Data Disclosure or Debureaucratization: Which is the Best Strategy to Reduce Corruption Vulnerability?

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ABSTRACT

This study aims to identify the contribution of governmental open data disclosure and debureaucratization in reducing a country's level of corruption. For this purpose, a theoretical model has been created, and three global country-based indicators—namely the Corruption Perception Index, Global Open Data Index, and The Ease of Doing Business Ranking— were analyzed. . The study is exploratory and employs a combined quantitative analysis of secondary data, which were analyzed through PLS. The reduction of bureaucracy has shown a more significant effect that the opening of data related to corruption perception in the 164 countries analyzed. Results show that government open data disclosure and the level of reduction in bureaucracy contribute to making a country less vulnerable to corruption; nonetheless, debureaucratization presented a superior and more significant effect. The results show that debureaucratization might be a starting point for initiatives against corruption, especially in countries with limited financial resources, and that it can support governmental decision-making in this regard.

CCS CONCEPTS

• Applied computing → Computers in other domains → Computing in government → E-government

KEYWORDS

Corruption, corruption protection, open government data, data disclosure, debureaucratization.

1 Introduction

Corruption is a complex and ancient subject. In Arthashastra, an Indian treatise on statesmanship, written in Sanskrit in 400 BC, Kautilya compares the difficulty of servants resisting the temptation to take a portion of what belongs to their king with the difficulty of trying not to taste the honey on the tip of their tongue. The earliest publications on corruption date back to the 18th century and mainly address issues like bribery and favoritism [53]. Considering that governments are sometimes inefficient and represent excessive intermediation between citizens and public services, corruption in the public sector is gaining ground.

Corruption is present in almost all countries, regardless of the political, economic or legal system, but in different intensities and scales [11]. Corruption leads to the waste of economic resources [2] and creates uncertainty and inefficiency that affect the development of fairer and more efficient markets negatively [18]. This results in internal and external inefficiencies in public and private organizations, affecting the population even more as poverty increases and economic development is compromised [86]. Corruption mainly affects citizens of lower social classes [61] and is therefore considered socially unfair [11].

Corruption is complex, abstruse, multiform and intricate in different forms of understanding. From the economic point of view, corruption involves obtaining illegal financial advantages by the agents involved [49], which increases transaction costs, reduces external investments and hampers economic growth [1]. The legal dimension sees corruption on three fronts: the first is the misapplication of laws [72]; the second is the lack of appropriate laws [40]; and, the third is the creation of laws that allow corruption [19]. Corruption from the political point of view is characterized as any irregularity associated with fraud in acquisitions, misappropriation of public funds and over-invoicing resulting from political manipulations [22]. The cultural dimension seeks to understand if cultural attributes can explain the variation in the level of corruption [56]. Corruption is linked to the way a society tolerates both corruption and corrupt agents and is related to beliefs, religion, ideas, the influence of the media

and social behavior [49]. The levels of corruption will be lower only if cultural changes occur [56]. Corruption is a behavioral issue that reinforces the vulnerability and fragility of government practices over those of self-interest groups indulging in corruption [12]. Corruption is also a problem of governance and compliance since the lack of a robust regulatory framework increases the vulnerability to corruption [78].

Corruption arises in situations where there is a problem of asymmetry of information, i.e., where agents know much more about public administration than anyone else [39]. In such situations, agents may exploit their power and position as middlemen, to act in their self-interest, usually through bribery, extortion, fraud, nepotism or embezzlement [78]. Transparency of government information, based on open government data disclosure, has been indicated as an effective way to reduce information asymmetry [39]. Open government data (OGD) is the data made available for free by governments, usually in OGD portals; this can be freely used, reused and distributed by anyone [6]. OGD can be used in civil society projects or integrated with the various range of services to society, such as navigation systems, and transportation timetable and routes [77]. OGD provide the basis for transparency and consequently accountability, which is the overarching goal of all government open data initiatives [65].Weberian Bureaucracy designates a group of officials who, organized in a specific way and subject to specific and determined standards of conduct, exercise legal authority. Bureaucracy works also as a regulatory solution, which is necessary to maintain some standards for operations, especially decentralised operation, as the governmental ones usually are. However, bureaucracy has been recognized also as the excess or redundant rules, forms and steps, sometime presenting and end in itself [54]. In highly bureaucratic countries, laws, rules and procedures are complex, numerous, and sometimes disconnected or overlapping, increasing the occurrence of over- or under-regulated situations. An example of this is the bureaucracy to regulate a business, a situation in which bureaucracy is identified as a limiting factor for starting a company [47]. In this situation, public agents can be corrupted to speed up the legalization process [20]. This bureaucratization is often created through laws that seek to formalize and regulate processes, but which ultimately make the system vulnerable to corruption.

Considering the extent that bureaucracies exist to satisfy a desire for regulation, in theory high-bureaucratic systems would be more successful at protecting countries from corruption. However, this happens to some extent: in countries which present efficient and restrained bureaucracy, bureaucracy is a protection to corruption, and there is an inflection point when bureaucracy starts to be excessive, unbridled and ungoverned, turning itself a vulnerability to corruption. This study addresses the role of open government data and bureaucracy in reducing vulnerability to corruption. Two underlying assumptions in this paper are: a) open government data contribute to reducing the vulnerability to corruption as they are the basis for transparency and accountability, which in turn contribute to a more democratic state and greater citizen participation; b) reduced bureaucracy lowers vulnerability to corruption by simplifying administrative procedures, and decreasing information asymmetry and the dependence on synchronous face-to-face services. Corruption is expressed through bribery, extortion, fraud, nepotism or embezzlement [78]. These are minimized in countries with a higher level of transparency, a result of the use of OGD, and a lower level of bureaucracy in the relationship between governments and citizens.

However, occasionally governments face limited resources for implementing the various initiatives and programs that may reduce the occurrence and impact of corruption in the medium and long terms. Additionally, less mature governments often seek external legitimacy, adopting solutions developed on legitimized countries through mimetic isomorphism. In both cases, it is necessary to discuss the better results to each specific context: are governments open data strategies more effective in reducing corruption than those aimed at reducing bureaucracy, or is it the opposite? This is the research question that this study seeks to answer by analyzing three indicators: a) Corruption Perception Index [16], maintained by Transparency International, which shows the level of perceived corruption in 175 countries; b) the Global Open Data Index, maintained by the Open Knowledge Foundation, showing the level of data disclosure in 181 countries; c) The Ease of Doing Business Ranking, maintained by the World Bank Group, which is considered as an indicator of the bureaucratization level in 164 countries. This study aims to identify the contribution of the government open data disclosure (indicator "b") and the level of bureaucracy (indicator "c") in a country's corruption level (indicator "a"). The study employs a combined quantitative analysis of these three rankings, which has the country as the unit of analysis.

This first section discussed the subject, the research problem and the reasons to perform this research. Section 2 presents the theoretical framework, followed by the research model, discussed in Section 3. Section 4 presents the methodological procedures and Section 5 the results of the research, followed by the final remarks (Section 6).

2 Theoretical Framework

2.1 Corruption and its impacts

The literature presents different definitions of corruption. One of them is presented by [28], who endorses the fact that corruption is a global problem and says that corruption is the inducement to error for bribery or other illegal or improper means. In the view of economists, corruption encompasses a broad context, determined by the political, social, institutional, market and interpersonal factors, defining it as the use of public resources to maximize private benefits [11]. The concept points out that corruption is an evil combination, which is intended to break established rules for private gain, between one or more individuals with a third party [41]. The author further emphasizes the presence of a principal agent, who has control over the rewards, penalties, and legal systems.

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Corruption can be understood as the misuse of public power for private gain [59]; [66]. Non-governmental organization Transparency International is dedicated to understanding the causes of corruption manifested through a universal scale and covers a broad concept of corruption, such as the abuse of a person's power for his or her benefit. Corruption in a country encompasses three national institutions: politics, justice and the media [73]. In this concept of corruption, abuse of public power, payment of irregularities in public negotiation, favoritism, bribery, misappropriation of money and misuse of influence can be included [81].

Corruption can also be understood as being the act in which the power of public officials is used for personal gain in a way that violates the rules in force [33]. These rules can be both legislative and what is considered appropriate in a given population group, according to cultural aspects. These acts refer to various types of financial and administrative infractions, such as bribes, misappropriation, nepotism, abuse of authority and extortion [61], as well as embezzlement, robbery, abuse of power and favoritism, exploiting conflicts of interests and lack of sufficient policies to curb this act [78]. Table 1 summarizes the primary definitions of corruption and its authors.

Table 1: Summary of definitions of corruption

Definition	Authors
Corruption is the inducement to error for bribery or other illegal or improper means	[28]
Corruption is the use of public resources to maximize private benefits	[11]
Corruption is a malevolent combination, which is intended to break established rules for private gain, between one or more individuals with a third party	[41]
Corruption is the misuse of public power for private gain	[59] [66]
Corruption is the abuse of a person's power for their benefit	[16]
Corruption is the act in which the power of public officials is used for personal gain in a way that violates the rules in force	[33]
Corruption is a behavior that diverges from the formal duties of the civil service for purposes of monetary gain or private status (for personal, family, or close group benefit).	[50]

Huberts proposed a set of five factors to understand corruption in a country: individual, social, economic, political, and organizational (structural and cultural) factors [31]. These factors were identified through a survey of 257 respondents from different regions of the world. Two characteristics define corruption, the generalized and the arbitrary, which respectively mean organized and disorganized [59]. The first type of corruption is institutionalized and widespread in public sector departments. Arbitrary or disorganized is the ambiguity or uncertainty associated with corrupt transactions or transactions in the country [59]. Also, according to the same authors, arbitrary corruption can occur more frequently than widespread corruption.

Corruption is the result of a combination of the macro and the micro level. The former is the organizational representation, national, political, cultural and management systems, and the latter is represented by individuals, their circumstances, needs, abilities, access, trust, and autonomy [28]. One can have different intensity levels and scales of corruption, that is, grand or petty corruption. Grand corruption represents a smaller occurrence of events, but with more significant values, and petty corruption occurs more frequently; however, the monetary value involved is lower [32].

However, regardless of the characteristic, combination, intensity, scale or amount of resources involved, corruption will always be harmful no matter in which sector it takes place. Corruption is an evil that affects everyone, as governments, citizens and companies suffer daily [15]. In addition to diverting resources that would otherwise be available for better implementation of public policies, corruption is also responsible for distortions that directly impact business activity due to unfair competition, overpricing or limited business opportunities. Therefore, combating it depends on every entity's joint and continuous effort, including companies, which play a crucial role in this context (CGU, 2015, p. 5).

As corruption is an evil that affects all, it is studied under different aspects, dimensions, approaches or visions. In relation to visions, it can have: a) an economic vision, as defined by Andvig [5], which occurs in a market situation and is linked to an exchange of money or material goods; b) a social one that can be considered a form of patronage and brings other forms of favoritism, such as nepotism, protection or favoritism [5], and whether corruption can be attributed to identifiable social, economic and political factors [56], which may or may not be independent of culture; that according to [56] approaches the question in a different way according to the region or country and

tries to understand if in fact the cultural attributes can explain at least a part of the variation in the level of intraregional and interregional corruption in the world.

Regarding study dimensions, the variables are different. [47] show in their study, for example, that the opening of companies in Brazilian states is negatively affected by the incidence of corruption, within an administrative dimension. For the same authors, the bureaucracy for the regulation of business is pointed out as a limiting factor to the opening of companies. In order to streamline bureaucratic procedures, new companies and public agents may form a plot since public agents could be corrupted to speed up legalization procedures [20]. This bureaucratization is often created through laws which seek to formalize and regularize processes.

The legal dimension involves the legal instruments used to deal with corruption [45] and relies on compliance initiatives used to mitigate risks and prevent corruption and fraud in organizations [67]. [45] comment that Brazilian anti-corruption legislation results from several reforms that occurred in very different political and social contexts in response to pressures from society. Legal mechanisms do not necessarily have an impact on reducing levels of corruption. In a survey of public servants and citizens, Filgueiras and Melo Aranha identified that the lack of stricter laws to control corruption represented less than 1% of the factors that explain corruption in the perception of respondents [23]. At times, "socially popular but unrealistic laws are approved to generate political popularity and extortion or bribery opportunities" [67].

The functional view covers both the participation of public servants in acts of petty or grand corruption, punctual or systematic, and their accountability in different forms of public money diversion [45] and their role in initiatives to reduce levels of corruption [57]. The functional view is strongly related to the administrative and political dimensions, due to the rules and administrative procedures performed by servers in order to follow, ignore or circumvent these rules. Concerning the political dimension, often the political strength of governments protects groups or individuals who misbehave, especially in research situations [75].

Regardless of the view or dimension that corruption is studied, it is important to realize that the tendency in countries with a high incidence of corruption and institutions that do not function properly is to have persistent levels of low growth [60] among the population in relation to moral and social aspects. [7] Contributed to the subject concerning moral and social values, conducting studies linking ICT and development (ICTD), and believes that ICT has a potential capacity to contribute to the improvement of various aspects of life and poverty alleviation to strengthen democratic politics. However, social inequality is deepened by corruption when resources are diverted that would be allocated by the state to mitigate the causes and effects produced by it [9].

2.2   Open government data disclosure

Open Data (OD) is the one that is free for use, without copyright restrictions, available for anyone, and machine processable

[83]. Open Government Data (OGD) is the OD that comes from public sector [70]. Around the world, governments enable open data and create expectations to transform the data into social benefits, when data generate knowledge or ideas to create public value [63]. OGD can improve open government [82] because data disclosure creates a set of public sector information useful for all stakeholders, including the government itself (Galiotou & Fragkou, 2013; Linders, 2013; O'Riain, Curry, & Harth, 2012).

The effective use of OGD depends on how data are disclosed and also the objective of using them [6]. Transparency itself is not the only objective of OGD, which is relative to the data usefulness and demands strategic decisions before its disclosure [8, 18]. The use of is a central challenge for all stakeholders [77] and requires adequate knowledge and training [26, 64].

OGD usefulness can generate social and economic benefits for the entire society [42]. For governments, OGD has the potential to help them to identify failures and inconsistencies in public services [17]. For that purpose, OGD is essential to public policies [34] and for improving public services [84]. Navigation systems, financial services, or previsions of weather conditions, for instance, can be good examples of the use of OGD [37]. The use of OGD contributes to democracy provided it contributes to more transparency, active citizenship, social control [76], and public administration improvements [26]. This might redefine the role of government in society because it provides a new stage for social participation [71].

Governments need to create conditions for possible use of the data, for example, in decision-making processes [27, 85]. The opening of government data is increasing the generation of new ideas, transforming society and contributing to its development [6]. Although the primary function of government is not to generate data for multiple stakeholders, this data consequently improves the government managerial practices [79]. Rarely, however, the research about OGD demonstrates the use of data in improving public services [26]. However, the OGD is available for the government, private sector, or citizens [35], and evidences in the literature of open data use by the government are limited.

The use of OGD for the government can produce social benefits such as improving cities' smartness, which benefits the whole society [55]. The growing body of research on OGD in the last few years demonstrates the importance of open government data disclosure for stakeholders. Government will not be a simple provider of open government data. The government can use the data to improve public policies, decision-making, public services, or even the evident lack of knowledge found in the literature. Open data initiatives can also help citizens learn about government activities, improve government accountability, and allow citizens to participate in the political process [34].

2.3   Desbureaucratization

Bureaucracy is a type of power and its main characteristics are: impersonality, control of routines, hierarchy, meritocracy and formality of communications [80]. It is a rational system since it has a division of labor aiming at the ends, coherently with its means [80]. However, the term bureaucracy is often used in a pejorative sense, to designate the slowness of procedures and bottlenecks, characterized by excessive formalism, eventually compromising the efficiency of administrative action [52]. Due to the excessive formalism of internal controls and the lack of transparency of public acts, the role of bureaucracy is frustrating since it opens the way for the internal formation of interest groups, as well as for increasing levels of corruption in the state apparatus [3]. This frustration occurs due to inefficient bureaucracy, where regulations tend to be less transparent [74]. However, it should not be the ideal role of bureaucracy to provide greater rigidity regarding corruption, to bring greater efficiency to the public sector, and to be less flexible for breaches that give rise to undue advantages, both for the public official and for a third party.

Somehow, bureaucracy prime aim is self-preservation [54] and bureaucracy inefficiency can increase because of corruption.

According to the game theory, people who are benefiting from the inefficient system and committing fraudulent acts have no incentive to streamline or improve the system [36]. Thus, corruption and bureaucratic inefficiency can be a vicious cycle. In reality, bureaucratic administration is burdensome, slow, self-referential, little or no oriented towards meeting citizens' demands [10], stimulating the rise of bureaucratic corruption.

Bureaucratic corruption is the action of a person with power legitimized by society to perform public tasks and one that uses such power for personal gain, thereby causing public harm by violating administrative rules and laws [4]. These public tasks can be exemplified as obtaining a negative debt certificate, starting a business, documentation, and authorizations for construction, payment of taxes, property records, among many others.

However, governments that tend to act in a corrupt way reinforce their bureaucratic structures, with the intention of creating spaces for parallel markets, causing complexity and delays in the performance of the public service, which will be facilitated by illegal action [62]. With this, it is important to work for debureaucratization of the State, which can be carried out through processes and policies.

3   Theoretical Model

The model presented in Figure 1 was created based on the general assumptions that the debureaucratization and the open government data disclosure are determinants do explain the corruption level in a country. It is possible to understand that a country can reduce its corruption vulnerability by opening government to society and reducing the bureaucracy.
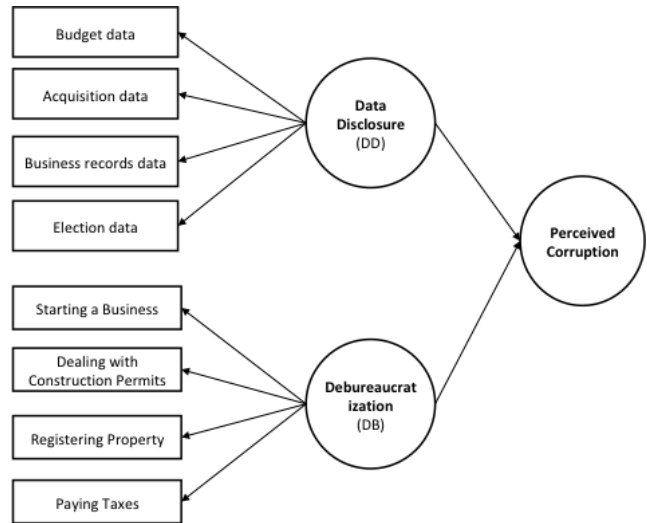

Figure 1: Research theoretical model

The Ease of Doing Business started in 2003 and is maintained by the World Bank Group. Presents quantitative indicators on business regulation and property rights protection, measuring regulation that affect 11 business areas in the processes of opening and maintaining a company, showing how easy or difficult it is to run a business in 169 countries. The values are presented from 0 to 100 percent, and the more significant this value is, the less bureaucratic businesses are in the country. Data is collected in several rounds through interviews with experts, practitioners and government officials. The main sources of data are: the relevant laws and regulations, interviewed, the governments of the countries and people of the world bank. According to the World Bank, over the last decade more than 60 economies have used Doing Business data in regulatory reform committees and around 920 reforms were inspired by Doing Business.

The Global Open Data Index is maintained by the Open Knowledge Foundation to 181 countries and refers to the open government data disclosure levels. Is the annual global benchmark for the publication of open government data, and tries to identify how governments around the world disclose open data from a civic perspective. The indicator analyzes 14 data categories, such as expenses, procurement, election results, national statistics, among others. The values range from 0 to 100 percent, where the more prominent this value is, the more open government data are.

The Corruption Perception Index (CPI), maintained by Transparency International [16], was the source of information related to corruption levels of 175 countries. Their scores in the last five years were used instead of their positions in the ranking.

4   Research Method

This research is characterized as exploratory and descriptive cross-sectional, with a quantitative approach due to the applied data collection and analysis techniques [48]. Figure 2 presents the methodological procedures performed in this research.
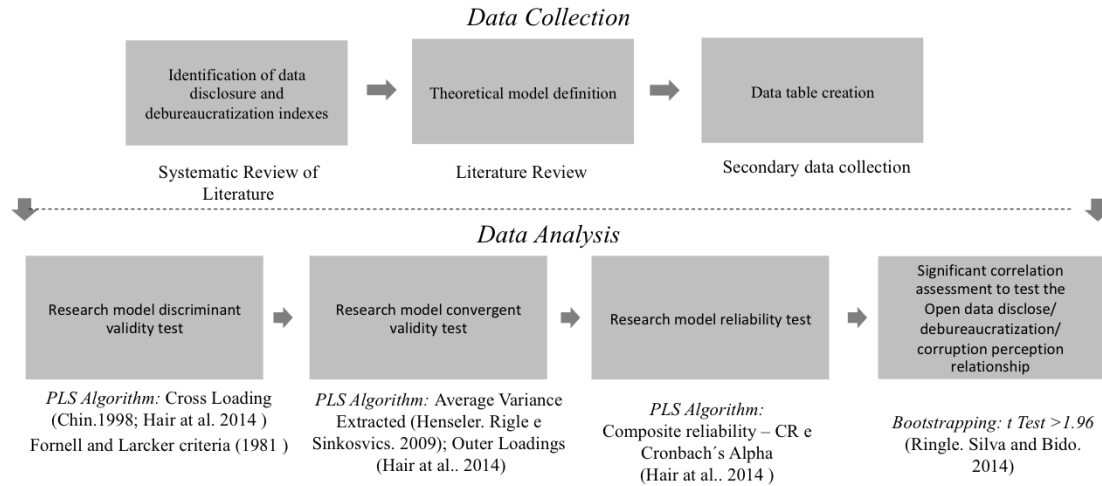
Figure 2: Research steps

The research was carried out taking into account 13 variables, five for the Corruption Perception Index, four for the Global Open Data Index and four for the Ease of Doing Business Ranking. The analysis was performed with data from 164 countries, for which data were obtained from the three rankings above. The countries are distributed around the world according to Table 2.

The Partial Least Squares (PLS) method was used as the data analysis technique. PLS was developed to maximize the predictive accuracy of the models, offering flexibility for the modeling of structural equations [68]. This technique was initially referred to as soft modeling, because there are no assumptions about the distribution of the variables, there is no need to transform the indicators to reduce their asymmetry and the size of the sample needed to be smaller than in the structural equations model, based on covariance [69]. The analysis was performed through SmartPLS®, version 2.

The evaluation of discriminant validity is obtained as the latent constructs or variables are independent of each other [68]. Two criteria must be used, where the first one is to observe the cross loads [58]. Indicators should have higher factor loads in their respective latent variables (or constructs) than in others [13]. The second criterion is the Fornell & Larcker [24], by which the square roots of the Average Variance Extracted (AVE) of each latent variable (or constructs) with the Pearson correlations between the constructs are compared. The square roots of the AVEs should be larger than the correlations between the constructs.

For the analysis of the structural model, the first indicator to be observed involves the Pearson determination coefficients (R^2) [58]. According to the authors, the R^2 indicators evaluate the variance of the endogenous variables, which is explained by the structural model, indicating the quality of the adjusted model. In the Social and Behavioral Sciences, $R^2 > 0.02$ is classified as a small effect, $R^2 > 0.13$ as medium one and $R^2 > 0.36$ as a large effect [14].

Next, the convergent validities obtained by AVEs must be observed. The Fornell and Larcker criterion is applied [29], in which AVE values should be higher than 0.50 (AVE > 0.50). Thus, when AVEs is higher than 0.50, it is assumed that the model converges to a satisfactory result [24].

Table 2: Number of countries analyzed by geographic region

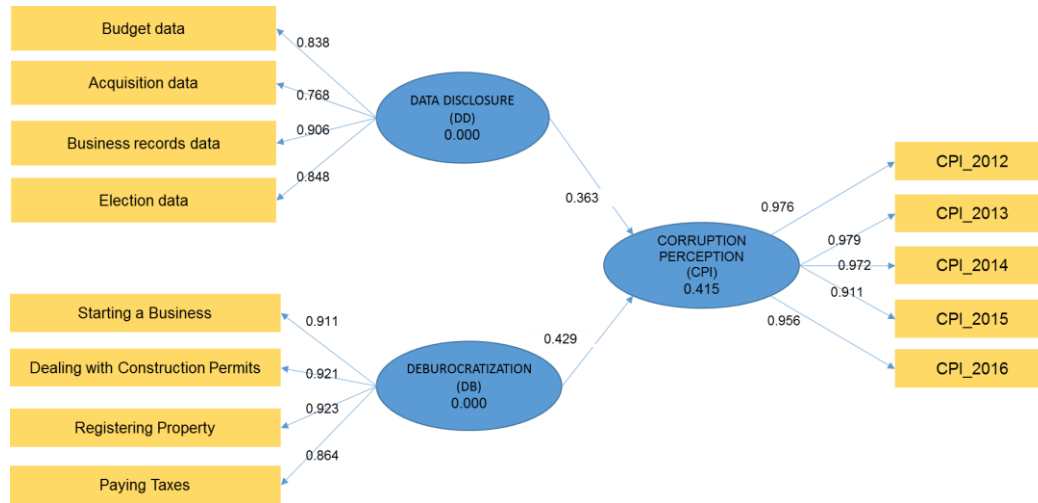| Region	Number of Countries	Frequency
Americas	31	18.9%
Asia and Pacific	27	16.5%
Europe and Central Asia	47	28.7%
Middle Eastern and North Africa	18	10.9%
Sub-Saharan Africa	41	25.0%
Total Observations	164	100%

Figure 3: First Order Model

The analysis of the Internal Consistency and Composite Reliability (CC) values should be performed after convergence analysis [58]. The traditional indicator is Cronbach's Alpha (AC), based on the intercorrelations of the variables. However, the CC indicator is more suited to the PLS-PM because it prioritizes the variables according to their reliability, while the AC is very sensitive to the number of variables in each construct. Further, both AC and CC should be used to evaluate whether the sample is free from bias, or whether the responses (as a whole) are reliable. Values of AC over 0.60 and 0.70 are considered adequate in exploratory research and values of 0.70, and 0.90 of CC are considered satisfactory [68].

SmartPLS®, through the Bootstrapping module, calculates Student t-tests between the original data values and those obtained by the resampling technique, for each correlation between the latent and the observed Variables, presenting t-test values instead of values of p-values. It should be interpreted that for high degrees of freedom, values above 1.96 correspond to p-values> 0.05 (between -1.96 and +1.96 corresponds to the probability of 95% in a normal distribution) [58]. SmartPLS 2.0 algorithm Path weighting scheme was used, which estimates the indicator weights, using multiple regressions so that the latent variables can be predicted and can be a good predictor of the subsequent ones. The use of validity and reliability indicators were defined according to the recommendations of the literature for SEM-PLS-PM (Lohmöller, 1989; Henseler & Ringle, 2007). The theoretical model was operationalized through the steps mentioned in this session, and the results are discussed in the following section.

5 Results Analysis and Discussion

In order to test the relationships exposed in the Theoretical Model, the data were input in the SmartPLS® software, and then the first order model was created, which can be observed in Figure 3, below.

The analysis of the Measurement Model began with the evaluation of the discriminant validity, obtained when the latent constructs or variables are independent of each other [68]. Cross-loads between observable variables and their factors were calculated [58] Table 3 presents the discriminant validity test, based on Cross Loading analysis [13]

Table 3: Cross Loading Analysis

Variable	CPI	DD	DB
CPI_2012	**0.9763**	**0.4616**	**0.4834**
CPI_2013	**0.9787**	**0.4700**	**0.4925**
CPI_2014	**0.9718**	**0.4746**	**0.5243**
CPI_2015	**0.9110**	**0.5001**	**0.5643**
CPI_2016	**0.9559**	**0.4794**	**0.5350**
DD_CR	**0.4559**	**0.8383**	**0.2802**
DD_ER	**0.4020**	**0.7683**	**0.2592**
DD_GB	**0.4433**	**0.9057**	**0.2610**
DD_Pr	**0.3654**	**0.8478**	**0.2614**
DB_DCP	**0.4762**	**0.2639**	**0.9109**
DB_PT	**0.5525**	**0.2896**	**0.9215**
DB_RP	**0.5190**	**0.3221**	**0.9226**
DB_SB	**0.4010**	**0.2642**	**0.8643**

It was possible to determine that the model has discriminant validity, according to Cross Loading results [13]. Next, the results obtained in the convergent validity and reliability test are presented in Table 4.

After the analysis of the measurement model, the first value to be considered in the analysis of the structural model is the Pearson determination coefficients (R²). The R² indicators evaluate the portion of the variance of the endogenous variable (Corruption

Perception Index - CPI), which is explained by the exogenous variables (DD and DB), indicating the quality of the adjusted model [58].

The obtained Pearson's coefficient of determination (R^2) was 0.4148 for the relationship between DD/DB and CPI, showing that the proposed model is adequate for its purposes. So it was possible to test the general hypothesis, which is that debureaucratization and data disclosure help a country to protect itself from corruption by reducing its vulnerability to it. The t values between the original values and those obtained by the resampling technique were calculated using the SmartPLS® Bootstrapping module. Table 5 shows the significance of the relationships identified between GOD and LB variables and the CPI.

Finally, the model adjustment indicators were evaluated, namely, Relevance or Predictive Validity (Q^2) and Stone-Geisser indicator and effect size (f^2). Table 6 shows the results of the tests performed.

Based on the tests, it is possible to infer that the levels of debureaucratization and data disclosure contribute to reducing perceived corruption in a country and that debureaucratization had a higher and more significant effect.

Together, these variables might help a country to create barriers to the occurrence and impact of corruption. Lower levels of bureaucracy reduce the vulnerabilities to corruption, especially the ones related to the civil servant discretionary power. Corruption arises in situations where there is a problem of information asymmetry, which might occur because of the discretionary power [39]. However, discretionary power is fundamental to the civil servant activity, and without it, civil servants will be merely bureaucrats, and consequently, they will not perform their role. However, this scenario opens doors to civil servants unlawful behavior, such as accepting bribery to help a citizen to overcome the traps of bureaucracy which may occur through bribery, extortion, fraud, nepotism or embezzlement [78]. Companies sometimes perceive informal payments as a transaction cost and prefer to pay these amounts rather than go through further inspections [21]. Otherwise, open government data is the basis for transparency and accountability. The society has the possibility of using social control of government agents by paying attention to data that show what they are doing. It can help to call attention when government agents show unlawful behavior and also to reduce the chance of recurrence of this behavior.

Table 4: Convergent validity, reliability and Fornell and Larcker criteria tests

Variable	AVE	CR	AC	Communality	CPI	DD	DB
CPI	0.92	0.98	0.41	0.98	0.959		
DD	0.71	0.91	0.00	0.86	0.499	0.841	
DB	0.82	0.95	0.00	0.93	0.544	0.316	0.905
Reference values	> 0.50	> 0.70	> 0.70	> 0.5	Fornell and Larcker Criteria		

Table 5: Relationships between the constructs significance test

	Original Sample (O)	Sample Mean (M)	Standard Deviation	Standard Error	T Statistics > 1.96	Significant relationship p-values < 0.05
DD ->CPI	0.135	0.153	0.062	0.062	2.173	Yes
DB -> CPI	0.640	0.636	0.037	0.037	17.293	Yes

Table 6: Values of Predictive Validity (Q^2) and Stone-Geisser indicator (f2)

	Predictive validity (Q^2)	Effect size (f^2)
CPI	0.442	0.952
DD	0.158	0.158
DB	0.405	0.405
Reference values	$Q^2 > 0$	0.02, 0.15 and 0.35 are considered respectively small, medium and big effects

Both variables are frequently cited as ways to reduce the levels of corruption [38], and it is the central assumption of this paper. One contribution of this study is to demonstrate that this assumption works for a set of 164 countries. The results show that in a less bureaucratic and more open country the context is less favorable to the generation, growth, and maintenance of corrupt actions and processes. At the same time, it broadens mechanisms to reduce corruption, manifested by fewer less impacting cases, or by their fast detection and interruption.

6 Final Remarks

Corruption might affect a country's development, hindering social development and the quality of life, either for lack of investment or financial diversions, causing internal inefficiencies in the market, further affecting its population and accentuating conditions of poverty and low economic development [86]. The primary objective of this research was to verify the impact of a country's government data disclosure and debureaucratization in its vulnerability to corruption. Results show that both contribute to reducing the vulnerability to corruption in a country, nonetheless debureaucratization presented a superior and more significant effect.

Even though the reduction of the levels of corruption in a country is a very complex subject, it is necessary to have a starting point. The results show that debureaucratization might be a start point, and it can support government decision-making when creating mechanisms to reduce the vulnerability to corruption. Data disclosure is indeed essential to increase transparency and consequently accountability in public management, to generate new businesses, to enable social control, as well as to reduce a country's vulnerability to corruption, as evidenced by this study. This study draws attention to the point that bureaucratization has a higher and more significant effect and thus should be part of an essential set of governmental initiatives. When governments are seeking for external legitimacy, adopting solutions developed on legitimized countries through mimetic isomorphism, there is a risk of skipping important steps. This is common in low mature democracies, which might skip, for example, bureaucratization initiatives and go straight to practices adopted in dominant countries.

To a certain extent, the results statistically demonstrate something related to the scale of benefits - every time a governmental service is simplified (by the reduction of steps, physical locations involved or required documents), the benefits reach all citizens that use that service. The benefits are direct and immediate. If virtualization is part of the rethinking of the service, all users who are skilled and capable of using digital devices are benefited. Considering the premise that digitalized services are more efficient to avoid some kinds of corruption [46], debureaucratization can also reduce vulnerability to bribery, most prominently, also to embezzlement, extortion, and fraud.

In the open data disclosure, the benefits are indirect, and medium and long terms. Data disclosure allows the social control of the government by the citizens [65], which can prevent or reduce the occurrence of corruption by reducing

its vulnerabilities. Data disclosure also allows accountability, which is fundamental in the fight against corruption. In the medium and long terms, open data contribute to more transparent countries with a better exercise of citizenship.

The main theoretical contribution of this research is the identification of two indicators that have a positive impact on reducing vulnerability to corruption. Reducing levels of corruption are abstract and therefore need to be initiated and carried out through mechanisms that, at the end of a maturity cycle, reduce the occurrence or impact of corruption in a country.

The main practical contribution is the identification of the impact of debureaucratization initiatives as a way to reduce vulnerability to corruption. These initiatives can support or expand programs in progress, thus increasing their public and social value. The agenda of debureaucratization may seem outdated and less attractive in times of uses of digital technology by governments, but the results of this study show the importance of such initiatives to reduce the vulnerability to corruption, a subject that sometimes seems inextirpable.

It is important to consider that the results should be interpreted as being limited to data from the 164 countries analyzed. These data consider the context of each country internally. However, the fact that no contextual analysis was done in this research, is the major limitation.

Further studies can involve a cluster analysis, as a way to understand groups of countries with similar characteristics (for example, developed and underdeveloped countries, or political regime). Case studies can also be performed in some of the countries listed in the CPI, verifying how the indicators analyzed in this study behave in loco. Interviews with citizens of these countries can also complement contextual analyzes.

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