

An Empirical Analysis of Socioeconomic Patterns of Host Country Transparency

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Abstract

Within the host country environment, the levels of corruption in a country's institutional structures influence the behavior of foreign-owned subsidiaries. Our empirical results suggest that countries with the ability to reduce corruption in their institutional structures have common socioeconomic characteristics.

Key words: business ethics; corruption; cultural dimensions; factor analysis; logistic regression; DEA

JEL classification: C14; M20; Z19

1. Introduction

Current studies in economic development and international business suggest that corruption is a major threat to the efficiency of business operations and to a country's economic development. Mauro (1995) suggests that corruption is a disincentive to investment, whereas Davids (1999) argues that the biggest threat from corruption lies in its effect on the misallocation of resources. Therefore, countries' levels of corruption will force multinational corporations (MNCs) to carefully select the location for their foreign subsidiaries since corruption can significantly increase their operating costs and the risks involved with their subsidiary operations.

Among others, Habib and Zurasawicki (2002) argue that corruption can create inefficiencies, and therefore foreign investors try to avoid highly corrupt host countries. Tanzi and Davoodi (1997) emphasize that corruption may act as a tax on foreign direct investment (FDI), which can increase considerably the operating costs of MNCs and lower public welfare.

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Furthermore, Rose-Ackerman (1999) argues that the institutional structure arrangement is a major determinant of corrupt practices. Corruption distorts efficient resource allocation. It also rewards unproductive behavior by channelling unmerited contracts and rights to companies in exchange for bribes at the expense of efficient and innovative firms. Most empirical work regarding corruption assumes a context in which the institutional setting shapes the behavior of the MNC. Therefore, in order to strive for external legitimacy, the MNC needs to adapt to its institutional context (Glynn and Abzug, 2002).

This paper measures the efficiency of 29 countries in terms of their ability to minimize corruption on different institutional structures (such as government, legal system, tax revenue services, business) and thus to maximize their transparency. For that reason the data envelopment analysis (DEA) model of Charnes et al. (1978; henceforth CCR) has been adopted in order to measure a host country's efficiency of minimising corruption in different institutional structures and maximising the overall transparency of the local investment environment. Different empirical studies suggest that there are different cultural characteristics between countries with higher levels of corruption and those with lower levels (e.g., Husted, 1999; Kimbro, 2002; Triadis et al., 2001; Davis and Ruhe, 2003; Getz and Volkema, 2001). Other studies suggest that different economic and political conditions cause corruption in a country's institutional structure (e.g., Alam, 1990; Getz, 2000; Mauro, 1995; Getz and Volkema, 2001).

In contrast to other theoretical studies (e.g., Alam, 1990; Klitgaard, 1988; Myrdal, 1970; Nye, 1979; Shleifer and Vishny, 1993; Spinellis, 1996), this paper takes into account different cultural and economic variables and explains empirically their implications of shaping a country's ability to reduce corruption and thus to maximize its transparency. Furthermore, this paper provides empirical evidence using factor analysis and logistic regression in addition to DEA methods to develop and test a model that takes into account the effect of various socioeconomic factors such as culture, economic, and political conditions. According to different studies (e.g., Husted, 1999; Kimbro, 2002; Triadis et al., 2001; Davis and Ruhe, 2003; Getz and Volkema, 2001), these factors are interrelated with different levels of corruption.

The structure of this paper is as follows. Section 2 reviews related literature, while Section 3 describes the data and methodology used in this research. Section 4 presents and discusses the empirical results. Section 5 concludes.

2. Literature Review

As Dunning (1981) suggests in the traditional theory of the emergence of MNCs, three conditions must occur for the existence of FDI. The firm must possess both an ownership advantage and an internalization advantage while the foreign market must offer a location advantage. Hence, as Buch et al. (2003) and Caves (1996) argue, firms' decisions to engage in FDI are predetermined by factors related to cost advantages, to the maintenance of proprietary asset advantages, and to market access. Bevan and Estrin (2004) argue that transportation and

communication costs, the costs of coping with cultural and language differences, and the informational costs of institutional factors all increase with distance.

In addition to the four dimensions of distance (cultural, administrative, geographical, and economic) identified by Ghemawat (2001), Habib and Zurawicki (2002) argue that the difference in corruption levels between countries is an important barrier for foreign investors because corrupt practices are parts of local business and administrative procedures. Habib and Zurawicki (2002) indicate that skills in managing corruption provide a competitive advantage in these environments, but they point out that this advantage diminishes, or even becomes a disadvantage, in a transparent market.

The harmful effects of corruption have been extensively documented in the literature (Mauro, 1995; Rose-Ackerman, 1975). Empirical studies have been conducted to show how a host country's corruption significantly reduces its FDI inflows (e.g., Lambsdorff, 1999; Mauro, 1995; Wei, 1997). Besides the volume of FDI inflows, Rodriguez et al. (2005) emphasize that the type of corruption in the host country also affects an MNC's choice of entry mode strategy.

In addition, within the host country environment, local governments and the business community influence the behavior of foreign-owned subsidiaries. The business people representing the MNCs may be reluctant to offer a bribe. Donaldson (1996) indicates bribery is an asymmetric obstacle which reduces market efficiency and predictability. However, Steidlmeier (1999), providing evidence from China, indicates that the differences between corruption, bribery, and gifts may be due to different cultural and moral values.

In fact, cultural values play an important role regarding the tolerance or the absence of corruption. Using Hofstede's measures of national culture, Husted (1999) identifies power distance, uncertainty avoidance, and masculinity to have a significant impact on national corruption. Furthermore, Kimbro (2002) reports power distance and individualism as related to corruption. It appears that the consensus is that individualism and power distance are the cultural traits that are associated with corruption; collectivistic cultures and cultures with high power distance gravitate towards high prevalence of corruption. Husted (1999) and Triandis et al. (2001) provide evidence that high power distance countries tend to have high prevalence of corruption. Triandis et al. (2001) find that countries with more collectivist scores show the most corruption.

Different studies seeking to investigate socioeconomic factors related to corruption have used the Corruption Index developed by Transparency International. This is a composite index based on a variety of different assessments made with the help of business surveys or expert panels. Some studies used data from these individual assessments, (i.e., the Institute for Management Development or the World Economic Forum); see for instance Lambsdorff (2004). Tanzi and Davoodi (1997), using the Transparency Index, examine the impact of corruption on the quality of public investments. They found that corruption lowers the quality of the infrastructure. Gupta et al. (2001) show that countries with high levels of corruption are associated with inefficient government services.

Lambsdorff (2003a, b) suggests that as corruption increases the risks associated with making investments (e.g., by lowering the security of property rights), economic theory predicts that corruption will have a clear negative impact on the ratio of investment to GDP. Wei (2000) detects a significant negative impact of corruption on FDI, whereas Doh and Teegen (2003) show that investments in the telecommunications industry are adversely affected by the extent of corruption. Smarzynska and Wei (2000) provide similar evidence for corruption and its ability to reduce firm-level assessments of FDI in Eastern Europe and the former Soviet Union.

Hofstede's cultural dimensions and other economic variables, such as GDP, inflation, unemployment, and FDI flows, have been used in several studies in order to explain the source and tolerance of corruption (e.g., Davis and Ruhe, 2003; Getz and Volkema, 2001; Habib and Zurawicki, 2002; Husted, 1999; Robertson and Watson, 2004). However, few studies provide empirical evidence that relates these socioeconomic aspects with a country's ability to reduce corruption.

Figure 1. An Input/Output Conceptual Model of Countries' Transparency Creation

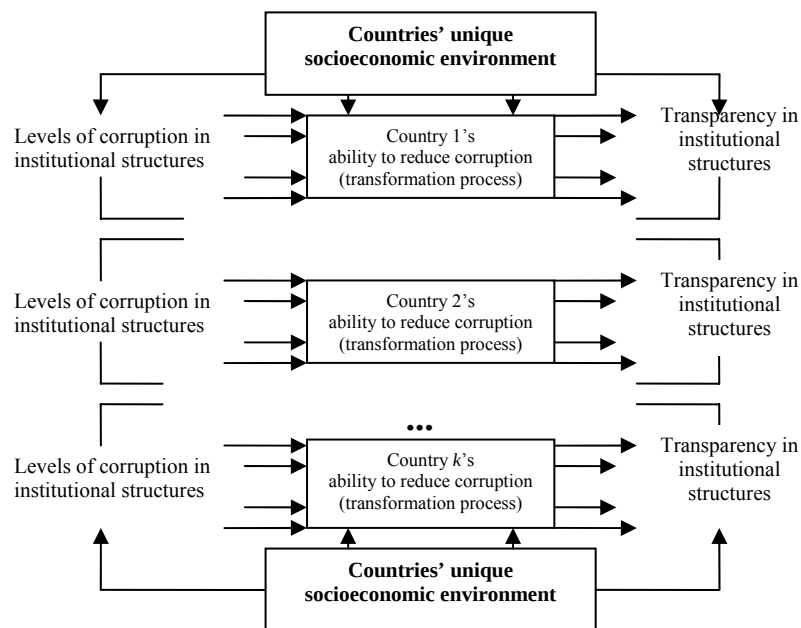


Figure 1 illustrates this concept. Every country is regarded as having different levels of corruption in their institutional structures (e.g., political parties, parliament/legislature, legal system/judiciary, tax revenue services, and business/private sector). In turn their tolerance to corruption or their ability to reduce it (termed its transformation process) is enhanced and characterized by their unique cultural values and economic environment (e.g., Davis and Ruhe, 2003; Getz and

Volkema, 2001). Finally, the results of these transformation processes provide different levels of transparency in their institutional structures given the effect their cultural and economic environments. Getz and Volkema (2001), analyzing the socioeconomic factors associated with higher rates of perceived corruption, found that higher perceived corruption is positively associated with higher inflation and lower GDP rates, high masculinity levels in a culture, high power distance levels, and higher collectivism and uncertainty levels. Davis and Ruhe (2003) have also found similar results. To our knowledge these are the only two studies similar to ours. However these studies investigate the effect of socioeconomic factors on a country's levels of corruption from a different empirical angle with the use of different methodologies.

This paper uses Hofstede's four dimensions: individualism/collectivism, power distance, uncertainty avoidance, and masculinity/femininity in order to measure countries' cultural characteristics (Hofstede, 1994). It also uses Hofstede's (1980a, p. 25) definition of culture being "the collective programming of the mind which distinguishes the members of one human group from another," which is regarded as the main determinant of the social aspect of corruption.

3. Methodology

3.1 Data

This paper analyzes 29 countries in terms of their socioeconomic patterns influencing their transparency. Specifically, using the DEA-CCR model, we calculate countries' ability to increase transparency. Five inputs and one output are used. Table 1 presents the variables used for the calculation of efficiency (in terms of a country's ability to be transparent given the harmful effects of corruption) and their data sources.

The five inputs are the levels of perceived corruption for political parties, parliament/legislature, legal system/judiciary, tax revenue services, and business/private sector, each taking values from 1 to 5 (where 1 indicates no corruption and 5 indicates a high level of corruption). The output used for this research is the perceived transparency index, taking values from 1 to 10 (where 1 denotes low transparency and 10 denotes high transparency). To measure the cultural environment of each country, the four cultural indexes introduced by Hofstede (1994) have been used to capture the social factors influencing transparency (e.g., Husted, 1999; Triandis et al., 2001; Kimbro, 2002; Davis and Ruhe, 2003; Getz and Volkema, 2001). Additionally, different macroeconomic variables have been used to analyze the economic determinants shaping each country's ability to reduce corruption (e.g., Davis and Ruhe, 2003; Getz and Volkema, 2001): the percentage of GDP change for 1995-2005 and the percentage of inflation change for 1995-2005 (OECD, 2005). Finally, the country risk index (World Investment Report, 2005) has been used to measure the general investment environment and its relation with the levels of corruption. The country risk index

ranges from 0% to 100% (where 0% reflects high risk and 100% reflects no risk). This index is associated with a country's political and socioeconomic stability.

Table 1. Data Description and Data Sources

Variable	Description	Source
POLP	Political parties	Transparency International (2005)
PARLEG	Parliament/legislature	Transparency International (2005)
LEGJUS	Legal system/judiciary	Transparency International (2005)
TAXRE	Tax revenue	Transparency International (2005)
BUSPR	Business/private sector	Transparency International (2005)
TI	Corruption transparency index	Transparency International (2005)
PDI	Power distance	Hofstede (1994)
IDV	Individualism/collectivism	Hofstede (1994)
MAS	Masculinity/femininity	Hofstede (1994)
UAI	Uncertainty avoidance	Hofstede (1994)
GDP	GDP % change 1995-2005	OECD
INFLA	Inflation % change 1995-2005	OECD
COUNTRISK	UNSTAD country risk index	World Investment Report (2005)

3.2 Measuring a Country's Ability to Be Transparent

DEA is a popular and useful technique for measuring efficiency, including production possibilities, which are deemed to be one of the common interests of operations research and management science (Charnes et al., 1994). This approach can be roughly described as a nonparametric method of measuring the efficiency of a decision making unit (DMU) with multiple inputs and/or multiple outputs. This is achieved by constructing a single "virtual" output to a single "virtual" input without pre-defining a production function. The terms DEA and the CCR model were first introduced in 1978 (Charnes et al., 1978).

DEA is concerned with the efficiency of the individual unit, which can be defined as the unit of assessment (Thanassoulis, 2001) or the DMU. DEA is used to measure the relative productivity of a DMU by comparing it with other homogeneous units, transforming the same group of measurable positive inputs into the same types of measurable positive outputs. The input and output data noted above can be expressed by matrices:

$$X = \begin{pmatrix} x_{11} & \cdots & x_{1s} \\ \vdots & \ddots & \vdots \\ x_{m1} & \cdots & x_{ms} \end{pmatrix} \text{ and } Y = \begin{pmatrix} y_{11} & \cdots & y_{1s} \\ \vdots & \ddots & \vdots \\ y_{n1} & \cdots & y_{ns} \end{pmatrix}, \quad (1)$$

where x_{ij} is the i th input data and y_{ij} is the i th output data of DMU_j .

To measure the ability to be transparent (CCR-efficiency), this paper uses five inputs (POLP, PARLEG, LEGJUS, TAXRE, BUSPR) and one output by applying

the CCR model (Charnes et al., 1978). The CCR model for the example of Figure 1 can be expressed by (2)-(5):

$$(FP_o) \max \theta = \frac{u_1 y_{1o} + u_2 y_{2o} + \dots + u_n y_{no}}{v_1 x_{1o} + v_2 x_{2o} + \dots + v_m x_{mo}}, \quad o = 1, \dots, s \quad (2)$$

subject to:

$$\frac{u_1 y_{1j} + \dots + u_n y_{nj}}{v_1 x_{1j} + \dots + v_m x_{mj}} \leq 1, \quad j = 1, \dots, s \quad (3)$$

$$v_1, \dots, v_m \geq 0 \quad (4)$$

$$u_1, \dots, u_n \geq 0. \quad (5)$$

Given the data X and Y in (1), the CCR model measures the maximum efficiency of each DMU by solving the fractional programming (FP) problem in (2) where the input weights $v_1, \dots, v_m$ and output weights $u_1, \dots, u_n$ are variables to be obtained. Note that there are s optimizations, one for each DMU_o . Constraint (3) reveals that the ratio of “virtual output” ($u_1 y_{1o} + \dots + u_n y_{no}$) to “virtual input” ($v_1 x_{1o} + \dots + v_m x_{mo}$) cannot exceed 1 for each DMU, which conforms to the economic assumption that in production the output cannot be more than the input.

The above FP (2)-(5) is equivalent to the following linear programming (LP) formulation (see for instance Cooper et al., 2000):

$$(LP_o) \max \theta = u_1 y_{1o} + \dots + u_n y_{no}, \quad o = 1, \dots, s \quad (6)$$

subject to:

$$v_1 x_{1o} + \dots + v_m x_{mo} = 1, \quad o = 1, \dots, s \quad (7)$$

$$u_1 y_{1j} + \dots + u_n y_{nj} \leq v_1 x_{1j} + \dots + v_m x_{mj}, \quad j = 1, \dots, s \quad (8)$$

$$v_1, \dots, v_m \geq 0 \quad (9)$$

$$u_1, \dots, u_n \geq 0. \quad (10)$$

It is worth mentioning that the computation of the above DEA-CCR model by transforming the FP model into the LP model has been of great significance for the rapid development and wide application of DEA. As a long-established mathematical method with various sophisticated computation methods and commercially available solutions software, LP possesses inherent advantages that make the complicated computation both easier and more feasible.

3.3 Factor Analysis

After measuring countries' ability to be transparent (CCR-efficiency) using the DEA-CCR model, this paper uses factor analysis to group the socioeconomic

variables into main factors according to their similarity of impact while avoiding the problem of multicollinearity.

Since, according to previous research, all these variables are associated with a country's efficiency, we perform a factor analysis using principal components as the method of extraction. Additionally, the proposed variables are expected to present an increased correlation as a result of overlapping variation between them in terms of multicollinearity in a regression model setup. Researchers suggest the application of factor analysis in order to examine the structure of the overlapping variation between the predictors (Leeftang et al., 2000), claiming that the only problem in this case remains the theoretical interpretation of the final components (e.g., Greene, 2000; Gurmu et al., 1999).

The factor scores are extracted using:

$$f_j = w_{j1}X_1 + \dots + w_{jp}X_p, \quad (11)$$

where f_j is the score of the j th common factor, and the w_{ji} are considered unknown and are estimated using regression. In the principal components method applied here, the scores are exactly calculated. Residuals are computed between observed and reproduced correlations.

If the common factors F and the specific factors u can be assumed normally distributed, then maximum likelihood estimates of the factor loadings and specific variances may be obtained. When F_j and u_j are jointly normal, the likelihood is:

$$\begin{aligned} L(\mu, \Sigma) &= (2\pi)^{-\frac{np}{2}} |\Sigma|^{-\frac{n}{2}} e^{-\frac{1}{2} \text{tr}[\Sigma^{-1} (\sum_{j=1}^n (X_j - \bar{X})(X_j - \bar{X})' + n(\bar{X} - \mu)(\bar{X} - \mu)')] } \\ &= 2\pi^{-\frac{(n-1)p}{2}} |\Sigma|^{-\frac{(n-1)}{2}} e^{-\frac{1}{2} \text{tr}[\Sigma^{-1} (\sum_{j=1}^n (X_j - \bar{X})(X_j - \bar{X})')] } (2\pi)^{-\frac{p}{2}} |\Sigma|^{-\frac{1}{2}} e^{-\frac{1}{2} (\bar{X} - \mu)' \Sigma^{-1} (\bar{X} - \mu)}, \end{aligned} \quad (12)$$

which depends on L and Ψ from the covariance matrix for the m th common factor model of $\Sigma = LL' + \Psi$. The maximum likelihood estimates of $\hat{L}$ and $\hat{\Psi}$ are obtained by maximizing (12). The maximum likelihood estimators $\hat{L}$, $\hat{\Psi}$, and $\hat{\mu} = \bar{X}$ maximize (12) subject to $\hat{L}'\hat{\Psi}^{-1}\hat{L}$ being diagonal. The maximum likelihood estimates of the communalities are $\hat{h}_i^2 = l_{i1}^2 + \dots + l_{im}^2$ for $i = 1, \dots, p$. The proportion of the total sample variance to the i th factor is:

$$P_{\text{var}} = \frac{\hat{l}_{i1}^2 + \dots + \hat{l}_{im}^2}{s_{11} + \dots + s_{pp}}.$$

A proof is provided in Johnson and Wichern (1998).

The elements of the residual matrix corresponding to maximum likelihood are much smaller than those corresponding to principal components. Based on this, the former approach is preferred. We applied the varimax rotation to determine the transformation matrix such that any given factor will have some variables loaded high on it and some loaded low on it. This may be achieved by maximizing the variance of the square loading across variables subject to the constraint that the

communalities of each variable remain the same (Johnson and Wichern, 1998; Sharma, 1996).

Table 2 presents the factor loadings and specific variance contributions according to the maximum likelihood method of extraction in our factor analysis. It can be seen that variables PDI, IDV, and GDP define factor 1 (high loadings on factor 1 and small loadings on factor 2), while variables UAI, INFLA, and COUNTRISK define factor 2 (high loadings on factor 2 and small loadings on factor 1). MAS is most closely aligned with factor 1, although it has aspects of the theory represented by factor 2. The communalities (0.434, 0.999, 0.131, 0.289, 0.371, 0.466, 0.999) being moderate indicates that the two factors account for an average percentage of the sample variance of each variable.

We conclude that there are clearly two different sets of independent variables in our sample. The first set (PDI, IDV, MAS, and GDP) is the set of variables we can group as factors of socioeconomic variables characterizing host country transparency. The second set (UAI, INFLA, and COUNTRISK) is the set of variables we can group as factors of socioeconomic ambiguity characterizing host country transparency. The two factors include three variables that describe a country's economic adversity (Getz and Volkema, 2001) and four determinants of a country's cultural values (Hofstede, 1994). Socioeconomic ambiguity, which may have a negative effect on host country transparency can appear in countries with an environment of political and investment instability, with high levels of uncertainty avoidance, and with high inflation rates (Davis and Ruhe, 2003; Getz and Volkema, 2001).

Table 2. Statistical Output of the Factor Analysis

Variables	Estimated factor loadings		Rotated factor loadings		Communalities $\hat{h}_i^2$
	F_1	F_2	F_1^*	F_2^*	
PDI	0.598	-0.276	0.606	0.258	0.434
IDV	-0.792	0.610	-0.984	-0.176	0.999
MAS	-0.004	0.176	-0.133	0.115	0.131
UAI	0.519	0.140	0.245	0.479	0.289
GDP	0.500	-0.348	0.594	0.136	0.371
INFLA	0.595	0.334	0.152	0.665	0.466
COUNTRISK	-0.791	-0.610	-0.079	-0.996	0.999
Cumulative percentage of total sample variance explained	35.494	51.270	25.646	51.270	
Kaiser-Meyer-Olkin	0.539				
Bartlett's test of sphericity	61.688 (p-value < 0.001)				

3.4 Logistic Regression

Next we consider logistic regression to formulate a model to explain the ability of countries to be transparent with the extracted factors. First we define the

distributional properties of the response variable (see Halkos, 2006; Kleinbaum, 1994; Hosmer and Lemeshow, 1989; Collett, 1991; Kleinbaum et al., 1999; Hair et al., 1998; Sharma, 1996).

In our sample the first n_1 out of n observations have the characteristic under investigation, namely an efficiency score $\geq 70\%$ versus efficiency score $<70\%$; the choice of 70% as the critical point was determined using the median value of the mean efficiency scores. Then $Y_1 = \dots = Y_{n_1} = 1$ while $Y_{n_1+1} = \dots = Y_n = 0$.

The logit form of the model is a transformation of the probability $\Pr(Y = 1)$ that is defined as the natural log odds of the event $E(Y = 1)$. That is:

$$\text{logit}[\Pr(Y = 1)] = \ln[\text{odds}(Y = 1)] = \ln \left[\frac{\Pr(Y = 1)}{1 - \Pr(Y = 1)} \right]. \quad (13)$$

In the general case, where the dichotomous response variable Y denotes whether ($Y = 1$) or not ($Y = 0$), the characteristic under investigation, is linked with the k regression variables $X = (X_1, \dots, X_k)$ via the logit equation:

$$P(Y = 1) = \frac{\exp \left\{ \beta_0 + \sum_{k=1}^K \beta_k X_k \right\}}{1 + \exp \left\{ \beta_0 + \sum_{k=1}^K \beta_k X_k \right\}}. \quad (14)$$

This is equivalent to $\text{logit}[\Pr(Y = 1|X)] = \beta_0 + \sum_{k=1}^K \beta_k X_k$.

The regression coefficients β_k of the logistic model quantify the relationship of the independent variables to the dependent variable involving the odds ratio (OR). We thus examine the estimated odds that the transformation process will take place:

$$\text{Odds}(E|X_1, X_2, \dots, X_n) = \frac{\Pr(E)}{1 - \Pr(E)}. \quad (15)$$

4. Empirical Findings

Table 3 presents results from our DEA analysis. The results indicate that three of the 29 countries (Denmark, Finland, and Singapore) are fully efficient in terms of minimizing corruption and therefore creating a transparent environment for MNCs. This means that these three countries have lower levels of perceived corruption in their institutional structures and higher transparency levels. Therefore, their efficiency scores are 100%. The countries with lower efficiency scores and thus with higher levels of corruption are Greece, Panama, Mexico, and Turkey, with efficiency scores of 37.9%, 29.9%, 28.8%, and 25.3% respectively. Looking at the results of our DEA analysis, four of the EU countries located in the Mediterranean region (Spain, Portugal, Italy, and Greece) have efficiency scores below 70%, which is also the case for the US and Japan.

Table 4 reports correlations of the seven socioeconomic factors with levels of efficiency. The results clearly indicate that the ability to be transparent is positively associated with lower power distance, higher individualism values, lower uncertainty avoidance, and lower levels of inflation and country risk values.

Table 3. Efficiency Scores and Country Rankings

Country	Transparency	Ranking	Country	Transparency	Ranking
Denmark	100.00	1	Japan	63.83	14
Finland	100.00	1	Spain	63.04	15
Singapore	100.00	1	Uruguay	62.10	16
Switzerland	92.37	2	Portugal	61.59	17
Austria	86.96	3	Israel	56.55	18
Norway	85.98	4	Malaysia	56.52	19
UK	83.45	5	Italy	48.06	20
Canada	81.57	6	South Africa	43.77	21
Netherlands	80.85	7	Korea	41.61	22
Germany	74.93	8	Thailand	38.41	23
Belgium	74.03	9	Greece	37.90	24
France	71.86	10	Panama	29.91	25
USA	68.37	11	Mexico	28.77	26
Chile	68.11	12	Turkey	25.27	27
Taiwan	67.60	13			

Table 4. Pearson's Correlations of Socioeconomic Variables and Efficiency Scores

Variable	Efficiency	Variable	Efficiency
PDI	-0.554 (0.002)*	GDP	-0.17 (0.377)
IDV	0.498 (0.006)*	INFLA	-0.66 (< 0.001)*
MAS	-0.182 (0.346)	COUNTRISK	0.767 (< 0.001)*
UAI	-0.559 (0.002)*		

Notes: * denotes significance at the 1% level.

In this stage of our analysis, the results regarding the association of the socioeconomic factors with host country efficiency scores are fully supported by Getz and Volkema (2001) and Davis and Ruhe (2003), who find links between a country's economic adversity, cultural characteristics, and perceived corruption. However, in our study the analysis goes further by introducing host country efficiency (measuring the country's ability to reduce corruption) and by formulating two main factors of all the socioeconomic variables according to their communality of influence in a logistic regression analysis.

The idea of performing a regression analysis between a response variable and extracted factors is not new. Duntelman (1989) also suggests this process to cope with multicollinearity in a regression analysis model. It is also an indicated way to minimize the number of predictor variables and maximize the degrees of freedom.

As our main interest is in terms of the main effects, we have ignored interactions. Working with the two factors extracted based on the most statistically significant variables, we write the logit form of the model:

$$\text{logit}[\Pr(Y=1)] = \beta_0 + \beta_1(\text{FACTOR 1}) + \beta_2(\text{FACTOR 2}) + \varepsilon_t,$$

where Y denotes the indicator response taking 1 for countries with efficiency scores of $\geq 70\%$ and 0 otherwise. The error term ε_t is assumed to be normally distributed with mean 0 and variance 1.

The response variable addresses the influence of a country's efficiency score derived from the DEA application, binarized into scores above and below 70%. The results of the fitted model are presented in Table 5.

Table 5. Logistic Regression Results

Response: Transparency				
Variables	Estimates	Odds Ratio	Estimates	Odds Ratio
Constant	-1.611	0.200		
Wald	[3.009]			
p-value	(0.083)			
Factor 1	-2.210	0.110	-1.558	0.210
Wald	[5.337]		[6.293]	
p-value	(0.021)		(0.012)	
Factor 2	-3.161	0.042	-2.254	0.105
Wald	[5.565]		[6.452]	
p-value	(0.018)		(0.011)	
Cox and Snell R^2	0.555		0.504	
Nagelkerke R^2	0.756		0.673	
Hosmer Lemeshow	2.147		6.445	
	[0.976]		[0.597]	
Likelihood Ratio	15.000		19.840	
	(< 0.001)		(< 0.001)	

We compute the difference $e^{\hat{\beta}_i} - 1$ which estimates the percent change (increase or decrease) in the odds $\pi = \Pr(Y=1)/\Pr(Y=0)$ for every unit change in X_i holding all the other covariates fixed. The coefficient of factor 1 is $\hat{\beta}_1 = -2.210$, which implies that the relative risk of this particular variable is $e^{\hat{\beta}_1} = 0.110$ and the corresponding percent change is $e^{\hat{\beta}_1} - 1 = -0.89$. This means that in relation to the socioeconomic features, a country's ability to reduce corruption decreases by almost 90% all else held fixed. In the case of the determinants of socioeconomic ambiguity, the result is $\hat{\beta}_2 = -3.161$, which implies that the relative risk of this particular variable is $e^{\hat{\beta}_2} = 0.042$ and the corresponding percent change is $e^{\hat{\beta}_2} - 1 = -0.958$. This means that in relation to socioeconomic ambiguity, the odds of a country's ability to reduce corruption decreases by almost 96% all else held fixed.

In case we fit the model with no constant term, the coefficient of factor 1 is $\hat{\beta}_1 = -1.558$, which implies that the relative risk of this particular variable is $e^{\hat{\beta}_1} = 0.210$ and the corresponding percent change is $e^{\hat{\beta}_1} - 1 = -0.79$. This means that in relation to factor 1, a country's ability to reduce corruption decreases by almost 79% all else held fixed. In the case of factor 2, $\hat{\beta}_2 = -2.254$, which implies that the relative risk of this variable is $e^{\hat{\beta}_2} = 0.105$, and the corresponding percent change is $e^{\hat{\beta}_2} - 1 = -0.895$. This means that in relation to factor 2, the odds of a country's ability to reduce corruption decreases by almost 90% all else held fixed.

The Wald (chi-square) individual test statistics are presented for each estimated coefficient. The significance levels of the individual statistical tests are presented in parentheses. Note that both factors are statistically significant at the 5% level, while the constant term is statistically significant at the 10% level. Fitting the logistic regression without the constant term, both factors are again statistically significant at the 5% level.

To compare the full model (with the intercept) to the reduced model, we use the likelihood ratio statistic:

$$LR = -2(\log \hat{L}_R - \log \hat{L}_F) = 15,$$

where the subscripts R and F correspond to the reduced and full model. The overall significance of the model is $X^2 = 15.000$ (or 19.840 in the case with no constant), with an attained significance level less than 0.001. We reject $H_0: \beta_0 = \beta_1 = \beta_2 = 0$ and conclude that at least one of the β coefficients is different from zero.

Finally, the Hosmer and Lemeshow value is 2.147 (with p-value 0.976). In the case with no constant, the results are 6.445 (with p-value 0.597). The non-significant test statistics indicate a good model fit based on the correspondence of the actual and predicted values of the response variable.

The results of our logit model support the theory for the variables in factor 1. The negative association between a high PDI or MAS cultural characteristics and a country's ability to reduce corruption are supported by the theory (e.g., Getz and Volkema, 2001; Davis and Ruhe, 2003; Husted, 1999; Triandis et al., 2001). However, we find that higher values of IDV cultural characteristics have also a negative association on a country's ability to reduce corruption, which is supported by Kimbro (2002). Furthermore, a GDP change doesn't ensure an increase in a country's ability to reduce corruption. Finally, the results for the variables in factor 2 fully support the empirical studies by Getz and Volkema (2001) and Davis and Ruhe (2003). It seems that countries with lower levels of cultural values of uncertainty avoidance (UAI), inflation rates (INFLA), and investment risk (COUNTRISK) are associated with higher levels of a country's transparent environment and thus lower levels of corruption in their institutional structures. These results support different studies (e.g., Davis and Ruhe, 2003; Lambsdorff, 1999; Mauro, 1995; Wei, 1997) and substantiate the fact that corruption occurs in countries with an environment of political and economic risks.

5. Conclusion

For the first time, this paper measures a country's ability to reduce corruption using efficiency measurement methods. Using DEA, we measure the efficiency of 29 countries in terms of their reduction of corruption in their institutional structures. Furthermore, using factor analysis, we separate the seven socioeconomic determinants into two main factors according to their communality of influence. Finally, logistic regression is used to clarify the way these two factors characterize a country's ability to reduce corruption.

The results indicate that cultural characteristics of lower power distance, lower masculinity values, lower uncertainty avoidance, and lower values of individualism characterize countries with higher levels of transparency in their institutional environment. Additionally, lower inflation rates and lower political and economical risks contribute to higher levels of a country's transparency. Finally, GDP growth doesn't ensure countries' transparency. These results are fully supported by the empirical evidence of several studies (e.g., Getz and Volkema, 2001; Davis and Ruhe, 2003; Husted, 1999; Triandis et al., 2001; Lambsdorff, 1999; Mauro, 1995; Wei, 1997).

However, several limitations must be highlighted. First, our study is restricted only to a non-random sample of 29 countries due to data availability constraints. Therefore, generalizations of our conclusions must be handled with care. Furthermore, the DEA methodology has a deterministic nature which produces results that are particularly sensitive to measurement error. It only measures efficiency relative to best practice within the particular sample. Thus, it is not meaningful to compare the scores between two different studies because differences in best practice between the samples are unknown. DEA scores are sensitive to input and output specification and the size of the sample (Nunamaker, 1985). Furthermore, the use of the Hofstede's cultural dimensions can be criticized as being out of date. Even though Hofstede's work has been widely criticized, the size of the sample and the stability of the dimensions identified over time have been a source of credibility and reliability (e.g., Kogut and Singh, 1988; Hofstede, 2002).

Finally, a major obstacle may lie in the way of the implementation and the rigid adoption of the results provided in this study. Therefore, people doing business across cultures should probably adjust their natural deceptive tendencies accordingly. Tracing the level of corruption to cultural determinants should not suggest that corruption is by and large inevitable. Culture can explain only a certain fraction of the level of corruption, and there remains sufficient room for improvements in the transparency of a country's institutional structures. However, as Husted (1999) suggests, the effective measures to fight corruption are dependent on culture. Countries with a large power distance or a strong desire for material wealth will require different treatment than others.

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