A bottom-up model to evaluate national transparency through evaluating government Internet portals

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Abstract

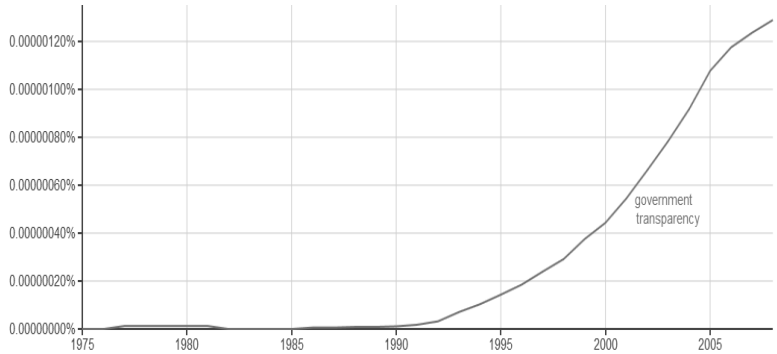
We present a framework for the determination of the economic and institutional transparency of a nation through a bottom-up approach. We adopt a recent model that utilizes the principal-agent framework in order to identify a political entity's important transparency characteristics. The transparency of the different political levels of a nation is evaluated and appropriately aggregated to form a measure of national transparency. The evaluation at each level is carried out by identifying important areas where corruption and inefficiency usually happens and determining whether information on these areas is available in government portals. The main contribution of the paper is in helping unbundle the measure of transparency. This has many implications, including the provision of a good fundament for the efficient allocation of resources, providing objective information for contributing to the enacting of appropriate policies, and pinpointing areas and government levels where more transparency is neeed for more accountability, participation, and the reduction of corruption and inefficiency.

8 Introduction

Government transparency is an instrument that lets the public know what their government is doing so this can be held accountable for such actions. This principle is known to contribute to the reduction of corruption and risk of conflict and war as well as to the improvement of government effectiveness, fiscal discipline, efficient allocation of resources, and economic competitiveness (Fearon 1995; Schultz 1998; Stiglitz 2000; Bellver and Kaufmann 2005; Lindstedt and Naurin 2006; Kumar and Ter-Minassian 2007).

The potentials of information and communication technologies (ICTs) in facilitating transparency has raised overall expectations to unprecedented levels. See Figure 1. These expectations are well justified: data-oriented ICTs which are widespread in society have also been adopted by governments for providing information and services. Indeed, most Latin American central governments have reached the highest levels of the first stage of the UN's four-stage[i] Online Service Index, demonstrating that these nations can already publish information on the Internet (Andersen and Henriksen 2006; UNDESA 2012). Seven of these nations have reached same levels of top raking developed nations in all four stages.

Figure 8.1 Book citations of the word "government transparency" from 1995 to 2008. Produced with Google Ngram



The use of modern data-oriented ICTs to provide government information implies that these should also be a tool to enhance transparency, if governments are indeed interested in letting the public know what these governments are doing. This is especially relevant for reaching areas or subsets of the population that were not possible to reach before and for utilizing the potentials of technology to transform information into knowledge.

In the context of this reality, there does not yet exist comprehensive tools that would help the public or policymakers accurately evaluate the level of national transparency in areas that are subject of corruption and inefficiency. We argue that the tools currently utilized are subjective and not comprehensive enough to provide a realistic evaluation of a nation's transparency level that considers the average citizen as the principal stakeholder. The present paper seeks to resolve this gap through the development of a framework that follows a bottom-up approach to determine national transparency levels offered through government Internet portals. We argue that the knowledge on the standing on nations is relevant not only for citizens who want to know of the government actions, but also for central governments and lower political entities who what to know about each other's dealings. Furthermore, the framework can be used to highlight strengths and weaknesses, monitor the progress of the nation through time, and perform a comparative evaluation of various nations and of political entities within nations.

In order to carry out the work, the next section explores relevant literature in order to provide a basis for building a proper methodology. Section 3 elaborates the proposed framework, while section 4 illustrates how the approach can be applied to different political structures, further identifying important areas to measure at each level. In section 4, we draw important implications for policymakers. Finally we draw important conclusions on the role of this approach for helping contribute the enacting of adequate policies.

8.1 Literature review

Government transparency is the degree in which a government or other political institution discloses information about its actions and processes in order to accurately inform the citizen on what such institution is doing (Kopits and Craig 1998; Bellver and Kaufmann 2005; Kolstad and Wiig 2009; Relly and Sabharwal 2009; Calland and Bentley 2010; Lindstedt and Naurin 2010). Transparency has lately been the mot du jour in discourses, initiatives, government communications, and the watching eye of international and non-governmental organizations.

The importance and expectations centered around this principle are being catalyzed by its potential in contributing to the reduction of corruption and inefficiency (Andersen 2009), by the potentials of modern Information Communication Technologies (ICTs) (Agre 2002; Shkabatur 2013), and the possibility of learning and evaluating governments' activities like at no other time in history (Finel and Lord 2000; Relly and Sabharwal 2009). Realities that enhance such expectations are nation-states' adequate levels of e-government infrastructure (UN 2010), the role that ICTs have had in changing public administration systems (Tat-Kei Ho 2002; Eyob 2004), the worldwide presence of civil society and grass roots initiatives that pressure for transparency and openness in the light of corruption cases (Hogge 2010), and the worldwide proliferation of government Internet portals and databases that profit of reusable data for the creation of meaningful information (Tauberer and Lessig 2007; Robinson, Yu et al. 2009). Perhaps the most important reason is that the citizenship is increasingly depending on ICTs to acquire information, be it through computers, smart phones, mobiles, or even community radios that in turn use digital ICTs to acquire updated information.

8.2 The importance of measuring transparency

The measurement of transparency, corruption, governance and other government characteristics are not measurements in an absolute sense but proxies or representations of complex government characteristics (Dawes 2010; UN 2010). The results and methodology of these measurements have introduced discontent and disagreement in the research community, practitioners and the measured stakeholders (Donchev, 2007; Abramo, 2008). Nevertheless, the results have been useful to approximately rate the performance of governments relative to one another, monitor the progress of individual governments, find relationships (Bellver and Kaufmann 2005), highlight relative strengths and weaknesses, target policy, draw analytical and policy lessons, denounce illegal behavior, and attract international investors (Kaufmann, Kraay et al. 1999; TI-CPI 2010).

While general characteristics of governments such as corruption and governance have been the object of much work and periodic measurements, there has not been much work on measuring and unbundling government transparency in its local and national, and institutional and political dimensions respectively (Kauffman and Bellver, 2005; United Nations, 2010; Lindstedt and Naurin 2010). Most of the work on transparency has been focused on central government transparency of discrete areas that should form an overall "measure" of central government transparency (Bellver and Kaufmann 2005; Bastida 2007; Carlitz, de Renzio et al. 2009; Piotrowski 2010; Hollyer, Rosendorff et al. 2012). The work by Bellver and Kaufmann (2005) has been possibly the most comprehensive construction of an aggregate index of transparency unbundled in two transparency dimensions, economic and institutional transparency and political transparency (Kauffman and Bellver, 2005; Lindstedt and Naurin 2010); however their work has included only the year 2004 and no detailed and transparent data exists.

8.3 The importance of transparency in lower political entities

Perhaps the biggest weakness of the aforementioned approaches is that their focus is limited to central government transparency (Bellver and Kaufmann 2005). While these provide a general standing of a nation, they are overly convoluted and do not show the reality at lower political entities, disregarding important characteristics such as autonomy level; naturally this can lead to misinformation and inhibit the creation of focused policies and strategies.

Because transparency's goal is to provide knowledge to the citizen so he can act and hold the government accountable, appropriate participation mechanisms must be present. Several studies have found that most important interactions between citizens and governments happen at the local level (Sandoval-Almazan and Gil-Garcia 2012).

Studies performed in the US have also noted that there may be greater possibilities for the development of ICT-enabled participatory models of interaction at the local level, rather than the national; indeed, where virtual communities have been established on the basis of co-location, the participatory model has emerged.[ii]

Furthermore, the citizen's level of knowledge, participation and impact at the different levels of the government can be dependent on the degree of autonomy lower political entities enjoy (Chadwick and May 2003). Indeed, decentralization has shown can improve political participation through additional access points for involvement, greater incentives to engage in regional policy issues, and an enhanced sense of community. The second half of the 20th century has seen an unprecedented transference of authority to lower levels of government in nearly every region of the world (Spina 2013).

In order to understand further the importance of transparency in lower political entities and to develop an appropriate methodology for measuring transparency that will also provide a fair assessment of a nation, we adopt a framework that adopts the principal-agent framework (Murillo 2014).

8.4 The principal-agent framework and types of transparency

The asymmetric relationship between a government and its constituency, with an informational advantage on one side and authority on the other, has often been modeled by political scientists through the principal-agent framework (Miller 2005; Lindstedt and Naurin 2010).

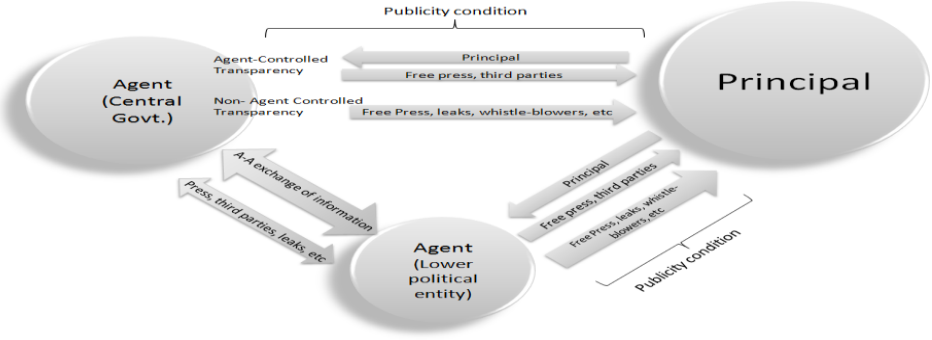
This approach was originally created by economists for helping explain the effects of information asymmetries in the insurance industry (Spence and Zeckhauser 1971; Miller 2005). The framework assumes that the preferences of the agent (different levels of government) and the principal (constituency) are different and that gathering complete information on the agent's actions is regarded as prohibitively expensive, thus resulting in a preference for shirking. In this setting, along inefficiently and ineffectiveness, corruption is one of the agent's activities that benefits its own interests rather than the principal's (Miller 2005).

Transparency is an instrument available to the principal that let's him evaluate his agent and take the necessary actions to control and avoid the agent's activities that would benefit its own interests rather than the principal's (Miller 2005; Lindstedt and Naurin 2010). Figure 1 illustrates this relationship which also considers different political entities, whose the degree of autonomy will create different degrees of relationships, associations, and information asymmetry between the agents and the principal and the agents.

Within this framework, two types of transparency are identified, depending on who controls the release of governmental information (Lindstedt and Naurin 2010). Agent-controlled transparency, of which economic and institutional transparency is the main component (Bellver and Kaufmann, 2005), is the agent's release of information about its activities as mandated by the agent itself or externally imposed by the principal.

This mandate could be self-imposed by the agent in an effort to increase its legitimacy or imposed by the principal in order to increase control, as modern freedom of information or other mandates do. Non-agent controlled transparency is the release of information through the work of an independent and investigative media or other third-party sources such as whistleblowers. While agent controlled transparency makes the life of the agent more complicated, non-agent controlled transparency makes it more dangerous as may identify actual instances of corruption and illegal activity (Lindstedt and Naurin 2010).

Figure 8.2 The agent, principal, and the information asymmetry.



8.5 The publicity and accountability conditions

While various empirical studies have determined that transparency is indeed an instrument that contributes to the reduction of corruption (Lambsdorff 1999; Treisman 2000; Bellver and Kaufmann 2005), only recent research has explored further, identifying two conditions that must be present for transparency to have an effect on reducing corruption: that the principal is (i) *enabled* to acquire and process information, and (ii) enabled to act based on the new acquired knowledge. These are also known as the *publicity* and *accountability conditions* (Lindstedt and Naurin 2006; Kolstad and Wiig 2009).

The publicity condition assures that information reaches the principal and she is able to process it in order to acquire knowledge. This condition is represented by the digging and mediating free and independent press, by adequate levels of citizen knowledge and education, and by the potentials of information and communication technologies in enabling and facilitating the former ones. See Figure 2. The accountability condition is represented by free and fair elections and other adequate mechanisms that enable the principal to control the agent and hold him accountable for its actions (Brunetti and Weder 2003; Lindstedt and Naurin 2006; Kolstad and Wiig 2009).

The role and importance of these two conditions were underlined through a simulation that consisted in different operationalizations of empirical data of key variables corresponding to 111 countries (Lindstedt and Naurin 2010).

Agent controlled transparency in Nigeria was raised to the same level as Sweden, however this did not have much effect on corruption unless it was accompanied by freeing the press, raising levels of education, and instituting free and fair elections. It was concluded that in order for transparency to reduce corruption, there must be adequate reforms on the side of the principal, the agent and the mediators (Brunetti and Weder 2003; Lindstedt and Naurin 2010).

8.6 Measuring transparency through internet portals

Adopting the earlier definition of agent controlled transparency and the relationship with the publicity and accountability conditions, it has been suggested that agent controlled transparency can be measured at the agent's "door" (See Figure 1) through evaluating the very availability of information present in the form of data in government web portals (Murillo 2014). The suggested approach has special relevance because common models of eGovernment set the "publishing" of information as the first level of a four-level model, which various Latin American nations have reached, along leading developed nations (Andersen and Henriksen 2006; Osimo 2008; UNDESA 2012). Thus we argue that the availability of relevant data is to become a next indicator as a natural main product of the "digitalization" of governments.

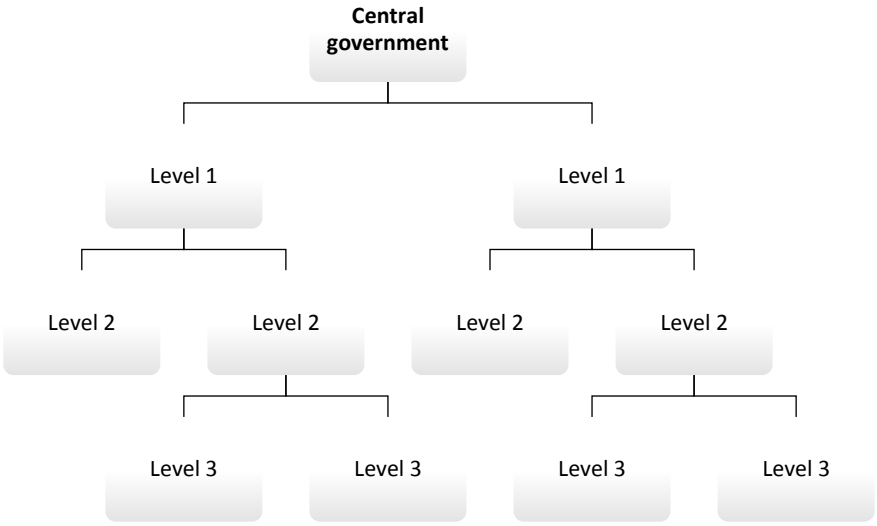
The utilization of the same methodology to measure the release of information in multiple areas at the agent's portals is a new approach that indeed measures government information availability and involves lower levels of perception and subjectivity than polls and surveys, if properly carried out through an appropriate methodology. This also implies less entangled measurements which open the possibility of the creation of more objective composite indexes. Another of the benefits of this approach is that it introduces the possibility of further unbundle transparency in local, regional and central governments and apply such to other public institutions. A measurement tool, applied to areas that are most important and essential to agent controlled transparency can be eventually utilized by itself or be a complement to other composite indexes.

8.7 Framework of new approach

Bottom-up building of a measure of agent-controlled transparency

Figure 8.3 illustrates a possible composition of a nation, with a central government on the top, composed of lower political entities, labeled as "Level 1", "Level 2", and “Level 3”.

Figure 8.3 Illustration of the different possible levels of political institutions



We argue that national government transparency is the weighted addition of government transparencies situated at Level 1 and central government transparency. This can be represented by the following equation:

$$T_N = \propto_{L1} AT_{L1} + \beta_{L1} T_C \quad (8)$$

Where T_N is the national transparency, AT_{L1} is the aggregated transparency of all political entities at Level 1, and T_C is the central government transparency itself.

The aggregated transparency of the political entity at Level 1 is represented by

$$AT_{L1} = \frac{1}{q} \sum_{\varepsilon=1}^{q} OT_{\epsilon}^{L1} \quad (8.1)$$

Where T_{ϵ}^{L1} is the individual transparency of each of the q political entities at Level 1, given by the following equation:

$$OT_{\epsilon}^{L1} = \propto_{L2} AT_{L2} + \beta_{L1} T_{L1} \quad (8.2)$$

Where AT_{L2} is the aggregated transparency of all political entities at Level 2, and T_{L1} is the transparency of the political entity itself.

AT_{L2} is represented by the following equation:

$$AT_{L2} = \frac{1}{r}\sum_{\varphi=1}^{r} OT_{\varphi}^{L2} \tag{8.3}$$

Similarly, T_{φ}^{L2} is the individual transparency or each of the r entities at Level 2, given by the following equation:

$$OT_{\varphi}^{L2} = \propto_{L3} AT_{L3} + \beta_{L2} T_{L2} \tag{8.4}$$

Finally, AT_{L3} is represented by the following equation:

$$AT_{L3} = \frac{1}{s}\sum_{\delta=1}^{s} T_{\delta}^{L3} \tag{8.5}$$

Where

$$OT_{\delta}^{L3} = \beta_{L3} T_{L3}$$

$\propto$ and β in all equations above refer to the weights given according the level of autonomy that each entity enjoys.

8. 8 The measure of transparency

In order to reduce the asymmetry of information between the principal and the agent, released data must become information, enabled by requirements underlined by the definition of transparency, that information must be proactively shared publically, timely, reliably, accurately, and must be made understandable to different audiences (Murillo 2014). The evaluation and appropriate aggregation of these principles would provide a measure of transparency of a specific area or process, describing the attitude and actions of the agent towards fulfilling important transparency principles in order to lessen the information asymmetry with the principal.

The government data openness index (GDOI) of an entity is the quantitative evaluation and aggregation of relevant transparency principles of areas where corruption generally occurs (Murillo 2014). It can be represented by the following equation:

$$GDOI_P = \frac{1}{m\cdot(GDOI_P)_{max}}\sum_{a=1}^{n}\beta_a \cdot \left[\propto_1 \cdot S_{a,1} + \propto_2 \cdot S_{a,2} + \ \ldots \ + \propto_m \cdot S_{a,m}\right] \tag{8.6}$$

Where:

$GDOI_P$ is the government data openness index of a political entity P.

m represents the number of principles (also referred as variables) of transparency.

n represents the number of areas

The factor β_a is the relevance of such area to transparency.

$S_{a,p} = S_{a,1} \ldots \cdot S_{a,m}$ are m scores of principles $p = 1 \ldots m$ corresponding to the area a.

And $\propto_p = \propto_1, \propto_2, \ldots \propto_m$ is a weighting factor, where is the inverse of the maximum score that the corresponding principle p can take:

$$\propto_p = \frac{\gamma_p}{(S_{a,p})_{max}}$$

The weight γ_p makes some principles more relevant than others. In this study, this weight is set to 1.0, making the product $\propto_v \cdot S_{a,v}$ in the zero to one range.[iii] Some transparency measurement approaches that consider only the presence of absence of data can be represented by weighting the *data availability* variable with $\gamma_v = 1.0$ and all other variables with $\gamma_v = 0$.
With such in hand, we have the following equation that can be applied to transparency of different government levels, $T_C, T_{L1}, T_{L2},$ and T_{L3}.

$$T = \frac{1}{m \cdot (T)_{max}} \sum_{a=1}^{n} \beta_a \cdot \left[\propto_1 \cdot S_{a,1} + \propto_2 \cdot S_{a,2} + \ \ldots \ + \propto_m \cdot S_{a,m}\right] \textbf{(10.7)}$$

8.9 On variables

The first of eight variables (See Appendix I), Specific FOI Policy, evaluates whether the nation's freedom of information (FOI) or other legislation explicitly mandates data or information of a specific area be made available through the Internet.
Because the implementation and enforcement of reactive FOIs have been challenging and have raised unmet expectations (Calland and Bentley 2010; Shkabatur 2013), the explicit mention of an area would allow the agent claim this law when relevant information is not available. A proactive mandate (versus a reactive) decreases the burden of the agent as a result of individual requests and makes data timelier, thus demonstrating the agent's commitment to transparency (Darbishire 2011).

Proactive Data Availability is a key initial step in seeking to lessen the information asymmetry between the agent and the principal as it allows for the evaluation of information's completeness, truthfulness, and other characteristics required by the principal. It is generally agreed that access to data and information constitutes a civil and political right as citizens own what the state gathers (Calland and Bentley 2010).

The release of data must be timely in order to preserve information's value, allowing citizens to more closely and effectively monitor government performance (Wong and Welch 2004; Tauberer and Lessig 2007). Timeliness has special relevance not only for applications that the principal might use in modern devices, but also to satisfy the publicity condition through new mechanisms in which journalists work with real-time data to produce information (Knight 2000; Attfield and Dowell 2003; Kawamoto 2003; Cohen, Li et al. 2011).[iv]

The Facility to Find variable evaluates the degree of effort that the principal must put in finding the required data. One reason that information might not reach the principal is the inability of finding and accessing it (Lindstedt and Naurin 2010), thus concluding that it is non-existent. The Relevancy of Location variable measures whether it is in a relevant location. Legislation or directives of some countries mandate central governments to consolidate data into central portals (Robinson, Yu et al. 2009; US-OGD 2009; OGD-UK 2010) while others share data through national entity websites. Yet other information is spread with no apparent organization. Data should be stored in an appropriate and relevant location so as different stakeholders have the same probability of accessing it; this is especially relevant when overwhelming amounts of irrelevant data might "hide" data that is more relevant for the reduction of corruption and inefficiency.

Once data are found, the expectation is that data be raw or Primary, as it was when it was collected from the originating source (Robinson, Yu et al. 2009). Raw data is represented by the digital copy or a digital representation of the original official completed report, form or template (Tauberer and Lessig 2007).

Machine Readability is a technical feature of government data (Robinson, Yu et al. 2009). While raw data can be presented in various document formats, its prompt and adequate representation to the principal will depend on its machine friendliness. Data is said to have the highest degree of machine readability if it is presented in open, non-proprietary formats that will allow various data to be automatically combined in order to create meaningful information to different stakeholders.[v]

While data might be available, it might not be useful to the principal because of a lack of capacity to access and analyze it. Data shared though the Internet must provide means to become understandable and provide appropriate and meaningful information, so as to enable the fulfillment of the publicity condition. otherwise neither transparency nor publicity are effective (Lindstedt and Naurin 2010). Representation Tools are relevant to all types of data. Data can often be represented through graphics, figures, audio and other medium relevant to different sectors of the population.

8.10 On the application to different types of government structures and areas

The national composition of Latin American governments is quite varied: lower political entities in some nations enjoy high degrees of autonomy in some areas and services where high percentage of GDP is allocated to. Table 1 illustrates examples of the degree of decentralization of various services in five countries.

Table 8.1 Examples of major functions decentralized (Tulchin and Selle 2004) .

Country / Decentralization level	Significant	Moderate	Limited
Mexico	Healthcare, Urban Planning	Education, Social development	
Venezuela		Education, Healthcare	
Brazil	Healthcare	Education, Infrastructure	Housing
Argentina	Education	Healthcare	
Guatemala	Water	Primary Healthcare	Education, Healthcare

The main implication of the degree of autonomy of a political entity is that the relevance of economic and institutional areas to be measured will change from level to level and from country to country; this relevance is controlled by the weight β_a. A second implication is that generally different areas in economic and institutional transparency will need to be evaluated at each level. Table 2 illustrates some areas suggested for evaluation in central governments.

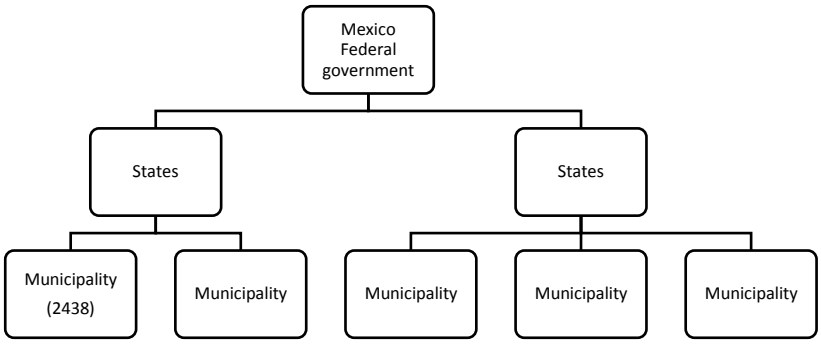
Table 8.2 Areas where transparency is relevant for the reduction of corruption and inefficiency

Area	Description	Level
Freedom of Information (FOI) Legislation	Over the last fifteen years, FOI legislation has become a reference for assessing a government's tendency to embrace transparency (Darbishire 2011). Only 7% of world countries had adopted national FOI laws in 1990. Today, 48% of world countries have a FOI law and 13% have relevant draft legislation (Banisar 2006; Florini 2007; UNDESA 2012). However FOI acts of some nations have not always lived up to their ideals (Shkabatur 2013).	Generally central government
Public Hearing of Draft Laws	The participation of the public in the drafting of laws, *Public Hearing of Draft Laws*, is an important instrument of democracy and a necessary condition for ensuring that the citizen and civil society's views are taken into account in the daily decisions of the government and the conception of policies. Modern technologies have the potential to enhance the citizens' opportunity of voicing her opinion regardless of geographical location, thus having the possibility of drafting better laws and more appropriate policy (Hutchinson 2005; Fox 2007). Technologies have also the potential to become tools that enhance the power of groups of people who know how to use it, thus enhancing the power of the rulers over the ruled (Altman, MacDonald et al. 2005; Hanson 2008).	Central and lower political entities
Asset Declaration of Top Public Figures	*Asset Declaration of Top Public Figures* ensures the absence of conflicts of interest in the actions and decisions of government officials, including the enacting of policies. Governments have been urged to strengthen asset declaration laws, especially in resource-rich countries which are proven to have higher rates of corruption (Kolstad and Wiig 2009; TI-CPI 2010).	All political entities
Public Procurement	*Public Procurement* accounts for a substantial part of the global economy, accounting for the 10 to 15% of GDP in developed countries, and up to 20% in developing countries (Bandiera, Prat et al. 2009). In dealing with the public sector, construction companies and public works tend to be the most likely to practice corruption and exert undue influence on the policies, decisions and practices of governments (Krafchik 2010). The full proactive disclosure of procurement information would certainly have an effect in reducing corruption, particularly when the taxpayer's contribution is at stake.	All political entities
Government Budget	Open budgets allow the citizenry to determine whether their government officials are good stewards of public funds (Krafchik 2010). *Central Government Budget* transparency is negatively correlated with corruption and positively correlated with economic development (Bastida and Benito 2007). A significant number of countries already produce information on budgets, revenues from natural resources, and foreign aid received for their internal purposes (Heuty and Carlitz 2009). With the proper directives, the publication of these could quickly and cost-effectively boost transparency.	All political entities
International Aid Received and provided	*International Aid Received and provided* can contribute to corruption causing the aid not reaching the intended beneficiaries (Svensson 2000; Knack 2001), especially in countries that depend heavily on significant amounts of foreign aid to finance public spending (Carlitz, de Renzio et al. 2009) and in countries that suffer from competing social groups (Svensson 2000).	Generally central governments (can depend on autonomy)
Revenues from Natural	Countries that are dependent on oil and gas revenues tend to be less transparent in their budgets (Heuty and Carlitz 2009); however this is not	Central, and lower political entities

Resource	inevitable, as examples such as South Africa, Norway, Botswana, and Peru show strong performance on *Revenues from Natural Resource* transparency (Kolstad and Wiig 2009).	(highly dependent on autonomy)
Air Pollution	It is expected that 70% of the world population will be urban by 2050, with most growth occurring in developing nations (UNDESA 2008). Studies have shown a strong correlation between pneumonia related deaths and air pollution from motor vehicles, with 2.4 million people deaths each year from causes directly attributable to air pollution (WHO 2002; Knox 2008). Recent studies have found that life expectancies are about 5.5 years lower in the northern part of China, owing to an increased incidence of cardiorespiratory mortality due to air pollution (Chen, Ebenstein et al. 2013). This reality calls for the enacting of appropriate policy and actions in the areas that face *Air Pollution* problems; this includes the building of green areas, the implementation of vehicular restrictions, the education the citizenship in that regard, and others.	Central, local, and lower political entities

8.11 Example of the application of the approach to Mexico

Figure 8.3 The different levels of government present in Mexico



In the case of Mexico, for example, the following process can be applied:

- The Central government transparency T_C is evaluated utilizing the central government transparency measurement approach (Murillo 2014). The areas suggested in Table 2 (among others) can be evaluated. For instance, Air Pollution can be excepted as the task is taken by the states or municipalities.

- The partial transparency level of each State, T^{L1}, is determined through the utilization of the transparency measurement approach (Murillo 2014).

- The transparency level of each municipality, T^{L2}, is determined through the same approach as above.

  At this point we have obtained the partial transparency levels of the central government, the states, and the municipalities.

- The overall transparency level of each municipality, OT_{L2}, is T^{L2}, assuming that no other lower political entities will be evaluated.

- The transparencies of municipalities that belong to the same state are aggregated to form AT_{L2} through $AT_{L2} = \frac{1}{r}\sum_{\varphi=1}^{r} OT_{\varphi}^{L2}$. r is the number of municipalities that belong to a specific state L1
- The overall transparency levels of each state, OT_{L1} is obtained through adding the aggregated measure of municipalities that belong to the state (AT_{L2}) and the measurement of the state itself, T^{L1}.
- The national transparency of Mexico is obtained by adding the central government transparency to the overall transparency level of all states through $T_N = \propto_{L1} AT_{L1} + \beta_{L1} T_C$, where $AT_{L1} = \frac{1}{q}\sum_{\varepsilon=1}^{q} OT_{\epsilon}^{L1}$

8.12 Conclusion

The present paper proposed a comprehensive framework for evaluating national economic and institutional transparency through evaluating the transparency of the lower political entities of a nation. The proposed approach takes advantage of the Internet to evaluate important transparency characteristics and then appropriately aggregates them in order to have a national measure of transparency. The main contribution of the paper is in disentangling the measures of transparency to the various levels of political entities different nations are composed of. The approach lets the public, policymakers, and institutions see the reality at a finer degree. The study is important for the enacting of appropriate policies, for in-nation comparison, for the effective and pinpointed allocation of central government or international funding, and for facilitating checks and balances through an approach that is appropriate for the reality of each nation. This is especially important as econometric approaches to measure transparency seem to overlook the nation state's composition, attributing transparency levels that might hide (positive and negative) realities of lower political institutions (administrative levels), thus leading to misunderstandings, and even influencing the enacting of inappropriate policy and allocation of resources.

8.14 Appendix I

Table 8.3 Variables that are part of the DOI and their possible values

Variable (v), Weight ($\propto_{\mathbf{p}}$)	Value assigned at evaluation ($\mathbf{S}_{a,\mathbf{p}}$)
1. Specific FOI policy (1/2)	**0** Not mentioned; **1** Mentioned in policy (i.e. FOI); **2** Elaborated in policy
2. Data Availability (1/2)	**0** Not available or available online after a payment (discriminatory); **1** Immediately available online after supplying personal information (reactive online, discriminatory); **2** Immediately available online (proactive)
3. Timeliness (1/4)	**0** Not available at all; **1** 100% or more of sampling time ($100\% < t_{data}$); **2** 50% - 100% of sampling time ($50\% < t_{data} \leq 100\%$); **3** 10% - 50% of sampling time ($10\% < t_{data} \leq 50\%$); **4** Real-time ($0\% \leq t_{data} \leq 10\%$)
4. Facility to find (1/5)	**0** Not available; **1** More than 15 references; **2** 11 -15 references; **3** 6 – 10 references; **4** 2 – 5 references; **5** 0-1 reference.
5. Relevancy of location (1/3)	**0** Not available; **1** Out of place; **2** Acceptable (Ministry); **3** Adequate location (Open Government Data portal)
6. Primariness(1/3)	**0** Not available; **1** Data has been modified (incomplete) ; **2** Data is processed (i.e. sampled, normalized, aggregated); **3** Data is raw

Machine Readability (1/6)	**0** Not available; **1** Proprietary - non-scrapable; **2** Proprietary - scrapable with no (human) information on its data; **3** Proprietary - with appropriate (human) information on its data; **4** Basic non-proprietary (xml, html, etc) with appropriate (human) information on data; **5** Machine readable (non-proprietary with metadata); **6** Machine readable and "mashable"[2] (linked data: xml, rdf, etc) (Schrenk 2007)
8. Representation tool (1/4)	**0** No; **1** Yes, basic (pie charts, bars, maps, etc); **2** Data feed through multimedia or other advanced representations; **3** Data feed through multimedia or other advanced representations aimed at different subsets of the population; **4** All the above including tools for combining with other variables to provide meaningful information to different subsets of the population

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