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The culture of corruption: A nonparametric analysis

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Abstract

By using a sample of 77 countries the analysis applies several nonparametric techniques in order to reveal the link between national culture and corruption. Based on Hofstede´s cultural dimensions and the corruption perception index, the results reveal that countries with higher levels of corruption tend to have higher power distance and collectivism values in their society.

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1. Introduction

The aim of this paper is to analyze and reveal the interrelation and the distinct characteristics between culture and corruption. Cultural values guide and shape the way the function of social institution (Licht et al. 2007). Barr and Serra (2010) suggest that social norms cannot be affected only by values and beliefs but by "the proportion of people who adhere to the norm, which in turn affects individuals' beliefs in the values underlying the norm, and, as a consequence, the likelihood that the norm will be internalized by others including future generations". This social mechanism explains the existence of "culture of corruption" indicating that individuals who grow up in societies in which corruption is prevalent will be more likely to accept corruption and act corruptly, in contrast with those who grow up in a more transparent society (Hauk and Saez-Marti 2002). According to Attila (2009) few studies have examined the relation between countries social factors and corruption levels. This research argues the existence of distinct cultural characteristics which explain countries' corruption levels (among other factors), which can be revealed through nonparametric techniques[1].

2. Methodology and data

Let the sample realizations (Y_i, X_i) are i.i.d. defined on $\Re$. Then the nonparametric regression model has the form of:

$$Y_i = g(X_i) + u_i, \quad i = 1, \ldots, n. \qquad (1).$$

The functional form of $g(\cdot)$ is a smooth function and can be estimated nonparametrically using kernel methods. Following Li and Racine (2007) $g(x) = E(Y|x)$ is a function of x. Then by denoting the joint probability density function (PDF) as $f_{y,x}(x, y)$ the marginal PDF of X as $f(x)$ and the conditional PDF of $Y|X$ as $f_{y,x}(y|x)$ [2] then:

$$f_{y|x}(x, y) = f_{y,x}(x, y) / f(x) \qquad (2).$$

Then Li and Racine (2007, p.59-60) have proved that:

$$E\left(Y|X = x\right) = \int y f_{y|x}(y|x)dy = \frac{\int y f_{y,x}(x, y)dy}{f(x)} \overset{def}{=} g(x) \qquad (3),$$

then the $\int y f_{y,x}(x, y)dy$ can be estimated as by replacing the unknown PDF $f_{y,x}(x, y)$ with its kernel estimated as $\int y \hat{f}_{y,x}(x, y)dy$ where

$$\int y \hat{f}_{y,x}(x, y)dy = \frac{1}{nh_1 \ldots h_q} \sum_{i=1}^{n} K\left(\frac{X_i - x}{h}\right) Y_i \qquad (4).$$

[1] Nonparametric techniques have been used by many studies on different context due to the fact that the fact that they relax the parametric assumptions imposed on the data generating process and let the data determine an appropriate model (Racine 2008, p.2)

[2] Also called a "stochastic kernel" (Stockey et al. 1989).

Finally, the $E(Y|x) \equiv g(x)$ can be estimated by:

$$\hat{g}(x) = \frac{\int y \hat{f}_{y,x}(x,y)dy}{\hat{f}(x)} = \frac{\sum_{i=1}^{n} Y_i K\left(\frac{X_i - x}{h}\right)}{\sum_{i=1}^{n} K\left(\frac{X_i - x}{h}\right)} \quad (5).$$

Where K is a second order Gaussian kernel and h is the appropriate bandwidth which will be analyzed next. Equation (5) is the "local constant" kernel estimator or the "Nadaraya-Watson" kernel estimator introduced by Nadaraya (1965) and Watson (1964).

The most popular data driven methods for bandwidth selection are least-squares cross-validation and the AIC based method[3] of Hurvich et al. (1998), which is based on minimizing a modified Akaike Information Criterion (Racine 2008). In this case the Hurvich et al. approach has been applied[4]. The AIC_c criterion can be defined as[5]:

$$AIC_c = \ln(\hat{\sigma}^2) + \frac{1 + \text{tr}(\text{H})/n}{1 - \{\text{tr}(H) + 2\}/n} \quad (6),$$

where

$$\hat{\sigma}^2 = \frac{1}{n}\sum_{i=1}^{n}\left\{Y_i - \hat{g}(X_i)\right\}^2 = Y'(I-H)'(I-H)Y/n \quad (7)$$

with $\hat{g}(X_i)$ being a nonparametric estimator and H being $n \times n$ weighting function with its (i,j)th element given by

$$H_{ij} = K_{h,ij} / \sum_{l=1}^{n} K_{h,il}, K_{h,ij} = \prod_{s=1}^{q} h_s^{-1} k\left(\left(X_{is} - X_{js}\right)/h_s\right) \quad (8).$$

According to Li and Racine (2007) there is a within sample measure goodness of fit analogue to the one of R^2 parametric regression models. Let Y_i denote the outcome and $\hat{Y}_i$ the fitted values for observation i, then the R^2 for the nonparametric regression can be defined as:

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[3] Also plug-in methods such as that by Sheather and Jones (1991) are very popular but according to Loader (1999) they have found to be tuned by arbitrary specification of pilot estimators and are prone to over-smoothing when presented with difficult smoothing problems.

[4] According to Hal et al. (2004) least-squares cross-validation (and the AIC_c) automatically determines which components of X are relevant to the problem of conditional inference and which are not, through assigning large smoothing parameters to the latter and consequently shrinking them toward the uniform distribution on the respective marginals. This effectively removes irrelevant components from contention, by suppressing their contribution to estimator variance (Racine 2008, p.25).

[5] Li and Racine (2004) have proved that AIC_c tends to perform better than the least square cross-validation method for small samples (as in this case), while for large samples there is no significant difference between the two.

$$R^2 = \frac{\left[\sum_{i=1}^{n}\left(Y_i - \bar{y}\right)\left(\hat{Y}_i - \bar{y}\right)\right]^2}{\sum_{i=1}^{n}\left(Y_i - \bar{y}\right)^2 \sum_{i=1}^{n}\left(\hat{Y}_i - \bar{y}\right)^2} \qquad (9).$$

Then a consistent significance test for continuous regressors defined by Racine (1997) is applied in order to verify the significance of the explanatory variables on the depended. Let z denote the explanatory variable(s) that might be redundant, let X denote the remaining explanatory variable(s) in the regression model, and let Y denote the dependent variable.

Then the null hypothesis can be written as (Racine 2008, p. 67):

$H_0 : E\left(y|x,z\right) = E\left(Y|z\right)$ almost everywhere, which is equivalent to

$H_0 : \frac{\partial E\left(y|x,z\right)}{\partial x} = \beta(x) = 0$ almost everywhere. Then the test statistic is an estimator of:

$I = E\left\{\beta(x)^2\right\}$[6].

The paper uses a sample of 77 countries[7] with the variable of interest being the average value (of 1996-2006) of corruption perception index (CPI)[8] provided by Transparency International. The explanatory variables used in order to measure countries' national culture are derived from the four cultural dimensions as introduced by Hofstede (1980)[9]: power distance (PDI); individualism versus

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[6] A test statistic can be obtained by forming a sample average of I, replacing the unknown derivatives with their nonparametric estimates $\hat{\beta}(X_i)$ as described in Racine (1997): where $\hat{\beta}(X_i)$ is the local constant partial derivative estimator described previously. Then $I_n \to 0$ in probability under H_0 and $I_n \to 0 > 0$ in probability under H_1. Then the null distribution of this statistic is obtained by applying bootstrap procedures.

[7] Argentina, Australia, Austria, Bangladesh, Belgium, Brazil, Bulgaria, Canada, Chile, China, Colombia, Costa Rica, Czech Rep, Denmark, Ecuador, Egypt, El Salvador, Estonia, Ethiopia, Finland, France, Germany, Ghana, Greece, Guatemala, Hong Kong SAR, Hungary, India, Indonesia, Iran, Islamic Rep, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Kenya, Kuwait, Lebanon, Libyan Arab Jamahiriya, Luxembourg, Malaysia, Malta, Mexico, Morocco, Netherlands, New Zealand, Niger, Norway, Pakistan, Panama, Peru, Philippines, Poland, Portugal, Romania, Russian, Saudi Arabia, Sierra Leone, Singapore, Slovakia, South Africa, Spain, Suriname, Sweden, Switzerland, Taiwan, Tanzania, Thailand, Turkey, United Arab Emirates, United Kingdom, United States of America, Uruguay, Venezuela, Viet Nam and Zimbabwe.

[8] Many studies (Gokcekus and Knörich 2006; Gokcekus 2008; Gundlach and Paldam 2009; Saha et al. 2009; Naved and Ali 2010) have used CPI as a proxy of corruption with a scale from 0 (perceived to be highly corrupt) to 10 (perceived to have low levels of corruption). For details see: http://www.transparency.org/policy_research/surveys_indices/gcb

[9] For an extensive analysis of Hofstede's cultural indexes see Halkos and Tzeremes (2011). For details see: http://www.geert-hofstede.com/.

collectivism (IDV); masculinity versus femininity (MAS); and uncertainty avoidance (UAI)[10].

3. Empirical analysis

Table 1 presents the results from the local constant relation with average CPI value as dependent variable and the four cultural values as independent (the full model). The results indicate a goodness of fit of 80.6% (R^2=0.8059) and the nonparametric significant test (Racine 1997) reveals that the four explanatory variables are statistically significant at 10% level (p-value= 0.097744). However, the individual influence of every explanatory variable needs to be assed; therefore four additional nonparametric regressions have been applied.

Table 1: The results of the nonparametric regressions

Variable Name	Selected Bandwidth	R-squared	Significant test
PDI	8.0323	0.6013	0.075188***
IDV	9.7042	0.5555	0.015038**
MAS	9.5203	0.2356	0.035088**
UAI	21.1777	0.0683	0.072682***
Full model		0.8059	0.097744***

**Significant at 1% level.*

***Significant at 5% level.*

****Significant at 10% level.*

Sub-figures 1a, 1c, 1e and 1g illustrate graphically the conditional densities (stochastic kernels) from the four cultural values. In addition the sub-figures 1b, 1d, 1f and 1h represent the local linear nonparametric regression plots with their bootstrapped pointwise error bounds[11]. For the case of PDI (sub figures 1a and 1b) the stochastic kernel reveals that the probability mass lies on high PDI values and lower CPI values. In addition we observe that the probability mass lies also at lower PDI and higher CPI values. Moreover the nonparametric regression line indicates a negative relation between the PDI and CPI with a goodness of fit of 60% with the

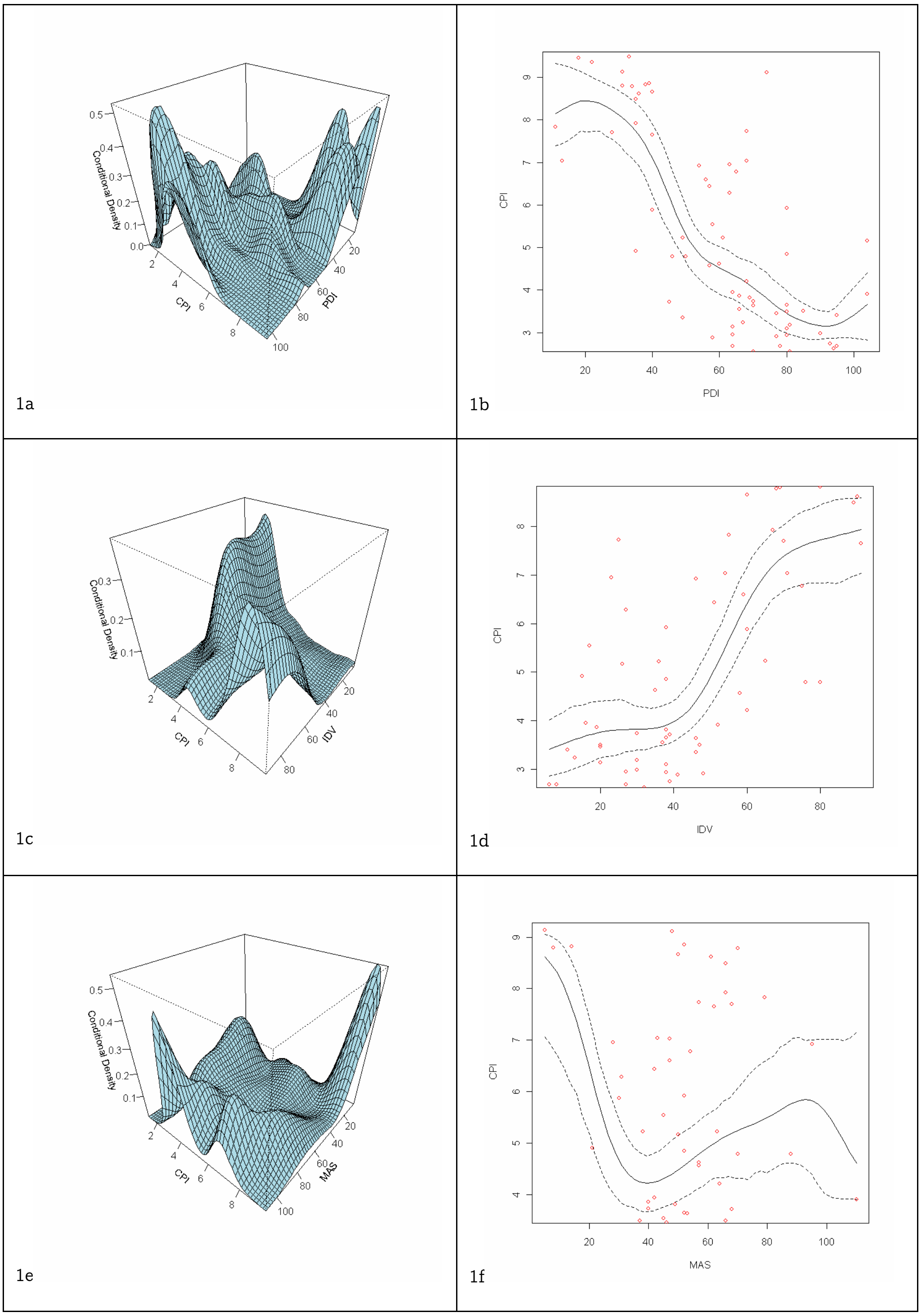
[10] Power distance: ''the extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally'' (p. 28). Individualism versus collectivism: ranges from ''societies in which the ties between individuals are loose'' to ''societies in which people from birth onwards are integrated into strong, cohesive in-groups'' (p. 51). Masculinity versus femininity: ranges from ''societies in which social gender roles are clearly distinct'' to ''societies in which social gender roles overlap'' (p. 82). Uncertainty avoidance: ''the extent to which the members of a culture feel threatened by uncertain or unknown situations'' (p. 113).

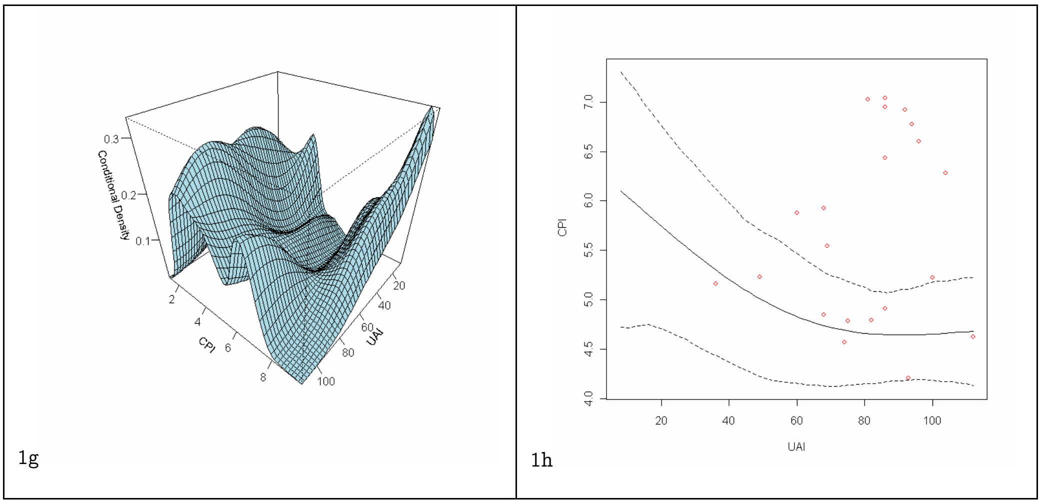
[11] According to Racine (2008, p.44) the asymptotic formula performs better only on small h values therefore bootstrapped variability bounds are often preferable to those obtained via the asymptotic approximations.

PDI being statistical significant at 10% level (Table 1). The main characteristic of societies with higher power distance is the tolerance of rigid social hierarchies with clear and distinct separations between socioeconomic classes. In addition high power distance societies are bureaucratic based societies with distinctive hierarchical roles of individuals. Getz and Volkema (2001) suggest that high power distance cultures tend to be more corrupted based on two factors. First, underclass members of such a society try to improve their position through the extortion for bribes and therefore corruption is perceived as a ‘vehicle’ for higher position within the society raising in such a way their living standards (Abueva 1970). Secondly, all the benefits that can be gained from corruption are regarded from higher officials as ‘natural-logical’ privileges gained from their official positions. Furthermore, due to the likelihood that officials demand or accept bribes leads to the phenomenon where businesses will offer or pay bribes. For the case of IDV (1c and 1d) the nonparametric regression reveals a positive relationship with a goodness of fit of 55% and the IDV variable being statistical significant at 5% level. The stochastic kernel reveals that probability mass lies at higher IDV and CPI values, but also at lower IDV and CPI values. Individualistic societies are based on the fact that individual is more valuable than the group. In contrast collectivism society values the social group over the individual. It is believed that collectivism is linked with lower ethical standards (Husted 1999), whereas individualism with higher (Amstrong 1996). According to Getz and Volkema (2001) collectivism cultures may contain networks of friends and family creating relationships which can facilitate abnormal or illegal transactions. Therefore it is expected that higher corruption levels are integrated to higher collectivism societies. Furthermore, the case of MAS (1e and 1f) the results indicate a “U” shape relationship with a goodness of fit of 23% and the MAS variable being statistical significant at 10% level. The stochastic kernel reveals that probability mass lies at higher MAS and lower CPI values, but also at lower MAS and high CPI values. According to Getz and Volkema (2001) in masculine cultures people may be comfortable pursuing their goals through bribes provided they view the probability of success as high. Furthermore, the nonparametric analysis between UAI and CPI (1g and 1h) reveals a negative relationship with relationship with a goodness of fit of 6% and the UAI variable being statistical significant at 10% level. The stochastic kernel reveals that the probability mass lies at lower UAI and higher CPI values, but also at higher UAI and lower CPI values. In societies with high uncertainty avoidance individuals perceive that is necessary to work through informal channels in order to achieve their personal objectives and thus to minimize uncertainty. Similarly the officials accept and demand those bribes and illegal channels. Since the corruption patterns are established breaking out of them would create further uncertainty (Getz and Volkema 2001).

Finally, looking the R^2 values of the four variables (Table 1) it appears that only PDI and IDV values in a society have a dominant role determining countries’ corruption levels.

Figure 1: Nonparametric conditional PDF figures and local constant estimators using the AIC$_c$ bandwidth selection and a second order Gaussian kernel throughout.





1g 1h

4. Conclusions

The nonparametric analysis reveals the fact that culture and corruption are interrelated. The highly corrupted countries have strong and distinct cultural characteristics. These are high power distance and lower individualistic values. According to Hofstede (1980, 2002) values are acquired in childhood and therefore, national cultures are remarkably stable over time. In addition cultural characteristics of countries would probably change at extremely slower rate compared to countries' corruption perception index. Therefore since governments cannot easily change cultural characteristics (and their influence on how societies perceive corruption), the only way which corruption can be controlled is through good governance. According to Kaufmann (2005, 2008) good governance is a direction of traditions and institutions towards common good. It implies the process of the effective management of resources by governments and the implementation of policies through the adjustment and the introduction of institutions which permit and promote private and public sector development.

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