

# The O-Ring Theory, Geographical Distribution Of Misery And Corruption

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## Abstract

*The approach in this paper is to explore the relationship between corruption perception index (CPI) and human development index (HDI) in order to determine whether or not poor countries resort to corrupt practices as a way of getting over their level of hopelessness. The results show that corruption poses a problem to all countries and consequently to world economic development.*

## 1. Introduction

One of the basic issues in any discussion of economic development relates to the elimination of poverty. Sen (1985), argues that poverty does not focus on being relatively poorer than others but on the failure to acquire some minimum capabilities that define basic opportunities of material well-being. Poverty is not the same as unequal distribution of income. On the contrary, poverty is the absolute standard of living of a part of society. Sharp *et al* (1996), argue that poverty is caused by the quality of a nation's labor force, stock of capital resources, state of technology and the efficiency with which a nation employs its resources.

Dudley notes that corruption is widespread in developing countries of the world. In a study by Paolo (1996), corruption is found to be negatively, related to the level of investment and economic growth. If one considers the issue of corruption, a logical conclusion from the aforementioned argument is that the bulk of the developing economies of the world could be in danger of being trapped in a vicious circle of poverty. Nurkse (1953), defines a vicious circle of poverty as a "circular constellation of forces tending to act and react upon one another in such a way as to keep a poor country in a state of poverty."

Kremer's (1993), O-ring theory predicts a large income inequality among countries of the world. Moreover, it predicts a preponderance of small firms in the poor countries of the world. An extrapolation of the O-ring theory predicts that the poor countries of the world are plagued with economic ills such as corruption. If this is the case, one expects a strong association between economic under-development and the existence of corruption. Therefore, the objective of this paper is to explore the existence or otherwise of the anecdotal evidence on the relationship between corruption and economic development.

## 2. Poverty And Human Development Index

Theoretically, the subject matter of poverty is based on the 'basic needs' approach. Fishlow (1995) notes that this approach emphasizes "the importance of separating generalized increases in income from the more significant attainment of the requirements for a permanent reduction of poverty – improvements in health, regular access to nutritional food, more education, and better and affordable shelter." The arguments used to support this thesis include the fact that many people that are classified poor are not direct producers but part of the dependent population. It is not automatic that an increase in income of individuals is spent on essential services such as better medical care, housing and safe drinking water. Finally, individuals vary in their ability to spend disposable income effectively and wisely.

Based on the foregoing, it is not unlikely for income to increase without any appreciable increase in the standard of living. More importantly, Fishlow (1995) notes that the negative correlation between income and poverty does not negate the relevance of public poverty strategies. However, any public policy directed at eliminating poverty should recognize the regional differences in poverty levels (Gyourko, 1991 and Gyourko and Tracy, 1991). Triest (1997) identifies the factors responsible for the regional differences in poverty rates in the U.S. These include, distribution of potential family earnings, number of weeks the family head was unemployed or whether or not the head of the family is a single woman. Burtless (1996) blames world trade for the inequality in earnings. According to him, even if trade is absolved of blame for trends in unearned income or changes in the composition of households, it is still a source of growing wage inequality.

Powers and Dupuy (1994) note that poverty is an eclectic concept that captures market conditions, demographic characteristics and fiscal policy. The authors posit further that it is difficult to accurately measure poverty because of complications created by interregional differences in cost of living and the quality of life. This point of view is consistent with Chenery et al (1974), Lipton (1995), Nussbaum and Sen (1993), Van der Gaag (1999) and Wingo and Evans (1977).

The United Nations Development Programme (UNDP) devised a measure of economic development called, Human Development Index (HDI) which measures the “people’s ability to live a long and healthy life, to communicate and to participate in the life of the community, and to have sufficient resources to obtain a decent living.” The components of the HDI are the life expectancy at birth, the adult literacy rate, the combined primary, secondary, and tertiary school enrollment ratios; and the per capita gross domestic product. The index varies from 0 (poor) to 1.0 (rich) in terms of relative achievement in health, education and income.

### 3. Kremer’s O-Ring Theory

The ill-fated Challenger shuttle exploded in 1986 as a result of a malfunction of one its many o-rings. According to Kremer (1993), an entire product or task will not function properly if one of its many components malfunctions. He uses the following mathematical representation to prove his point.

$$E(y) = k^a (q_1, q_2, \dots, q_n) nB \quad (1)$$

where,

E[y] = Expected output

k = Capital

n = Total number of tasks

$q_i$  = Probability that worker i performs perfectly

a = A constant

B = Benefits per worker per unit of capital given that all tasks are performed well.

As a result of production *complementarity* between workers’ skills, Kremer argues that incremental output of a worker increases as he works with a higher quality worker. That is:

$$\frac{d^2 E[y]}{dq_i dq_j} > 0 \quad (2)$$

The initial approach of Kremer was to apply the O-ring theory to the theory of economic development. He however, extended the theory to the labor market in a way that shows how a low-skill worker can jeopardize the efforts of several highly skilled workers. In the area of development theory, the O-ring theory predicts a large income inequality among countries of the world. More importantly, there is a preponderance of small firms in the poor countries of the world. An extrapolation of the O-ring theory predicts that the poor countries of the world are plagued with economic ills such as corruption.

#### **4. Corruption And Corruption Perception Index (CPI)**

The literature on corruption is very rich with several research studies, such as Andvig and Moene (1990), Bac (1996), Khan (1996), Dudley (2000), Frank (1998) and Li *et al* (2000). Li *et al* (2000), sum up the literature definition of corruption as an illegal payment, which may or may not be deserved in exchange for private gains. Paolo (1996) notes that corruption has been in existence for a long time and that economists study it from the point of view of rent seeking. According to the author, corruption in the public sector, are “illegal activities that reduce the economic efficiency of governments.” The different classes of corruption include high-level versus low-level corruption and well organized versus poorly organized corruption. Moreover, he notes that the level of economic performance by itself is no argument for pervasive corruption.

Frank (1998), approaches the issue of corruption from the point of view of a principal-agent problem in which the agent motivates himself to favor a third party at the expense of the principal in exchange for an illegal compensation. While probing the repercussion of corruption, Dudley (2000), notes that the malaise is widespread in developing countries where development funds are in short supply. More importantly, internationally funded projects are easy prey for corruption because of the perception that these projects lack effective monitoring mechanism.

Paolo argues that public corruption arises from government intervention in the economy through regulation, which has been known to promote rent-seeking behavior. Pervasive government regulation, with a lot of discretion at the disposal of government officials, individuals are often subjected to giving bribes in order to circumvent the rules. The consequence of corruption is to slow down economic growth and development. It lowers capital investment flows into an infected economy. Paolo notes that where it is lucrative to indulge in rent-seeking behavior than productive work, human capital is often misallocated. A misallocation of government expenditure can arise when government officials choose expenditure items on the basis of promoting their rent-seeking behavior rather than overall public welfare benefits.

Transparency International (TI), an international crime fighting organization defines corruption in the public sector as “abuse of public office for private gain.” TI compiles an annual ranking of a selected countries based on its corruption perception index (CPI). The CPI measures the degree to which corruption is perceived to exist in the public sector of a selected country. The index is a composite that draws on several polls and surveys carried out by several independent institutions. The CPI is used in this paper as proxy for corruption. This index varies from 0 (for most corrupt) to 10 (least corrupt).

#### **5. Methodology**

As stated earlier, the objective of this paper is to determine the level of consistency between the human development index and corruption perception index rankings across countries of the world. Moreover, it is important to know if geographical disparities in poverty rates are associated with investors’ perception of how corrupt countries of the world are. The data employed in this paper are the corruption perception index (CPI) which is computed and distributed by Transparency International and the human development index (HDI) which is computed and circulated by the United Nations Development Programme (UNDP) for 45 randomly selected countries for 1998 and 1999. Two non-parametric tests are applied to the aforementioned data.

The Spearman’s (1904) Rho and Hotelling-Pabst (1936) test are employed to analyze the data. These tests are the nonparametric equivalent of a test of correlation for matched pairs of data. Consider the following bivariate random sample of size  $n$ ,  $(X_1, Y_1), (X_2, Y_2), \dots, (X_n, Y_n)$ . Let  $R(X_i)$  be the rank of  $X_i$  compared with the other values of  $X$ , for  $i = 1, 2, \dots, n$ . For example,  $R(X_i) = 1$  if  $X_i$  is the smallest number in the series. By the same token, let  $R(Y_i)$  be the rank of  $Y_i$  for  $i=1, 2, 3, \dots, n$ . The Spearman’s Rho is defined as,

$$\rho = \frac{\sum_{i=1}^n [R(X_i) - \frac{n+1}{2}][R(Y_i) - \frac{n+1}{2}]}{n(n^2 - 1) / 12} \tag{3}$$

where,

- $\rho$  = Spearman’s correlation coefficient
- $R(X_i)$  = The rank of variable  $X_i$
- $R(Y_i)$  = The rank of variable  $Y_i$
- $n$  = Sample size

An equivalent but computationally convenient form is given by:

$$\rho = 1 - \left\{ \frac{\sum_{i=1}^n [R(X_i) - R(Y_i)]^2}{n(n^2 - 1)} \right\} \tag{4}$$

As Conover (1980) notes, the Spearman’s rho ( $\rho$ ) is insensitive to some types of dependence in the data; thus, a researcher is allowed to be specific as to the nature of the dependence that may be detected. Under this test, the null hypothesis is that variables  $X_i$  and  $Y_i$  are mutually independent. The alternative hypothesis is that there is a tendency for the smaller values of X to be paired with the larger values of Y, and vice versa. The null hypothesis is rejected if  $\rho$  is less than its selected critical level. The Hotelling-Pabst test is similar to the Spearman’s Rho test. The Hotelling-Pabst T is defined as,

$$T = \sum_{i=1}^n [R(X_i) - R(Y_i)]^2 \tag{5}$$

The null hypothesis stated above will be rejected if T exceeds its  $1-\alpha$  quantile. It should be noted that T is large when  $\rho$  is small, and vice versa.

**6. Results**

The aforementioned tests were applied to the HDI and CPI rankings for 45 countries in 1997 and 1998. The null hypothesis tested is that the human development index rankings and the corruption perception index rankings are mutually independent. Consequently, the alternative hypothesis is that there is a tendency for the smaller values of HDI to be paired with the larger values of CPI and vice, versa. The results based on the application of Spearman’s rho and Hotelling-Pabst tests are reported in Table 1. These results indicate that one cannot reject the null hypothesis of independence.

**Table 1: Statistical Results**

<b>Statistic</b>	<b>1997</b>	<b>1998</b>
Spearman $\rho$	0.832	0.715
Hotelling-Pabst T	2547	4322

Critical level for Spearman  $\rho$  at the 5 percent level = 0.248

Critical level for Hotelling-Pabst T at the 5 percent level = 19,665.40

## 7. Conclusion

This paper explores the relationship between corruption perception index(CPI) and human development index (HDI) in order to determine whether or not poor countries resort to corrupt practices as a way of getting over their level of hopelessness. In other words, are poor countries desperate that they just resort to rent-seeking behavior in order to survive? The results of the Spearman and Hotelling-Pabst tests show no association between CPI and HDI. These results indicate that corruption is not an exclusive disease of poor countries of the world. The results reported here are consistent with those of Paolo (1996), who concludes that, "Substandard economic performance by itself does not argue to pervasive corruption, nor is economic success an infallible sign of innocence of corruption." In conclusion, we observe that corruption poses a problem to all countries and consequently to world economic development. 📖

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**Notes**