who use an array of information, including news reports and information from NGOs, to review the scorings and to check for consistency. A more detailed description of the methodology, the experts' questionnaire and the aggregation process can be obtained from http://www.freedomhouse.org.

[13] The WGI project includes the computation of six indicators, five of which are used for the MCA selection process.

[14] All definitions provided in parenthesis are taken from Kaufmann et al., 2007.

[15] The WGIs are composed from 310 individual underlying data sources that are assigned to one of the dimensions and are then aggregated using an unobserved component model that attributes weights to individual variables according to their estimated precision. For a more detailed description of construction and aggregation and the data sources, see Kaufmann et al., 2004; 2005.

[16] The latter hypothesis can be specifically validated by testing the results of bivariate OLS regression for each indicator on GNI/capita. The White-test indicates that the null hypothesis of a constant variance of OLS residuals can be rejected at the 10 percent level in all cases, except for WGI RQ. The Preusch-Pagan test clearly rejects the homoscedasticity hypothesis in five of the seven cases.

[17] Maximum Likelihood and iterated principal factors yield very similar results with only minor deviations. For an overview on methods of factor extraction see Kim and Mueller (1994).

[18] For EFA and CFA the sample and sub-samples are normalized such that average is zero and standard deviation is 1 in each year.

[19] λ_{ik} describes the loading of the observed variable j by the common (unobservable) factor k. δ_j describes the loading of the unique factor on the observable variable j. In the case of EFA, squared loadings, for both common and unique factors, can be interpreted as the share in the observable's variance, as the variables are normalized such that their variance is 1. For the applied method of rotation see Appendix III.

[20] An explanatory note on the difference between the EFA and CFA method is provided in Appendix II.

[21] The CFA estimation is based on the STATA® Confa algorithm devised by Kolenikov (2009). Results for best fit CFA specifications can be found in appendix IV (LIC country sample).

[22] Results are available from the authors upon request.

References

Arndt, C. (2010) The Politics of Governance Ratings. *International Public Management Journal*, 11(3), pp. 275–297.

Arndt, C. and Oman, C. (2006) *Uses and Abuses of Governance Indicators.* (Paris: OECD).

Benz, A., Lütz, S., Schimank, U. and Simonis, G. (eds) (2007) *Handbuch Governance. Theoretische Grundlagen und empirische Anwendungsfelder*, (Wiesbaden: Verlag für Sozialwissenschaft).

Berthélemy, J.-C. and Tichit, A. (2004) Bilateral donors' aid allocation decisions – a three-dimensional panel analysis. *International Review of Economics and Finance*, 13, pp. 253–274.

Bollen, K.A. (1989) *Structural Equations with Latent Variables* (New York: Wiley).

Burnside, C. and Dollar, D. (2000) Aid, Policies, and Growth. *The American Economic Review,* 90(4), pp. 847–868.

Chhotray, V. and Hulme, D. (2009) *Contrasting* Visions for Aid and Governance in the 21st Century: The White House Millennium Challenge Account and DFID's Drivers of Change. *World Development,* 37(1), pp. 36–49.

Clemens, M. and Radelet, S. (2003): The Millennium Challenge Account: How much is too much, how long is long enough*?* Working Paper, No. 23, Center for Global Development.

Doornbos, M. (2001) 'Good Governance': The Rise and Decline of a Policy Metaphor? *Journal of Development Studies,* 37(6), pp. 93–108.

Hair, J. F., Black, B., Rabin, B., Anderson, R.E. and Tatham, R.L. (2005) *Multivariate Data Analysis* (6th ed.) (Upper Saddle River , NJ: Prentice Hall).

Hermes, N. and Lensink, R. (2001) Changing the Conditions for Development Aid: A New Paradigm? *Journal of Development Studies,* 37(6), pp. 1–16.

Jolliffe, I.T. (2002) *Principal Components Analysis* (2nd ed.) (New York: Springer).

Kaiser, H.F. (1974) An index of factorial simplicity. *Psychometrika* 39, pp. 31–36.

Kaufmann, D., Kraay, A. and Zoido-Lobatón, P. (1999a) Aggregation Governance Indicators. Policy Research Working Paper, No. 2195, The World Bank Institute.

Kaufmann, D., Kraay, A. and Zoido-Lobatón, P. (1999b) Governance Matters. Policy Research Working Paper, No. 2196, The World Bank Institute.

Kaufmann, D. and Kraay, A. (2002) Governance Indicators, Aid Allocation, and the Millennium Challenge Account. Working Paper Series, Draft Version, The World Bank Institute.

Kaufmann, D., Kraay, A. and Mastruzzi, M. (2004) Governance Matters: Governance Matters III: Governance Indicators for 1996, 1998, 2002 and 2004. *The World Bank Economic Review,* 24(2), pp. 253–287.

Kaufmann, D., Kraay, A. and Mastruzzi, M. (2005) Governance Matters IV: Aggregate and Individual Governance Indicators 1996–2004. World Bank Policy Research Working Paper, No. 3630, The World Bank Institute.

Kaufmann, D., Kraay, A. and Mastruzzi, M. (2007) Governance Matters VI: Aggregate and Individual Governance Indicators 1996–2006. World Bank Policy Research Working Paper, No. 4280, The World Bank Institute.

Kaufmann, D., Kraay, A. and Mastruzzi, M. (2008) Governance Matters VII: Aggregate and Individual Governance Indicators 1996–2007. World Bank Policy Research Working Paper, No. 4654, The World Bank Institute.

Kim, J.O. and Mueller, C.W. (1990) Introduction to Factor Analysis. Sage University Paper Series on Quantitative Applications in the Social Sciences, No. 07-013, Sage University.

Kim, J.-O. and Mueller, C. (1994) Factor Analysis: Statistical Methods and Practical Issues. Sage University Paper Series on Quantitative Applications in the Social Sciences, No. 07-014, Sage University.

Kolenikov, S. (2009*)* Confirmatory factor analysis using confa. *The State Journal,* 9(3), pp. 329–373.

Kurtz, M.J. and Schrank, A. (2007) Growth and Governance: Models, Measures, and Mechanisms. *The Journal of Politics,* 69(2), pp. 538–554.

Langbein, L. And Knack, S. (2010) The Worldwide Governance Indicators: Six, One or None? *Journal of Development Studies,* 46(2), pp. 350–370.

Lawley, D.N. and Maxwell, A.E. (1962) Factor Analysis as a Statistical Method. *The Statistician,* 12(3), pp. 209–229.

Lockwood, M. (2005) *The State They're In: An Agenda for International Action on Poverty in Africa* (London: ITDG Publishing).

Long, S.J. (1994) Confirmatory Factor Analysis. A Preface to LISREL. Sage University Paper series on Quantitative Applications in the Social Sciences, No. 07-033, Sage University.

MCC (2004) *2004 Country Scorebook*. http://www.mcc.gov/documents/reports/mcc-2004-scorebook.pdf (accessed 15 December 2010).

MCC (2005) *2005 Country Scorebook*. http://www.mcc.gov/documents/reports/mcc-2005-scorebook.pdf (accessed 15 December 2010).

MCC (2006) *2006 Country Scorebook*. http://www.mcc.gov/documents/reports/mcc-2006-scorebook.pdf (accessed 15 December 2010).

MCC (2007) *2007 Country Scorebook*. http://www.mcc.gov/documents/reports/mcc-2007-scorebook.pdf (accessed 15 December 2010).

MCC (2008a) *2008 Country Scorebook*. http://www.mcc.gov/documents/reports/ mcc-2008-scorebook.pdf (accessed 15 December 2010).

MCC (2008b) *Guide to the MCC Indicators and the Selection Process. Fiscal Year 2009.*

MCC (2009) *2009 Country Scorebook.* http://www.mcc.gov/documents/reports/mcc-2009-scorebook.pdf (accessed 15 December 2010).

Nowels, L. (2006) *Millennium Challenge Account: Implementation of a New U.S. Foreign Aid Initiative*. CRS Report for Congress.

Nuscheler, F. (2009) Good Governance – Ein universelles Leitbild von Staatlichkeit und Entwicklung? INEF Report, No. 96/2009, Institut für Entwicklung und Frieden, Universität Duisburg-Essen.

OECD (2003) The Millennium Challenge Account. Fact Sheet. Joint OECD DAC/Development Centre Experts' Seminar on Aid Effectiveness and Selectivity: Integrating multiple objectives into aid allocation, OECD.

OECD (2005) Handbook on Constructing Composite Indicators: Methodology and User Guide. OECD Statistics Working Papers, No. 2005/3, OECD.

Radelet, S. (2002a) Beyond the Indicators: Delivering Effective Foreign Assistance through the Millennium Challenge Account. Center for Global Development, 12 September 2002.

Radelet, S. (2002b) Qualifying for the Millennium Challenge Account. Center for Global Development, 13 September 2002.

Sperling, G. and Hart, T.(2003) A Better Way to Fight Global Poverty: Broadening the Millennium Challenge Account. *Foreign Affairs*, 82(2), pp. 9–14.

Tarnoff, C. (2009) Millennium Challenge Corporation, CRS Report for Congress.

The White House (2002) *Remarks by the President on Global Development*. Office of the Press Secretary, released 14 March 2002.

The White House (2010) *The Budget: Historical Tables. Outlays by Functions and Sub-Functions 1962–2015.* http://www.whitehouse.gov/omb/budget/Historicals (accessed 15 December 2010).

Thomas, M. (2010) What Do the Worldwide Governance Indicators Measure? *European Journal of Development Research*, 22, pp. 31-54.

United Nations (2002) Final Outcome of the International Conference on Financing for Development. Note by the Secretariat, No. A/CONF.198/3, UN.

USAID (2010) *USAID's U.S. Overseas Loans and Grants: Obligations and Loan Authorizations.* http://gbk.eads.usaidallnet.gov (accessed 15 December 2010).

Van de Walle, N. (2005) *Overcoming Stagnation in Aid-Dependent Countries: Politics, Polices and Incentives for Poor Countries* (Washington, D.C.: Center for Global Development).

World Bank (1989) *Sub-Saharan Africa: From Crisis to Sustainable Growth. A Long-Term Prospective Study* (Washington, D.C.: The World Bank).

World Bank (1998) *Assessing Aid: What Works and What Doesn't* (Washington, D.C.: The World Bank).

Appendix I: Summary Statistics, MCA Governance Indicators, 1996–2009

All Countries*					
Variable	**Mean**	**Median**	**Std. dev.**	**Min**	**Max**
WGI CC	-0.062	-0.288	0.966	-2.489	2.467
WGI GE	-0.053	-0.249	0.955	-2.394	2.267
WGI RL	-0.089	-0.268	0.950	-2.313	1.963
WGI RQ	-0.029	-0.152	0.923	-2.652	3.345
WGI VA	-0.054	-0.095	0.958	-2.150	1.827
FH CLI	3.310	3.000	1.720	1.000	7.000
FH PRI	3.368	3.000	2.110	1.000	7.000
Observations:	1,820				
Low Income Countries*					
Variable	**Mean**	**Median**	**Std. dev.**	**Min**	**Max**
WGI CC	-0.734	-0.769	0.457	-2.489	0.825
WGI GE	-0.765	-0.771	0.460	-2.394	0.815
WGI RL	-0.781	-0.789	0.523	-2.313	0.864
WGI RQ	-0.703	-0.591	0.545	-2.652	0.688
WGI VA	-0.666	-0.637	0.646	-2.150	1.039
FH CLI	4.305	4.000	1.290	1.000	7.000
FHI PRI	4.468	4.000	1.723	1.000	7.000
Observations:	741				

Source: Own calculations.

* For EFA and CFA the sample and sub-samples are normalized such that average is zero and standard deviation is 1 in each year.

Appendix II: Eligibility Criteria

Year	All Countries	LICs	MCA Threshold in USD*	LMICs	MCA Threshold in USD*
1996	138	61	1.505	22	3.035
1998	171	76	1.460	31	3.125
2000	170	78	1.445	24	2.995
2002	172	76	1.435	26	2.975
2003	173	73	1.415	30	2,935
2004	172	70	1.464	27	3,035
2005	171	70	1.575	30	3,255
2006	169	65	1.675	30	3,465
2007	168	64	1.735	28	3,595
2008	165	57	1.785	29	3,705
2009	151	51	1.855	26	3,855
Total:	1,820	741		303	

Source: World Bank, GNI per capita threshold (atlas method), MCA eligibility according to IDA eligibility thresholds.

Appendix III: Technical note on EFA and CFA

1. Explanatory Factor Analysis

EFA is a statistical technique to determine how many underlying common and unique factors account for the variance and covariance of the given data (Kim and Mueller, 1994).

It assumes that the observables are a linear combination of the common and unique factors, such that the model can be written in algebraic form:

$$y_j = \sum_{k=1}^{K} \lambda_{jk}\xi_k + \delta_j,$$

with: $y_j, j = 1,...,J$ obs. variables,

$\xi_k, k = 1,....K$ unobs. variables,

λ_{jk} loadings of common factors,

δ_j loadings of unique factors.

When standardizing variables, the variance of the observables can be expressed as the sum of the communality and the unique variance:

$$\mathbb{V}\left(y_j\right) = h_j^2 + \delta_j^2$$

with

$$h_j^2 = \sum_{k=1}^{K} \lambda_{jk}^2.$$

In orthogonal principal factor analysis, estimates for the factor loadings are obtained by solving the eigenequations of the adjusted correlation matrix, where diagonal elements are replaced by the estimated communalities h^2. Estimates are obtained by calculating the squared multiple correlations between each observed variable and the remaining observed variables. The squared multiple correlation of any variable with the remaining variables is given by:

$$SMC = \mathbf{I} - \left\{\text{diag}\ \mathbf{R}^{-1}\right\}^{-1}.$$

The relationship between the adjusted correlation matrix **R** and the factor loading matrix is not unique because (1) a specific adjusted correlation matrix can be reproduced by models with different numbers of factors and (2) a specific adjusted correlation matrix can be generated by a specific number of factors but different factor loading patterns.

For the extraction of loadings the postulate of *parsimonious factorial causation* (assuming that observables are loaded by a minimum number of factors) and the postulate of *simplicity* (the model with the smallest factor complexity) have to be made.

Solving the determinant form of the eigenequation and determine eigenvalues:

$$\mathrm{Det}\left(\hat{\mathbf{R}} - \lambda\mathbf{I}\right) = 0.$$

Where $\hat{\mathbf{R}}$ is the adjusted correlation matrix.

For determining the minimal amount of factors to be retained, several criteria are available, such as Kaiser's (criterion of eigenvalues above 1.0) and Jolliffe's (criterion of eigenvalues above 0.7).

To achieve maximal simplicity, factors have to be rotated to the final solution. Using the Varimax method, simplicity is measured by the variance of the squared loadings for each factor:

$$v_k = \frac{1}{J}\left[\sum_{j=1}^{J}\lambda_{jk}^2 - \frac{1}{J}\sum_{j=1}^{J}\lambda_{jk}^2\right]^2.$$

The general index of simplicity is defined as the sum of the simplicity $\boldsymbol{v}_k$ over all factors:

$$V = \frac{1}{J}\sum_{k=1}^{K}\left[\sum_{j=1}^{p}\lambda_{jk}^2 - \frac{1}{J}\sum_{j=1}^{J}\lambda_{jk}^2\right]^2.$$

The greatest possible simplicity is obtained when the variance of squared loadings for each factor is maximized, subject to:

$$h_j^2 = \sum_{k=1}^{K}\lambda_{jk}^2.$$

2. Confirmatory Factor Analysis

The explanatory power of EFA is limited, for two principal methodological problems exist: (i) the structure of factorial causation derived from EFA is obtained by imposing the arbitrary postulates of parsimony and simplicity, and (ii) a particular algorithm is imposed on the data without leaving much scope to control for model specification. Hence, EFA results can only be regarded as indicative and need to be validated by other means such as CFA.

The unrestricted relation between the observed variables and the underlying factors used in CFA is, except for the regression intercept, equivalent to EFA model specification:

$$y_j = \mu_j + \sum_{k=1}^{K} \lambda_{jk}\xi_{ik} + \delta_{ij} .$$

In matrix form the equation can be expressed as:

$$\underset{p\times 1}{\mathbf{y}} \boldsymbol{\mu} = \underset{p\times 1}{\boldsymbol{\Lambda}} + \underset{p\times m}{\boldsymbol{\xi}} \underset{m\times 1}{\boldsymbol{\delta}} + \underset{p\times 1}{\quad} .$$

If unique factors are assumed to be independent of common factors and if variables are normalized, then the covariance matrix of the observables is given by:

$$\underset{p\times p}{\boldsymbol{\Sigma}(\theta)} = \underset{p\times m}{\boldsymbol{\Lambda}} \underset{m\times m}{\boldsymbol{\Phi}} \underset{m\times p}{\boldsymbol{\Lambda}'} + \underset{p\times p}{\boldsymbol{\Theta}} .$$

As the unconstrained covariance equation contains $J \cdot (J+1)/2$ independent equations, there are $J \cdot (J+1)/2 + J \cdot K + J \cdot (K+1)/2$ independent parameters. Hence, at least $J \cdot K + K \cdot (K+1)/2$ restrictions are needed to ensure that the model is identified. For sufficient conditions for the identification see Bollen (1989). The best model fit was obtained when using a factor complexity of one. In this case the model is always identified.

The maximum likelihood estimation equation in matrix from can be written as:

$$\begin{aligned} \ln L\left(\mathbf{Y}, \Sigma(\theta)\right) &= -\sum_{i=1}^{n}\left[\frac{p}{2}\ln 2\pi + \frac{1}{2}\ln\left|\Sigma(\theta)\right| + \frac{1}{2}\left(\mathbf{y}_i - \mu\right)\right] \\ &= \frac{np}{2}\ln 2\pi - \frac{n}{2}\ln\left|\Sigma(\theta)\right| - \frac{1}{2}\Sigma^{-1}(\theta)S \end{aligned}$$

where S is the maximum likelihood estimate of the covariance matrix of the data.

Suitable fit indices are (i) the Root Mean Square Residual where the square root of the mean of the squared residuals between observed and estimated correlation matrix indicates the fit quality (values below 0.05 are considered good fit) and the Comparative Fit Index which compares between estimated model and a null model (values above 0.9 are considered good fit).

Appendix IV: Explanatory Factor Analysis, Low Income Countries, 1996-2002

Factors	Eigenvalue	Difference	Proportion	Cumulative
Factor 1	4.067	2.844	0.581	0.581
Factor 2	1.223	1.197	0.175	0.756
Factor 3	0.026	0.054	0.004	0.760
Observations				291

Source: Own calculations.

Factor Loadings and Uniqueness (rotated)

Observables	**Factor 1**	**Factor 2**	**Uniqueness**
WGI CC	0.827	0.233	0.262
WGI GE	0.764	0.159	0.391
WGI RL	0.822	0.311	0.229
WGI RQ	0.632	0.387	0.451
WGI VA	0.314	0.909	0.075
FH CLI	0.200	0.888	0.171
FH PRI	0.151	0.920	0.131

Source: Own calculations.

Appendix V: Explanatory Factor Analysis, Low Income Countries, 2003-2009

Factors	Eigenvalue	Difference	Proportion	Cumulative
Factor 1	4.317	3.101	0.617	0.617
Factor 2	1.216	1.006	0.174	0.791
Factor 3	0.209	0.232	0.030	0.821
Observations				450

Source: Own calculations.

Factor Loadings and Uniqueness (rotated)

Observables	**Factor 1**	**Factor 2**	**Uniqueness**
WGI CC	0.842	0.255	0.225
WGI GE	0.759	0.204	0.382
WGI RL	0.852	0.313	0.175
WGI RQ	0.698	0.353	0.389
WGI VA	0.276	0.928	0.062
FH CLI	0.269	0.899	0.120
FH PRI	0.181	0.924	0.114

Source: Own calculations.

Appendix VI: Confirmatory Factor Analysis, Low Income Countries 1996-2009

Log Likelihood = -5004.15 Number of observations: 741

	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Means						
WGI CC	0.000	0.037	0.00	1.00	-0.072	0.072
WGI GE	0.000	0.037	0.00	1.00	-0.072	0.072
WGI RL	0.000	0.037	0.00	1.00	-0.072	0.072
WGI RQ	0.000	0.037	0.00	1.00	-0.072	0.072
WGI VA	0.000	0.037	0.00	1.00	-0.072	0.072
FH CLI	0.000	0.037	0.00	1.00	-0.072	0.072
FH PRI	0.000	0.037	0.00	1.00	-0.072	0.072
Loadings						
Governance						
WGI CC	0.791	0.031	25.16	0.00	0.729	0.852
WGI GE	0.866	0.030	28.61	0.00	0.806	0.925
WGI RL	0.917	0.029	31.43	0.00	0.860	0.974
WGI RQ	0.741	0.033	22.68	0.00	0.677	0.806
Voice						
WGI VA	0.979	0.01964	36.61	0.00	0.927	1.031
FH CLI	0.933	0.02477	33.58	0.00	0.879	0.988
FH PRI	0.918	0.02222	32.57	0.00	0.862	0.972
Factor Covariance						
Governance – Governance	1.000	.	.	.	.	.
Voice – Voice	1.000	.	.	.	.	.
Governance – Voice	0.558	0.027	20.15	0.00	0.504	0.613
Error Variance						
WGI CC	0.373	0.023	16.20	0.00	0.328	0.418
WGI GE	0.249	0.020	12.63	0.00	0.210	0.288
WGI RL	0.158	0.017	9.08	0.00	0.124	0.192
WGI RQ	0.449	0.027	16.42	0.00	0.395	0.502
WGI VA	0.040	0.008	5.29	0.00	0.025	0.055
FH CLI	0.127	0.009	13.55	0.00	0.109	0.146
FH PRI	0.157	0.011	14.68	0.00	0.136	0.177
Fit Indices						
CFI	0.947					
TLI	0.932					
RMSR	0.912					

Source: Own calculations.

Diskussionsbeiträge
des Fachbereichs Wirtschaftswissenschaft
der Freien Universität Berlin

2011

2011/1 NEHER, Frank
Markets Wanted – Expectation Overshooting in Transition
Economics

2011/2 KNOLL, Martin / Petra ZLOCZYSTI
The Good Governance Indicators of the Millennium Challenge Account
Economics

2011/3 KAPPLER, Marcus / Helmut REISEN / Moritz SCHULARICK / Edouard TURKISCH
The Macroeconomic Effects of Large Exchange Rate Appreciations
Economics