AN EMPIRICAL EVALUATION OF COMMON CROSS-NATIONAL MEASURES OF STATE CAPACITY

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1. Introduction

State capacity is of broad and current interest in many social science subfields. Most researchers and policymakers agree that a capable state apparatus with effective institutions is crucial for the creation of long-term socioeconomic prosperity. Conversely, "weak or failed states are close to the root of many of the world's most serious problems" (Fukuyama, 2004). Therefore, today, building well-functioning state institutions is a high-priority global objective: it is one of the targets of the UN 2030 Agenda Sustainable Development Goals (SDGs), and more generally, considered as a necessary condition for the achievement of the SDGs.

Despite the widespread consensus on the importance of state capacity, there is much less agreement on how the concept – usually understood as the state's ability to reach its objectives (e.g., Acemoglu and Robinson, 2019) – should be quantified. Plenty of different measures have been used to capture state capacity. Yet, these measures are hardly ever evaluated comparatively. In particular, the empirical differences between these measures and the quality of these measures are seldom discussed in the literature.

If measures of broadly related concepts such as democracy (e.g., Knutsen, 2010; Boese, 2019; Vaccaro, 2021) and rule of law (e.g., Skaaning, 2010; Møller and Skaaning, 2011; Versteeg and Ginsburg, 2017) have been analysed extensively, only a handful of studies have compared measures of state capacity. Furthermore, most of these comparative studies have taken primarily a conceptual (e.g., Cingolani, 2018) rather than empirical (e.g., Hendrix, 2010) approach to the issue.

While conceptual questions are important, empirical aspects ought not to be treated superficially. As well put by Jerven (2013), "scholars pay great attention to defining the concepts ad devote great effort to theorizing the existence of the phenomenon and spend comparatively little time critically probing the numbers that are supposed to represent them". My study aims then to tackle this shortcoming in the literature by providing one of the first in-depth comparative empirical assessments of common measures of state capacity. The central contribution of my study is to help researchers and policymakers to make better choices among

competing measures of state capacity by reducing current "informational uncertainties" (Mudde and Schedler, 2010).

My study proceeds as follows. First, I conduct a survey of existing cross-national measures of state capacity and select the most "currently relevant" measures for further analysis. Second, I examine the basic statistical properties of the selected measures and assess the measures according to two criteria: normality of distribution and ability to discriminate between observations. Additionally, the most problematic measures are further discussed through empirical examples. Third and last, in the conclusive section, I sum up the main findings and provide ideas for future research on the topic.

2. Selection of data

Social scientists have used a variety of different cross-national measures to quantify state capacity. Since it is impossible to analyse comprehensively all these measures in a single study, I pick out some of the most relevant ones for further analysis. The selection process is carried out according to four criteria: (1) academic relevance, (2) type of data, (3) coverage, (4) accessibility.

The first criterion is met if a measure has been used to quantify state capacity in several comparative social science studies. The second criterion is met if a measure is based – at least partially – on subjective (i.e., perception-based) data. The third criterion is met if a measure provides yearly country-level scores over time and across countries in the world. The fourth criterion is met if a measure is publicly and freely available for use. An extensive review of recently used datasets suggests that seven measures meet the selection criteria. Table 1 presents these measures.

Table 1 – *Selected measures of state capacity.*

Measure	Producer
Quality of government index (QOG)	Quality of Government Institute
Capacity index (HSI)	J. Hanson and R. Sigman
Government effectiveness (WGI)	The World Bank
State fragility index (SFI)	Center for Systemic Peace
Failed states index (FSI)	Fund for Peace
Corruption perceptions index (CPI)	Transparency International
Impartial public administration (VDM)	Varieties of Democracy

Before proceeding with the analysis, it is important to stress that the selected measures differ – at least up to a certain extent – in terms of content and intended purpose. That said, assessing the content validity and/or the intended purpose of the measures is out of the scope of my study. What matters for the study at hand instead is the effective use of these measures to quantify state capacity. Following the

aforementioned selection criteria, regardless of their content and their intended purpose, the chosen measures have been all frequently used to quantify the concept of state capacity in comparative cross-national social science research.

Quality of government index (QOG) is published by the Quality of Government Institute (Teorell *et al.*, 2020). It aggregates three indicators – *Bureaucracy quality*, *Corruption*, and *Law and order* – from PRS Group's International Country Risk Guide into a single multidimensional index. The data is thus entirely coded by PRS Group's country experts. QOG ranges from 0 (low) to 1 (high) and provides data for most countries (140 in 2015) in the world from 1984 onwards.

Capacity index (HSI) is developed by Hanson and Sigman. It synthesises pre-existing data on the extractive, administrative, and coercive capacities of the state (Hanson and Sigman, 2021). The underlying data contains both subjective and objective indicators. HSI runs from low to high and provides annual data for up to 177 countries from 1960 to 2015. In our sample, the final index ranges from -2.31 to 2.96, with a mean of 0.68 and a standard deviation of 0.93.

Government effectiveness (WGI) is one of the six Worldwide Governance Indicators (Kaufmann *et al.*, 2011). It synthesises perception-based data related to the quality of public administration and the quality of public services from nearly 20 sources into a single composite index. WGI runs from low to high on a standardised (z-score) scale with a mean of 0 and a standard deviation of 1. It provides yearly data from 2003 onwards (biannual data from 1996 to 2002) for virtually all countries and some territories in the world (209 in 2015).

State fragility index (SFI) is published by the Center for Systemic Peace (Marshall and Elzinga-Marshall, 2017). It is based on 14 sub-indicators related to four aspects of state effectiveness and state legitimacy: political, social, economic, and security. The final index combines both subjective and objective data. SFI is scaled from 0 to 25, where 0 represents the highest and 25 the lowest level of state capacity. It provides yearly data for all countries in the world with a population of at least 500,000 from 1995 onwards (167 in 2015).

Fragile states index (FSI) is developed by the Fund for Peace. Its scores are based on qualitative expert assessment, content analysis of articles and reports, and quantitative secondary data relevant to 12 dimensions of the state such as security and rule of law (Fund for Peace, 2017). FSI provides yearly data for most countries in the world (177 in 2015) from 2005 onwards. The final index is scaled from 0 to 120, where 0 represents the highest and 120 the lowest level of state capacity.

Corruption perceptions index (CPI) is published by Transparency International. It is based on pre-existing perception-based data (from 12 sources in 2015) on public sector corruption and closely related aspects such as transparency and bureaucratic professionalisation (Transparency International, 2015). CPI provides annual scores from 1995 onwards, and its 2015 edition covers 168 countries in the world. The

index ranges from 0 to 10 until 2011 and from 0 to 100 from 2012 onwards. A higher score indicates less corruption, and thus, more state capacity.

Impartial public administration (VDM) is produced by the Varieties of Democracy Institute (Pemstein *et al.*, 2019). The measure answers the question: "Are public officials rigorous and impartial in the performance of their duties?" (Coppedge *et al.*, 2019). Its scores are based on expert coding and its annual data goes back as far as 1789 for nearly all countries in the world (177 in 2015). In our sample, VDM ranges from −3.22 (low) to 3.61 (high), with a mean of 0.43 and a standard deviation of 1.47.

3. Research strategy

Now that I have selected some of the most relevant measures of state capacity, it is time to proceed to compare and evaluate them. This section describes briefly my research strategy. The next section presents and discusses the empirical results.

I start the empirical evaluation of the measures of state capacity by exploring their basic statistical properties through violin plots. Approximately normally distributed variables are preferable to completely non-normal variables, not because we expect real world state capacity to be distributed Gaussian, but because many common statistical tests and analyses assume that variables follow more or less a bell-shaped curve. The visual assessment of the measures is complemented with a formal Shapiro-Wilk test for normality (Royston, 1992).

Acquiring information on basic statistical properties and distributional characteristics of measures of state capacity is important in itself. Nevertheless, violin plots allow us to discover also some less apparent measurement issues, which are further examined through individual country scores.

To be more specific, considering that all sciences aim to describe reality accurately (Goertz 2020) and that "a key purpose of measurement in social sciences is to identify, quantify and possibly explain the differences that exist between units of analysis" (Gnaldi *et al.*, 2017), then all other things equal a measure of state capacity that is unable to discriminate between countries must be inferior to a measure that successfully describes true cross-national differences.

If such lack of precision causes scores to clump at extreme values, a measure additionally fails to capture interesting variation in its entirety, and thus, its scale is not extended enough (Goertz, 2020). On these grounds, it seems reasonable to assume that the inability to discriminate between different cases and clumping at extreme values are characteristics that a flawless measure of state capacity should not possess.

As we have seen in the previous section, the selected measures of state capacity do not have equal scales. Hence, to ease the comparability among the measures, I normalise[1] (min-max) all indicators to range from 0 to 1, where a lower score indicates a weaker state and a higher score indicates a stronger state. This means also that throughout the empirical analysis the original scales of FSI and SFI are reversed. Missing data is deleted listwise. Therefore, the empirical analysis includes only country-years that are common to all the selected measures. This ensures that our results are not even minimally driven by differences in samples.

4. Results and discussion

4.1 Basic statistical properties

Violin plots (Figure 1) illustrate the basic statistical properties of the selected measures in all common country-years. The grey outlines of the "violins" show the frequency distribution of each measure. The black-bordered box in the middle of each violin stretches out from the first to the third quartile of each variable. The whiskers stretch out to the lowest and highest observations that are not considered unusual in the data. Single observations that do not fall inside this range of the data (i.e., outliers) are represented by dots above or below the whiskers. The small black rectangle inside the box represents the median.

First, a visual inspection of the violin plots suggests that all the measures deviate from a perfectly bell-shaped distribution. The results of a formal Shapiro-Wilk test for normality confirm that none of the measures is normally distributed. In comparative terms, however, there are some interesting differences between the measures. FSI, QOG, HSI, WGI, and VDM seem to be more normally distributed than CPI and SFI. They have a main peak at intermediate levels of state capacity, the median approximately at halfway of the scale, and a lower frequency of observations at the two extremes of the scale. CPI and SFI instead seem to be far from having a reasonably bell-shaped distribution.

CPI is heavily skewed to the right and its mode and median are remarkably low. As many as 41.1% of CPI's observations are in the bottom quarter of the scale and 74.5% of its observations are below the mid-point of the scale. In practice, this means that many countries receive much lower scores with CPI than with the other measures.

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[1] See Mazziotta and Pareto (2021) for a comprehensive analysis of the advantages and disadvantages of common normalisation methods.

SFI, instead, suffers from the opposing problem: it has a heavily left-skewed distribution and a comparatively high mode and median. As many as 43.6% of its observations are in the topmost quarter of the scale, but only around 8.1% of its observations are in the bottom quarter of the scale. This means that in general countries are more "capable" with SFI than with the other measures.

Figure 1 – *Violin plots of measures of state capacity (2005-2015).*
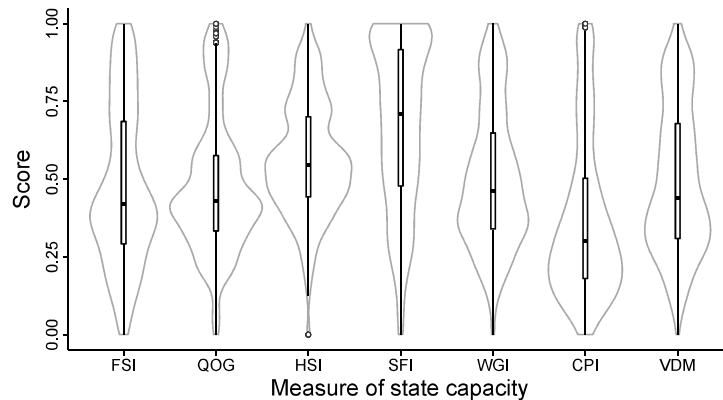
N = 1411.

Overall then, FSI, QOG, HSI, WGI, and VDM are more normally distributed than CPI and SFI. Their main modes, medians, and means are relatively close to the halfway of the scale. FSI's, QOG's, WGI's, and VDM's main peaks and medians are closer to the low end of the scale, whereas HSI's main peak and median is closer to the high end of the scale. QOG and CPI have some outliers at the upper extreme of the scale, whereas HSI has a single outlier observation at the low extreme of the scale. FSI, WGI, SFI, and VDM do not have any outliers.

4.2 Ability to discriminate between countries

As already said, acquiring information on the above features of the data is helpful in itself. Additionally, however, violin plots are useful in revealing certain less obvious empirical shortcomings in the measures. In particular, a careful inspection of the shapes of the distributions of our measures, suggests that SFI compresses too many observations at the upper extreme of the state capacity scale. From 2005 to 2015, SFI rates nearly 200 country-years with the maximum possible level of state capacity. In 2015, the most recent year of common observations, SFI assigns the maximum possible score to as many as 20 countries (out of 130).

As shown by Table 2, SFI is by far less sensitive than the other six measures in describing differences between high capacity countries. For instance, there is abundant evidence that the German state apparatus is more capable than the Italian one (Fukuyama, 2014) and that state institutions in Sweden function more effectively than state institutions in Spain (Dahlström and Lapuente, 2017). Yet, SFI is the only measure that fails to discriminate between these countries.

Different countries should have the same score only if such equivalence reflects reality. Since the other measures of state capacity are able to distinguish not only between Germany, Italy, Sweden, and Spain but also between all the other countries in Table 2 nearly without exceptions, we are induced to conclude that SFI has severe limitations in its ability to distinguish high state capacity countries one from another. Its scores are thus relatively imprecise and do not reflect well reality.

**Table 2 –** *State capacity in countries with maximum score with SFI in 2015.*

Country	SFI	FSI	QOG	HSI	WGI	CPI	VDM
Austria	1.000	0.909	0.938	0.955	0.829	0.819	0.838
Canada	1.000	0.947	0.938	0.874	0.893	0.904	0.929
Czech Rep.	1.000	0.769	0.688	0.768	0.732	0.578	0.775
Denmark	1.000	0.972	1.000	1.000	0.912	1.000	1.000
Estonia	1.000	0.742	0.641	0.792	0.736	0.747	0.928
Finland	1.000	1.000	1.000	0.925	0.904	0.988	0.903
France	1.000	0.835	0.781	0.780	0.820	0.747	0.800
Germany	1.000	0.897	0.906	0.917	0.887	0.880	0.949
Hungary	1.000	0.644	0.625	0.754	0.608	0.518	0.679
Ireland	1.000	0.961	0.938	0.856	0.841	0.807	0.828
Italy	1.000	0.745	0.547	0.755	0.597	0.434	0.664
Japan	1.000	0.829	0.875	0.806	0.898	0.807	0.762
Latvia	1.000	0.700	0.641	0.745	0.741	0.578	0.819
Netherlands	1.000	0.901	0.969	0.899	0.909	0.916	0.774
Poland	1.000	0.770	0.688	0.735	0.676	0.663	0.701
Portugal	1.000	0.891	0.750	0.807	0.771	0.675	0.726
Slovenia	1.000	0.841	0.688	0.770	0.715	0.627	0.789
Spain	1.000	0.779	0.719	0.855	0.760	0.602	0.884
Sweden	1.000	0.960	1.000	0.928	0.905	0.976	0.886
UK	1.000	0.857	0.906	0.808	0.889	0.880	0.941

Min-max normalised scores from low to high. Missing data deleted listwise.

The inability to differentiate between countries is not the only problem caused by such an agglomeration of observations at extreme values. Given that so many countries have the maximum score with SFI, as a consequence, the index is also unable to detect any possible increase in the level of state capacity over time in multiple countries. We would obviously expect an ideal cross-national measure of state capacity to be informative both about differences across countries and over time changes within single countries.

As many as 12 countries have the maximum possible score with SFI every year from 2005 to 2015. Yet, generally speaking, it is unrealistic to assume that state capacity has not changed at all in any of these countries in more than ten years. Figure 2 shows more detailed evidence of the evolution of the level of state capacity in one of these countries: Poland. As we can see from the line plot, all measures except SFI identify an increase in the level of state capacity in Poland from 2005 to 2015.

Figure 2 – *State capacity in Poland (2005-2015).*
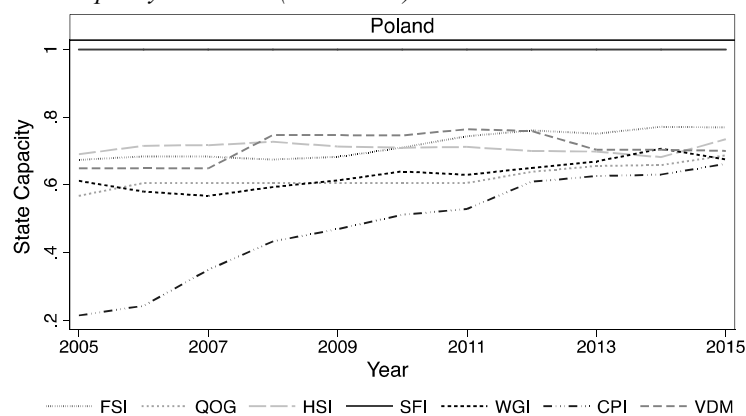
This imprecise representation of reality is one of the practical consequences of SFI's inability to discriminate between high capacity countries. Since the index assigns the maximum possible score to so many countries, it is simply not as sensitive as the other measures in detecting changes in high capacity countries, and especially, it is not able to capture improvements over time in any of these countries. Considering also that according to case studies the level of state capacity in Poland has actually increased since the country became a member of the European Union in 2004 (Charasz and Vogler, 2021), there are no doubts that SFI describes high capacity countries less accurately that the other six measures.

Clumping at the upper extreme of the scale and the inability to distinguish between high capacity countries are thus weaknesses of SFI. Luckily, the other six measures of state capacity do not have such an agglomeration of equivalently rated observations at either of the two extremes of the scale. Nevertheless, some of these measures do have some less severe problems in distinguishing observations one from another.

CPI is not finely grained enough to discriminate between many countries at low levels of state capacity. For instance, in the most recent year of common observations

(2015), Brazil, Burkina Faso, India, Thailand, Tunisia, and Zambia have exactly the same score with CPI. QOG, instead, is not finely grained enough to discriminate between many countries at intermediate levels of state capacity. Just to give an example, in the most recent year of common observations, Albania, Algeria, Bangladesh, Egypt, Kazakhstan, Pakistan, Panama, Papua New Guinea, Peru, Uganda, and Zambia have exactly the same score with QOG.

With both measures, despite the empirical equivalence in country-scores, it is unlikely that there are no actual differences in the level of state capacity of so many countries. Otherwise the remaining measures would not be able to capture the differences between these countries virtually without exceptions.

FSI, HSI, WGI, and VDM are able to distinguish well between different countries. In fact, in 2015, WGI and VDM are able to distinguish between all common observations. With FSI and HSI instead no more than two countries have an identical score in 2015. If we hold on to the assumption that the ability to differentiate between countries is an asset of any measure of state capacity, from this specific perspective, FSI, HSI, WGI, and VDEM can be considered to be more informative than SFI, CPI, and QOG. Overall, SFI seems to have less desirable empirical features than the other surveyed measures.

5. Conclusions

This study has compared and evaluated seven frequently used measures of state capacity, in terms of basic statistical properties and the ability to discriminate observations one from another. Most existing comparative studies on the measurement of state capacity have focused mainly on conceptual issues. To address this shortcoming in the literature, the approach adopted in this study has been empirical, not conceptual.

My findings indicate that SFI is the most problematic of the evaluated measures. First, its values are far from being normally distributed. Second, it is not able to discriminate between countries with a high level of state capacity. Third, it is not able to capture any possible increase in the level of state capacity in many high capacity countries, and thus, its scale should be further extended. Given these findings, at least in respect of our evaluation criteria, researchers should not use SFI as a measure of state capacity, unless they have strong theoretically justifiable reasons to do so.

My analysis reveals that the other six measures of state capacity are less tricky in terms of our evaluation criteria. Of the six remaining measures, CPI seems to have the least desirable features. It has too many observations at low levels of state capacity and has some difficulties in discriminating between these low-capacity

countries. QOG is not very effective in discriminating between some of the countries at intermediate levels of state capacity, but apart from that, the remaining five measures are fairly bell-shaped and able to distinguish well different countries one from another.

My findings provide a first look into the empirical aspects of cross-national measures of state capacity. In general, they should be considered as an initial step on the path towards a more comprehensive understanding of existing data on the state and state capacity. My study provides valuable guidance for the users of this data, but it should not be seen as a final and conclusive analysis on the topic.

On the contrary, many important questions on measures of state capacity and their quality remain to be addressed in future comparative studies. For instance, since I found that some of the measures rate countries with high divergence, future studies should assess whether these empirical differences affect the results of inferential research. Future research should also explore the causes of these empirical differences and assess the quality of the input side of the data generation process (e.g., transparency, replicability, aggregation). The comparative analysis at hand can be used as a starting point for these future studies.

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SUMMARY

An Empirical Evaluation of Common Cross-National Measures of State Capacity

Today, most experts have no doubt that *state capacity* is crucial for sustainable development. Anyhow, there is no agreement on how to quantify state capacity and there are plenty of different measures of state capacity to choose from. Ideally, one should pick a measure that closely represents the chosen theory. If that is not possible, however, existing literature offers little guidance in helping scholars to select one measure over another. The study at hand contributes to fill this gap in the literature by comparing and evaluating selected empirical characteristics of seven frequently used measures of state capacity in commonly available years (2005-2015). Ultimately, thus, this study provides new valuable guidance to the users of measures of state capacity.

By drawing on previous comparative research on social science measurement, the author of this study analyses common cross-national measures of state capacity mainly along two desirable features: the normality of distribution and the ability to discriminate between cases. The results of this study show that measures of state capacity are not all the same: some measures have more desirable empirical features than others. In particular, *State fragility index* seems to have the least advantageous characteristics. Therefore, unless theoretically justifiable, the study at hand does not recommend its use in statistical analyses on the topic.

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