CORRUPTION AROUND THE WORLD: EVIDENCE FROM A STRUCTURAL MODEL*

by

Axel Dreher, Christos Kotsogiannis and Steve McCorriston†

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Abstract: The causes and consequences of corruption have attracted much attention in recent years by both academics and policy makers. Central in the discussion on the impact of corruption are perception-based indices. While informative, these indices are ordinal in nature and hence provide no indication of how much economic loss is attributed to corruption. Arguably, this shortcoming is rooted in the lack of a structural model. This is the issue addressed in this paper. By treating corruption as a latent variable that is directly related to its underlying causes, a cardinal index of corruption is derived for approximately 100 countries. This allows us to compute a measure of the losses due to corruption as a percentage of GDP per capita.

Department of Economics, School of Business and Economics, University of Exeter, Streatham Court, Rennes Drive, Exeter EX4 4PU, England, UK.

†Correspondence to: Steve McCorriston. Tel: ++44 (0)1392 263848; Fax: ++44 (0)1392 263242. Email: S.McCorriston@exeter.ac.uk

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1 Introduction

Corruption around the world is believed to be endemic and pervasive and a significant contributor to low economic growth, to stifle investment, to inhibit the provision of public services and to increase inequality to such an extent that international organizations like the World Bank have identified corruption as 'the single greatest obstacle to economic and social development' (World Bank, 2001).[1,2] More recently, the World Bank has estimated that more than US$ 1 trillion is paid in bribes each year and that countries that tackle corruption, improve governance and the rule of law could increase per capita incomes by a staggering 400 percent (World Bank, 2004). Commensurate with the place of corruption on the policy agenda, the economics literature has paid increased attention to the issue of corruption.[3] Though the recent literature is mainly theoretical in focus, there have also been attempts – albeit relatively few in number – to address the causes and consequences of corruption from an empirical standpoint. Notable efforts in this area include, among others, Mauro (1995) on the impact of corruption on economic growth and investment, Treisman (2000) on the causes of corruption and Fisman and Gatti (2002) on the links between political structure and corruption.

Corruption is a variable that cannot be measured directly. However, in recent years, several organizations have developed a corruption perceptions index across a wide range of countries to qualitatively assess the pervasiveness of corruption. These indices have been used in econometric studies (including the ones mentioned above) either as a dependent variable when exploring the causes of corruption or as an explanatory variable when investigating its consequences. Undoubtedly, these perception-based indices have made an important contribution to the understanding of the pervasiveness of corruption across countries. They are, however, not free of problems. One such problem arises from the ordinality of the indices and therefore with the difficulty of assigning a meaningful economic interpretation to them. Clearly, this shortcoming is rooted in the lack of a structural model encompassing the underlying causes of corruption.[4] It is this issue that this paper deals with.

[1]This argument, though, is not supported unanimously. Routine corruption may have the desirable property of creating incentives for public employees. For an early statement of this argument see Leff (1964), Morgan (1964), and Lui (1985). For a criticism of this view see Tanzi (1998), Kaufmann and Wei (1999), and Rose-Ackerman (1999).

[2]The definition of corruption varies widely. The most widespread one seems to be the misuse of public office for private gain, Rose-Ackerman (1999).

[3]Bardhan (1997), Jain (2001), and Aidt (2003) provide comprehensive accounts of the latest developments on corruption. See also Rose-Ackerman (1978, 1999), and Lambsdorff (1999).

[4]Other problems exist. See, for instance, Andvig *et. al.* (2000), and Kaufmann *et. al.* (2003).

In particular, we estimate corruption employing a special case of a structural equation model, the Multiple Indicators Multiple Causes (MIMIC) model, introduced to economics by Weck (1983), and Frey and Weck-Hanneman (1984) and latterly explored by Loayza (1996) and Giles (1999), among others, to measure the size of the hidden economy,[5] Raiser *et. al.* (2000) to investigate the institutional change in Eastern Europe, and Kuklys (2004) to measure welfare.

Based on a sample of around 100 countries, we derive an index of corruption based on estimated parameters that relate directly to its causes and indicators. There are two key advantages to this approach of measuring corruption. First, the ranking of countries in our index is based on a structural relationship between causes and indicators of corruption and it is – reflecting the structural variables – cardinal. The cardinal nature of the index, in turn, allows the pervasiveness of corruption across the countries in the sample to be expressed as a percentage of GDP per capita.[6] This provides a more direct measure of how significant corruption is as a policy issue. Second, since we have, albeit limited, data on the causes and indicators of corruption dating back to the 1970s, we can re-estimate the model for different time periods allowing us to address the question of whether corruption has increased or decreased since the late 1970s.

The key results are as follows. Firstly, the estimated model produces cardinal cross-countries indexes (and so a ranking) of corruption based on the structural relationship between the variables that cause and indicate corruption from the mid-1970s to the late 1990's. The resulting ranking of countries is not surprising with the developed countries reported as having lower corruption than the developing ones. The estimates show that in 1997 Switzerland was the least corrupt country followed by Japan, Norway, Denmark, Germany and the Netherlands. The US is in 9^{th} position followed by France and Belgium. The most corrupt countries are (in reverse order) Zambia, Ghana, the Central Africa Republic, Syria, Nigeria and Guinea-Bissau, the most corrupt country. Secondly, and perhaps more importantly, we confirm that corruption is indeed a significant problem with the losses due to corruption as a percentage of per capita GDP being high particularly in developing countries. On average, relatively low losses arise from corruption in developed countries but with higher losses in Latin America and Asia and, in particular, sub-Saharan Africa. For example, in the 1991-1997 period, the losses due to corruption are estimated to be 11.2 percent of GDP per capita for Norway while the losses for Nigeria and Guinea-Bissau are 66.05 and 66.79 percent of GDP per capita,

[5]Schneider and Enste (2000, 2002) offer a comprehensive account of studies on the hidden economy that have employed this approach.

[6]This is being done by appropriately benchmarking the index on proxies for corruption. We return to this is detail in Section 5.

respectively. The losses due to corruption in Western Europe average 22.26 percent of per capita GDP. In East Asia and Pacific, Middle East and North Africa, Latin America and Caribbean, South Asia and sub-Saharan-Africa they average 39.7, 54.26, 57.74, 62.77 and 63.23 percent, respectively. The other periods exhibit the same trend.

The paper is organized as follows. In Section 2, the MIMIC methodology to measure corruption as a latent variable is presented. In Section 3, data on the causes and indicators of corruption are discussed. In Section 4, the results from the estimated MIMIC model and the index of corruption across countries are presented and in Section 5 the associated economic losses of corruption are reported. Finally, in Section 6, we conclude with some observations on the relevance of the results for further empirical research on corruption.

2 A structural equation model for corruption

We focus on the MIMIC model that is characterized by a latent endogenous variable with no measurement error in the independent variables. The unknown coefficients of the model are estimated separately through a set of structural equations with the indicator variables being used to capture the effect of the unobserved variables indirectly. Using causal and indicator variables of corruption across countries, the structural model can be estimated and, in turn, a cardinal index of corruption across countries retrieved. Moreover, by appropriately benchmarking this index, a measure of the effect of corruption as a percentage of GDP per capita across our sample countries and across time periods can be derived.

More formally, but briefly,[7] the specification of the MIMIC model is as follows. Let y_i, $i = 1, \ldots, n$, be one of the indicators of the latent random variable corruption, denoted by η, such that

$$y_1 = \gamma_1 \eta + u_1, \ldots, y_n = \gamma_n \eta + u_n \ , \tag{1}$$

where γ_i is the factor loading[8] and u_i, $i = 1, \ldots, n$, are the error terms with mean zero and covariance matrix $\mathbf{\Theta}_u$. The disturbances are mutually independent such that any correlation across the indicators are driven by the common factor η. Equation (1) is, then, a confirmatory factor analysis model for the observable indicators $\mathbf{y} = (y_1, \ldots, y_n)'$ with common factor η and unique factor u_i, $i = 1, \ldots, n$. The latent variable η is

[7] See Jöreskog and Goldberg (1975) for the original contribution to estimating the MIMIC model with a single latent variable and Bollen (1989) for a more accessible, but thorough, treatment.

[8] A factor loading represents the expected change in the respective indicators following a one unit change in the latent variable.

linearly determined by a set of exogenous variables (causes) given by $\mathbf{x} = (x_1, \ldots, x_k)'$ and a stochastic disturbance ϵ, that is

$$\eta = \boldsymbol{\beta}'\mathbf{x} + \epsilon \ , \tag{2}$$

where $\boldsymbol{\beta} = (\beta_1, \ldots, \beta_k)'$. The model, therefore, comprises of two parts: the measurement model in equation (1) which specifies how the observed endogenous variables are determined by the latent variable and the structural equation model, equation (2), which specifies the relationship between the latent variable and its causes.

Since the latent variable η is unobserved it is impossible to recover direct estimates of the structural parameters $\boldsymbol{\beta}$. Substituting (2) into (1), the MIMIC model can be interpreted as a multivariate regression model that takes the reduced form, connecting the observable variables, given by

$$\mathbf{y} = \mathbf{\Pi}'\mathbf{x} + \mathbf{z} \ , \tag{3}$$

where the reduced-form coefficient matrix is $\mathbf{\Pi} = \boldsymbol{\gamma}\boldsymbol{\beta}'$, where $\boldsymbol{\gamma} = (\gamma_1, \ldots, \gamma_n)'$, and the reduced-form disturbance vector is $\mathbf{z} = \boldsymbol{\gamma}\epsilon + \boldsymbol{u}$, with covariance matrix

$$\mathbf{\Theta}_\epsilon = E[(\boldsymbol{\gamma}\epsilon + \boldsymbol{u})(\boldsymbol{\gamma}\epsilon + \boldsymbol{u})'] = \boldsymbol{\gamma}\boldsymbol{\gamma}'\sigma_\epsilon^2 + \mathbf{\Theta}_u \ , \tag{4}$$

where σ_ϵ^2 is the variance of the disturbance ϵ. Clearly, the rank of the reduced form regression matrix $\mathbf{\Pi}$, in (3), is equal to 1. The error covariance matrix $\mathbf{\Theta}_\epsilon$, being the sum of a rank-one matrix and a diagonal matrix, is also similarly constrained. This property calls for a normalization of one of the elements of the vector $\boldsymbol{\gamma}$ to a pre-specified value prior to the estimation of the reduced form of the model. The fundamental hypothesis for a structural equation model is that the covariance matrix of the observed variables, $\mathbf{S}$, may be parameterized based upon a given model specification with parameter vector $\boldsymbol{\delta}$. The model parameters, under normality, are estimated based upon minimizing the function

$$F = \ln|\mathbf{\Sigma}(\boldsymbol{\delta})| + \mathrm{tr}\{\boldsymbol{S}\mathbf{\Sigma}^{-1}(\boldsymbol{\delta})\} - \ln|\mathbf{S}| - \rho \ , \tag{5}$$

where $\boldsymbol{S}$ is the sample covariance matrix of the observed variables, $\mathbf{\Sigma}^{-1}$ is the estimated population covariance matrix and $\rho = k + n$ is the number of measured variables.

Once the hypothesized relationship between the variables has been identified and estimated, the latent variable scores η_j for each country $j = 1, \ldots J$ can be obtained following the procedure suggested by Jöreskog (2000).[9] Clearly, then, the challenge in implementing this framework is to identify the relationship amongst the variables. This, together with data issues, is discussed in the following section.

[9]While this provides a ranking of corruption across countries, to provide an estimate of the economic losses associated with corruption across all countries in our sample, we must benchmark the value of this index on an external source, (Frey and Weck-Hannemann (1984), and Loayza (1996)). We return to this in Section 5.

3 Causes and indicators of corruption

3.1 Causes of corruption

To identify the hypothesized variables that relate to the causes and indicators of corruption we draw on the theoretical and empirical literature on this topic. We start with a discussion of the causal variables and then turn to the variables that have been used as indicators. To ease the exposition the causal variables have been categorized into four main factor-groups namely: political and judicial factors; historical factors; social and cultural factors, and economic factors.[10]

3.1.1 Political factors

The political factors capture the democratic environment of a given country, the effectiveness of its judicial system and the origin of its legal system. The role of democracy has been highlighted in several studies of corruption (see, among others, Treisman (2000), and Paldam (2003)). It is widely believed that corruption is related to the deficiencies of the political system and that democracy, by promoting political competition and hence increasing transparency and accountability, can provide a check, albeit an imperfect one, on corruption. Other characteristics of the political environment, including electoral rules (Persson *et. al.* (2003)) and the degree of decentralization (Treisman (2000), and Fisman and Gatti (2002)) may also be important in explaining corruption.[11]

The judicial system is also expected to play a role in controlling corruption (Becker (1968)). The role of the legal system and the rule of law have featured prominently in many recent studies on the quality of governance and its consequences for development (see, for example, North (1990), and Easterly and Levine (1997)). Strong legal foundations and efficient legal systems with well-specified deterrents protect property rights and so provide a stable framework for economic activity. Failure of the legal system to provide for the enforcement of contracts undermines the operation of the free market and, in turn, reduces the incentives for agents to participate in productive activities. But legal systems may differ in the degree to which property rights are protected and in the quality of government they provide. Empirical work suggests that the common law system, mostly found in the former colonies of Britain, appear to have better protection of property rights compared with the civil law system typically associated with the former colonies of continental Europe (see, for example, La Porta *et. al.* (1999)). Political

[10]The specific data employed in our modelling effort is discussed in Section 4. Description of all the variables that have been tried, and their sources, can be found in the appendix.

[11]To be more precise, since the measure of corruption is based on the perception-based indices discussed above, these studies investigate whether the structure of the political system leads to higher levels of perceived corruption.

instability may also matter for corruption, the expectation being that more unstable countries will have higher levels of perceived corruption.[12]

3.1.2 Historical factors

To a large extent, it is difficult to separate the historical factors from the political and judicial factors since the effectiveness of the judicial system is dependent on the colonial heritage of the country in question. La Porta *et. al.* (1999) show that those countries that were former colonies of Britain and who adopted the common law system appear to have more effective judicial systems than those who adopted civil law systems associated with former colonies of continental European countries. Treisman (2000) also explores the direct influence of historical tradition on perceived corruption showing that former British colonies or dominions appear to reduce perceived corruption in excess of the role played by the common law system.

3.1.3 Social and cultural factors

This group of factors captures the social and cultural characteristics of a country that may impact upon the pervasiveness of corruption in a given country. For example, religion shapes social attitudes towards social hierarchy and family values and thus may determine the acceptability, or otherwise, of corrupt practices. In more hierarchical systems (for example, Catholicism, Eastern Orthodoxy and Islam), challenges to the status quo are less frequent than in more equalitarian or individualistic religions. The role of the religious tradition and corruption has been explored explicitly by Treisman (2000) who found that a Protestant tradition appears to have a negative (though small) effect on perceived corruption. Religion may also impact on the quality of the legal system, as explored by La Porta *et. al.* (1999). They found that countries with a high proportion of Catholics or Muslims reduces the quality of government and, by extension, may reduce the deterrence of corruption. Religious fractionalization may also have an impact on corruption and other characteristics associated with the quality of government (Alesina *et. al.* (2003)).

Ethnic and linguistic fractionalization of a society may also contribute to the pervasiveness of corruption in a given country. The evidence is, however, mixed. Treisman (2000) found no evidence that linguistic fractionalization had a direct impact on perceived corruption, while La Porta *et. al.* (1999) found evidence that, in societies that were more ethno-linguistically diverse, governments exhibited inferior performance. More recently, Alesina *et. al.* (2003) have presented evidence that ethnic and linguistic frac-

[12] Treisman (2000), however, finds little support for this.

tionalization has a statistically significant impact on corruption i.e. countries that are ethno-linguistically diverse are associated with higher perceived levels of corruption.

3.1.4 Economic factors

The economic determinants of corruption across countries have focussed typically on three factors: the degree of openness, a country's endowments of natural resources and the size of the public sector. Less open countries restrict trade and impose controls on capital flows. This creates rents and hence enhances the incentives to engage in corrupt activities. There are a number of papers that have investigated this issue: for example, Ades and Di Tella (1999) have shown that increased competition reduces corruption and that more open economies are less corrupt. Treisman (2000) has shown that higher imports lowers corruption. Wei and Wu (2001) have presented evidence that countries with capital controls have higher corruption and, in turn, receive less foreign investment and are more prone to financial crisis. More recently, Neeman *et. al.* (2003) have shown that the effect of corruption on economic growth depends on the openness of the economy.[13]

Natural resource endowments have also featured in cross-country studies of corruption, the justification here being that the concentration of exports on natural resources is a proxy for rent-seeking opportunities. Ades and Di Tella (1999) suggest that corruption may offer greater gain to officials who exercise control over the distribution of the rights to exploit these natural resources. Treisman (2000) finds that a higher concentration of natural resource exports has a positive effect on perceived corruption.

Several studies on the causes of corruption have emphasised the size of the public sector. Tanzi (1998), for instance, notes that the significant role of the public sector in the economy affords public officials some degree of discretion in the allocation of goods and services provided and hence increases the likelihood of corruption. This mechanism is reinforced if the wages public officials receive are relatively low. This issue is explored by van Rijckeghem and Weder (2001) who find that low wages for civil servants have a statistically significant effect on (perceived) corruption. Treisman (2000), however, finds rather inconclusive evidence of the size of the public sector in influencing corruption across countries.

We now turn to a discussion of the possible indicators of the structural model.

[13]Neeman *et. al.* (2003) suggest that higher levels of openness is more likely to increase the impact of corruption as openness will allow for the dissipation of stolen money abroad. However, while they use an overall index of openness, the mechanism for whether corruption will have this effect is primarily limited to restrictions on the capital account.

3.2 Indicators of corruption

While the existing literature offers sufficient guidance as to the causal variables to be used as determinants of corruption, less guidance is available in the appropriate indicators. The challenge, therefore, is to select variables that appear to be correlated with the pervasiveness of corruption across the countries on our sample. This, as emphasized above, will enable us to estimate the MIMIC model and retrieve a measure of the latent variable. While there are a large number of candidate variables, we report only those that were successful in our modelling effort.[14]

Naturally, the most obvious indicator variable that should be incorporated into the structural model is GDP per capita. Almost all available evidence would appear to suggest that corruption varies inversely with development (see, among others, Mauro (1995), and Paldam (2003)). Capital control restrictions are also included as an indicator variable. As noted in the discussion above, countries less open to foreign trade appear to be correlated with high levels of corruption.[15] More specifically, recent studies have noted that countries appearing to exhibit relatively high levels of corruption are more likely to impose capital account restrictions (Wei and Wu (2001), and Dreher and Siemers (2003)). Recent empirical studies on the consequences of corruption have also focused on the allocation of resources, emphasizing not only the negative impact of corruption on investment but also its negative impact on the composition of investment. Mauro (1997) argues that the allocation of public procurement contracts through a corrupt system will lead to lower quality public services and quality of infrastructure.[16] A natural variable that captures the distortion of corruption on the allocation of resources is a measure of financial development. One would expect, in the absence of a well-developed financial sector, that corruption would be particularly distorting relative to those countries where a highly developed financial sector is present. Along these lines, Hillman and Krausz (2004) argue that corruption provides the source of the ineffectiveness of the financial system by reducing the volume of financial intermediation. Following Claessens and Laeven (2003), financial development is proxied by private credit as a share of GDP.

The final indicator variable uses apparent consumption of cement and endeavors to capture projects where the scope for corruption is high. As noted by Mauro (1997), lucrative

[14]Indicator variables that were tried, but without success, include, among others, growth of GDP, growth of GDP per capita, public investment as a share of GDP and trade as a percentage of GDP. Naturally, the size of the shadow economy may also be a good candidate as an indicator of corruption. Since such data are not available for a sufficient number of countries and periods, it is not used in the paper. This is also true for military spending as a percentage of GDP.

[15]As noted in the previous footnote, the level of trade (imports and exports) as a share of GDP was tried as an indicator variable but without much success.

[16]See also Rose-Ackerman (1999), and Tanzi (1998).

opportunities for corruption typically arise with large projects the exact value of which are difficult to monitor. It is also easier to collect bribes on large infrastructure projects or on military expenditure.[17] In addition, data from the Bribe Payers Index shows that sectors where corrupt practices are likely to be higher include public works contracts and construction. Rose-Ackerman (1999, pp. 30-31) provides direct justification for the use of cement consumption as an indicator variable noting that: 'In Nigeria in 1975, the military government ordered cement that totalled two-thirds of the estimated needs of all of Africa and which exceeded the productive capacity of Western Europe and the Soviet Union'. Supportive of this is also della Porta and Vannucci (1997) who note that per capita cement consumption in Italy (a country that is perceived to be high on corruption indices) has been double that of the US and triple that of the UK and Germany. It seems, therefore, that cement is a natural proxy for large-scale projects. Given this evidence and the results from the Bribe Payers Index, we collected data on total consumption of cement for all the countries in our sample. To account for the role of development, this consumption data was expressed as a percentage of GDP. In addition, to account for the distribution of the population, this data was also adjusted for the density of the population.

Before turning to the results a word of clarification is in order. Given that the latent variable is intrinsically uncertain one may, naturally, ask whether this variable does indeed measure corruption. The answer to this question is, with a good degree of certainty, affirmative. This is because,[18] as the results presented below show, the derived index is highly correlated with the perception-based indices that are widely reported and so – to the extent that perception-based indices are correctly reporting cross-country corruption – our indices are picking up the same phenomenon. We return to this in more detail below.

4 Results

4.1 Corruption 1991-1997

We initially estimated the model for the 1991-1997 period covering between 98 and 103 countries.[19] The time period was restricted to the cut-off year 1997 because of unavailability of more recent data for the causal and indicator variables. We took the mean

[17]As noted in footnote 14, military expenditure – being unavailable for the whole period – has not be included in the set of estimated variables.

[18]Leaving aside that the goodness-of-fit-statistics of the models, discussed in Section 4, and the fact that, as emphasized already, all indexes presented make use of well documented variables that relate to corruption.

[19]All estimations have been performed with LISREL® V. 8.5.4.

values of the available data over this period. In estimating the model, we used data that relate directly to the causes of corruption outlined in the previous section.[20] Since we estimate the model over different sub-periods, we include only those variables where data was available from the 1970s to the 1990s.[21] For the political factors, we used the following: whether the country was a democracy; the period of uninterrupted democratic government; number of years in office of the incumbent government; the rule of law; whether the political system was presidential; fractionalization of elected parties; whether the political system was federal; extent of decentralization; degree of political stability; freedom of the press and the school enrolment rate. The latter variable is used by Treisman (2000) who argues that corruption will be lower where populations are more educated and literate and where the normative separation between 'public' and 'private' is clearer. In a similar vein, Knack *et. al.* (2003) suggest that education and literacy act as a vertical check on government. For social and cultural factors we used data on: the dominant religion in each country; the extent of religious fractionalization; whether English was the dominant language; the degree of linguistic fractionalization and ethnic fractionalization. Historical causes included the following: legal origin; whether the country is a former colony of Britain; whether a common or civil law system applies; settler mortality and latitude. Variables used to capture the economic causes of corruption included: trade as a percentage of GDP; natural resource exports as a percentage of merchandize exports and the size of the public sector. Making use of these variables, a number of specifications have been tested. In what follows, the discussion is confined to those variables which are statistically significant at conventional levels.

The results are presented in Table 1. Starting with the indicator variables, it can be seen that they are fairly consistent across all model specifications. As pointed out in Section 2, one of the coefficients of the indicators must be normalized for the estimated parameters to be identified. The choice of the indicator on which to normalize the latent variable has to be the one that best represents the underlying construct. We have therefore normalized the estimated parameters with respect to cement consumption (see below). All indicator variables are statistically significant at the 1 percent level and have the anticipated sign, with cement consumption being positively and financial development negatively related to corruption, respectively. Lower levels of GDP per capita and more restrictions on the capital account are also associated with higher corruption.

[20]Prior to estimation the data is standardized; this is a common procedure in estimating MIMIC models. We also tested each specification for multivariate normality. In those cases where transformations have been necessary, in order for the data to satisfy the multivariate normality assumption, the transformed data produced similar results.

[21]Since the objective is to provide a model that would be comparable across sub-periods, variables with data available only for recent years, or a sub-set of countries, have been excluded.

Turning to the causal variables, the results show that the rule of law has a negative effect on corruption that is statistically significant at the 5 percent level across all specifications. School enrolment, too, reduces corruption and so – recalling that school enrolment can be interpreted as a proxy for the effectiveness of democracy in a given country – countries with weak democratic institutions will be expected to have higher levels of corruption. This coefficient is significant at the 1 percent level in the specifications reported in columns 1 and 2, while it is significant at the 5 percent level in specifications 3 and 4. Columns 1 and 4 include latitude (a variable with ambiguous economic interpretation). At the 10 percent level of significance, latitude reduces corruption. Columns 2 and 4 also include a dummy for German legal origin, while the age of democracy is included in columns 3 and 4. Both variables negatively affect corruption at the 5 percent level of significance.[22]

It can be difficult to compare the effects of two or more variables when they have different units of measurement. Standardized coefficients can be useful in interpreting the relative effects of different explanatory variables.[23] The standardized coefficient is the expected change in standard deviation units of the latent variable when the other variables are held constant. According to the standardized coefficients of the full model (not reported in the Table) of column 4, a one standard deviation increase in the rule of law leads to a reduction in corruption by 0.20 standard deviations. A one standard deviation increase in the school enrolment rate, latitude, and the age of democracy reduces corruption by 0.32, 0.12 and, 0.32 standard deviations, respectively.

Table 1 also reports goodness-of-fit statistics for the four model specifications. The chi-square test of exact fit accepts all models at least at the five percent level of significance.[24] The Root Mean Square Error of Approximation (RMSEA) accounts for the error of approximation in the population and has recently been recognized as one of the most informative criteria in covariance structure modelling (Steiger, 1990).[25] The RMSEA

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[22]When including non-continuous variables, the estimator is no longer consistent, Bollen (1989). This, however, does not seem to impose any problems here. The results are very similar when legal German origin is excluded from estimation. Note that the index of restrictions is continuous due to averaging and standardizing.

[23]These standardized coefficients are defined as $\hat{\gamma}_{ij}^s = \hat{\gamma}_{ij}\sqrt{\hat{\sigma}_{jj}/\hat{\sigma}_{ii}}$, and $\hat{\beta}_{ij}^s = \hat{\beta}_{ij}\sqrt{\hat{\sigma}_{jj}/\hat{\sigma}_{ii}}$ where the subscript s denotes the standardized coefficient, i is the 'dependent' variable, j is the 'independent' and $\sqrt{\hat{\sigma}_{jj}}$, $\sqrt{\hat{\sigma}_{ii}}$ are the model-predicted variances of the j^{th} and i^{th} variables, respectively.

[24]The chi-square statistic tests the specification of the model against the alternative that the covariance matrix of the observed variables is unconstrained, where smaller values indicate a better fit. In other words, a small chi-square does not reject the null hypothesis that the model reproduces the covariance matrix.

[25]Expressed differently, the RMSEA measures how well the model fits based on the difference between the estimated and the actual covariance matrix (and degrees of freedom). Values of the RMSEA less

is smaller than 0.05 in the most recent period and still acceptable in the other three specifications. Other indices providing evidence of an acceptable fit are the Goodness of Fit Index (GFI), the Adjusted Goodness of Fit Index (AGFI) and the Normed Fit Index (NFI). These indices range from zero to one, with values close to one indicating a better fit.[26] The estimated latent variable explains 92 percent of the variance of cement consumption, 33 percent of private credit, 0.06 percent of per capita GDP, and 0.47 percent of capital account restrictions. Based on these goodness-of-fit statistics we conclude that the model fits the data fairly well.

The next step is to derive the ranking for the countries in the sample in terms of their expected levels of corruption.[27] The results for the full model are reported in the first column of Table 2. The ranking, to a large extent, is not surprising, the developed countries being typically reported as countries with lower corruption and developing countries with higher corruption. The world's least corrupt country is Switzerland, followed by Japan, Norway, Denmark, and Germany. With the exception of Japan, Singapore and the US, only Western European countries are among the 15 least corrupt nations. At the bottom of the scale, Guinea-Bissau, Nigeria, Syria, and the Central African Republic are found to be most corrupt. As can be seen, sub-Saharan African countries dominate the bottom of the scale, with the exception of Syria, Ukraine, and Romania. Latin American and Caribbean countries can be found at ranks between 31-71. To get a better understanding of those regional differences, we also calculated average corruption indices according to region. Corruption is by far lowest in Western Europe, with an average index of -0.36. The ranking for the other regions is as follows: East Asia Pacific (-0.05), Middle East and North Africa (0.16), Latin America and Caribbean (0.22), East Europe and Central Asia (0.26), sub-Saharan Africa (0.29) and South Asia (0.29). Within Western Europe, Greece is the most corrupt country followed by Portugal and Cyprus. The most corrupt South Asian countries are Papua New Guinea, Philippines, and China. In the Middle East and North Africa, Kuwait and Israel are the least, and Syria and Algeria the most, corrupt countries. The least corrupt sub-Saharan Africa country is South Africa. In what follows, we will explore the developments

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than 0.05 indicate good fit, values as high as 0.08 represent reasonable fit, values from 0.08 to 0.10 indicate mediocre fit, and those greater than 0.10 indicate poor fit (MacCallum *et. al.* 1996).

[26] These indices are based on comparison with a null model predicting all covariances to be zero. The NFI relates the chi-square of this null model to the chi-square of the actual model. It should be greater than 0.90. The GFI and the AGFI compare the loss function of the null model with the loss function of the actual model, with AGFI adjusting for the complexity of the model.

[27] In the economics literature the normalized coefficients are sometimes multiplied by the corresponding (standardized) data to derive an estimate of the latent variable, (Frey and Weck-Hannemann (1984), and Loayza (1996)). The results reported are robust to this procedure. We have opted, however, to use the methodology of Jöreskog (2000) which uses more structural information.

of these patterns over time.

4.2 Corruption 1976-1997

We now explore how corruption has changed over time since 1976. However, in doing this, there are several drawbacks. First, the further back in time, the less data there is available in terms of country coverage. For each sub-time period the model is estimated, the sample size reduces considerably (for the periods 1986-1990, 1981-1985 and 1976-1980 the sample reduces to 91, 77 and 65 countries, respectively). The second issue relates to the countries we lose from the sample; typically those countries will be the less developed ones where corruption may be expected to be high.[28] In this case, it is likely that the estimated model will give less statistically significant coefficients for the earlier periods.

To deal with these issues, the basic specification of the model included all causal variables discussed in Section 3. However, for different time periods, not all variables were statistically significant. Therefore, to provide consistency in our specification across sub-periods, we estimate a more parsimonious version of the model to the one that was presented in Table 1.[29] In choosing the most parsimonious version of the model, we relied on the variables that would be statistically significant across all time periods and the goodness-of-fit statistics. While all the indicator variables continued to perform well, the number of statistically significant causes was reduced to two: the rule of law and the school enrolment rate. The results for the estimation of the model for each sub-period (including the 1991-97 period) are presented in columns 2-4 of Table 3.

The estimated parameters for both the causal and indicator variables are fairly consistent across each sub-period. The signs of the estimated parameters continue to hold (as in the less parsimonious model for 1991-1997 presented in Table 1) while the parameter values show little variation. Table 3 also reports goodness-of-fit statistics for our four models. The chi-square test of exact fit accepts all models at least at the five percent level of significance. The RMSEA is smaller than 0.05 in the most recent period and still acceptable in the other three specifications. The other indices that provide evidence of model fit (the GFI, the AGFI and the NFI), all indicate values relatively close to 1. Based on these goodness-of-fit statistics, we conclude that our model fits the sample data fairly well when estimated for each sub-period.

[28]The exception is Switzerland where data on capital account restrictions are not available for earlier periods. This is because Switzerland only became a member of the IMF in 1992.

[29]Note that for the most recent period, the correlation between the full and the parsimonious model is 0.998. The quality of our results is thus not reduced by estimating a more parsimonious model.

The indices of corruption derived from those estimates are presented in the last four columns of Table 3. There are two important results. First, levels of corruption seem to be fairly consistent over time, as are the relative positions of countries.[30] Second, there are some obvious regional patterns. Overall corruption in Western Europe decreased since the mid-70s, whereas corruption increased in sub-Saharan Africa and Latin America/Caribbean. The pattern is more mixed in East Asia Pacific, where the huge decrease in Japan's level of corruption reduces the average level for the region, and the Middle East/North Africa, with decreases in corruption in Israel and Malta and increases in most other countries. The averages for the period 1976-1980 are -0.13 (West Europe), -0.01 (East Asia Pacific), 0.05 (Middle East and North Africa), 0.7 (Latin America and Caribbean), 0.1 (sub-Saharan Africa) and 0.1 (South Asia). It is also worth noting that, of the 10 most corrupt countries reported in Table 3, all witnessed an increase in corruption since the 1980s.

There are three ways to test for the validity of a structural model (Bollen, 1989). Firstly, it is necessary to examine the fit of the model. Secondly, variables related to the latent variable in the theoretical literature should have the expected impact. Thirdly, the obtained latent variable should be correlated with other measures of the same concept. We have dealt with the first two validity tests above. To further improve our confidence that the latent variable really measures corruption, we calculated the correlation of the resulting indices with the Corruption Perception Index of Transparency International (which is highly correlated with other perception-based indices). The resulting correlations for the respective time periods range from 0.80 for the period 1976-80 to 0.83 for all models in 1991-97. Consequently, we can be reasonably confident that our latent variable is picking up the ranking of corruption across countries.

5 Economic losses due to corruption

By benchmarking the index to estimates of the losses due to corruption from an external source, we can derive a value for each of the countries in terms of the losses as a percentage of GDP per capita that arise due to corruption. This benchmarking exercise raises obvious challenges: since there are no published estimates of the losses due to corruption available, one has to search for suitable alternatives. Therefore, the choice of unit on which to benchmark is to some extent arbitrary. Nevertheless similar benchmarking exercises are common in the literature. Loayza (1996), for instance, uses the VAT evasion rate to benchmark the shadow economy, whereas Frey and Weck-Hannemann (1984) use

[30] In interpreting the ranking one has to keep in mind that in many cases a country moves up or down in the ranking because of missing data for other countries.

two external estimates for the shadow economy. With respect to corruption, one such possibility is the cost of entry as a percentage of GDP per capita estimated by Djankov *et. al.* (2002) who show that the regulation of entry in terms of setting up new businesses (in the form of number of procedures to be completed and the time involved in meeting these requirements) is associated with higher corruption.[31] However, the choice of countries on which to benchmark on is arbitrary and, of course, the results are rather sensitive to this choice.

We choose to benchmark our index of corruption on two observations from Table 3 of Djankov *et. al.* (2002) – countries which are shown to be among the least corrupt according to our corruption index. We do not employ Switzerland and Japan because the values for the estimated index for those countries are extremely negative, as compared to the rest of the sample. We thus benchmark on Norway and Denmark. The benchmarking exercise allows us to derive the distance in terms of changes in the value of our corruption index. The results are presented in Table 4.

The first column reports the losses due to corruption as a percentage of per capita GDP over the same period. The results suggest that the losses due to corruption can vary considerably from 11.20 percent of per capita GDP in Norway to around 67 percent of per capita GDP in Guinea-Bissau.[32] On average, countries in West Europe lose about 24 percent in per capita GDP due to corruption. In East Asia and Pacific, corruption leads to 44 percent lower GDP per capita, while the other regions exhibit even higher losses. The corresponding figures for other regions are: Middle East and North Africa (54 percent), Latin America and Caribbean (58 percent), East Europe and Central Asia (59 percent), sub-Saharan Africa (63 percent) and South Asia (63 percent).[33] Taken together, these results confirm that corruption is indeed a significant economic problem and suggest that the incidence of corruption is one of the most significant barriers to

[31] A word of clarification is in order here. One may argue that the variable 'to set up a business' could be either a cause or an indicator of corruption. Estimation of the model shows that as a cause it is insignificant. As a candidate indicator for the empirical analysis it cannot be used too. This is because it is available for only the mid-1990s and covers only 85 countries falling short of the sample size (see also footnote 21). If the variable is included as an indicator to the full model of Table 1, the results are almost unchanged but there is a loss of data on 35 countries. As an indicator, it is significant at the 10 percent level, with the expected positive sign. Issues relating to the costs of corruption that use data for more recent periods are addressed in Dreher *et. al.* (2004).

[32] Note that Switzerland and Japan have been excluded from Table 4. This is because the index value for these two countries significantly deviates from the average and therefore we do not consider the results for these countries to be reliable. In fact the losses derived for these countries are negative.

[33] Though these estimates seem to be particularly high, they are nevertheless consistent with the World Bank's recent observation on the impact of corruption across countries. As noted in the introduction, the World Bank estimates that, in some cases, tackling corruption and mis-governance could increase income by as much as 400 percent.

economic development.

With respect to the changes of the losses in corruption over time the results, of course, correspond to the developments of the index as outlined in Section 4.2. These results are consistent with the concerns that corruption has become more pervasive in poor developing countries and that it increased following the move to a market economy in the countries of Central and Eastern Europe and China.[34]

6 Concluding remarks

This paper was predicated on the fact that the current policy focus on corruption around the world as well as most empirical studies of corruption employ perception-based indices to gauge the ranking between the most and less corrupt countries. While informative, there are several problems in the interpretation of these indices. Arguably, the most fundamental criticism is that they do not provide any indication of the losses that are likely to arise from corruption which is of fundamental importance in the current focus on how corruption inhibits economic development. To this end, we employed a structural model of corruption that simultaneously deals with the causes and indicators of corruption within a unified framework.

There are several attractions to using this framework to estimating corruption. First, the model is explicitly causal in nature such that the ranking one retrieves across countries is tied to the causal variables that were used to estimate the model. As such, the model produces a cardinal index of corruption rather than one that is solely ordinal. Second, benchmarking the estimated index on specific countries using a proxy for the losses due to corruption, we can then derive losses as a percentage of GDP for all countries in our sample. This is an explicit gauge to evaluate how much corruption matters. Finally, dependent on data availability, the model can be estimated over different sub-periods to assess how corruption has changed over time for each country.

The key results from the paper is that the losses due to corruption are generally high. In developed countries, the losses due to corruption as a percentage of per capita GDP are comparably low (22.26) in the period 1991-97; in developing and transition countries, the losses are considerably higher particularly in sub-Saharan Africa where the average loss amounts to over 60 percent of per capita GDP. This suggests that corruption is quite rightly a major policy issue for developing countries. The results suggest that since the

[34]Varese (1997), for example, discusses the likely increase in corruption in Russia following the introduction of market reforms while Johnston and Hao (1995) discuss the apparent 'surge' in corruption in China following liberalization.

1980s, the losses due to corruption have decreased in West Europe, exhibited a positive trend in Middle East and North Africa, Latin America and Caribbean, sub-Saharan Africa and have remaind fairly constant in East Asia and Pacific. As such, the focus of corruption as a barrier to economic development is clearly warranted.

The methodology applied in this paper holds much promise for future research in the empirical analysis of corruption. For example, the impact of economic, political and economic reform on corruption is a potentially fruitful avenue of research and one that has received some attention for those who identify the role of institutions as a determinant of economic development (Acemolgu *et. al.* (2001) and Rodrik *et. al.* (2002)). Moreover, the methodology reported here can be extended to the case where some of the exogenous variables are themselves inherently latent and interrelated (for example, with institutional reform, the rule of law and the hidden economy) which interact with the endogenous latent variable of corruption. For example, in measuring the size of the hidden economy which has been a previous focus of researchers using MIMIC, the estimates are likely to be picking up aspects of corruption (and vice versa). Separating these two aspects will provide a more accurate assessment of the relative importance of each of them.

Tables

Table 1: Model estimates, 1991-1997

	(1)	(2)	(3)	(4)
Causes				
Rule of law	-0.09	-0.08	-0.06	-0.06
	(2.41**)	(2.33**)	(2.04**)	(2.10**)
School enrolment	-0.14	-0.15	-0.12	-0.09
	(2.61*)	(2.66*)	(2.43**)	(2.36**)
Latitude	-0.04			-0.03
	(1.78***)			(1.72***)
Legal German origin		-0.09		-0.09
		(2.56**)		(2.59**)
Age of democracy			-0.09	-0.09
			(2.35**)	(2.47**)
Indicators				
Cement	1.00	1.00	1.00	1.00
Private credit	-2.83	-2.97	-2.99	-2.77
	(2.85*)	(2.78*)	(2.70*)	(2.75*)
GDP per capita	-3.41	-3.47	-3.53	-3.32
	(2.90*)	(2.82*)	(2.74*)	(2.79*)
Restrictions	2.57	2.63	2.74	2.50
	(2.81*)	(2.74*)	(2.67*)	(2.70*)
Number of countries	102	103	102	98
p-value	0.40	0.36	0.80	0.22
RMSEA	0.02	0.03	0.00	0.05
GFI	0.97	0.97	0.98	0.95
AGFI	0.92	0.92	0.95	0.89
NFI	0.98	0.98	0.99	0.97

Notes:

1. *t*-statistics in parentheses.
2. Levels of significance: 1 percent (*), 5 percent (**), 10 percent (***).

Table 2: Ranking and indices of corruption across all model specifications.

Country	**1997**	**$\mathbf{1997}_P$**	**$\mathbf{1990}_P$**	**$\mathbf{1985}_P$**	**$\mathbf{1980}_P$**
Switzerland	1 (-0.9165)	1 (-0.9047)	n.a.	n.a.	n.a.
Japan	2 (-0.8801)	2 (-0.8705)	1 (-0.6238)	1 (-0.5633)	1 (-0.276)
Norway	3 (-0.5489)	3 (-0.5346)	4 (-0.3966)	4 (-0.3646)	4 (-0.1984)
Denmark	4 (-0.5409)	4 (-0.5232)	2 (-0.4231)	2 (-0.3924)	2 (-0.2405)
Germany	5 (-0.5193)	5 (-0.5142)	3 (-0.4007)	n.a.	n.a.
Netherlands	6 (-0.5005)	6 (-0.5058)	7 (-0.3635)	6 (-0.3502)	5 (-0.1889)
Austria	7 (-0.4953)	7 (-0.4904)	8 (-0.3548)	5 (-0.3507)	8 (-0.1821)
Sweden	8 (-0.472)	8 (-0.4723)	5 (-0.3898)	3 (-0.3725)	3 (-0.2012)
United States	9 (-0.4615)	9 (-0.4589)	6 (-0.3635)	7 (-0.3404)	6 (-0.183)
France	10 (-0.4322)	10 (-0.4281)	10 (-0.3226)	8 (-0.3349)	7 (-0.1825)
Belgium	11 (-0.4209)	11 (-0.4148)	12 (-0.2665)	11 (-0.2524)	9 (-0.1493)
Hong Kong, China	n.a.	12 (-0.3926)	n.a.	n.a.	n.a.
Finland	12 (-0.3894)	13 (-0.386)	9 (-0.3369)	9 (-0.3)	11 (-0.1471)
Singapore	14 (-0.3419)	14 (-0.3452)	15 (-0.1988)	13 (-0.178)	19 (-0.0404)
Iceland	13 (-0.3471)	15 (-0.3323)	11 (-0.2874)	10 (-0.2651)	12 (-0.1449)
United Kingdom	15 (-0.2864)	16 (-0.2948)	14 (-0.2256)	14 (-0.1598)	16 (-0.0751)
Canada	17 (-0.2583)	17 (-0.2614)	13 (-0.2288)	12 (-0.2322)	13 (-0.1167)
Australia	16 (-0.2588)	18 (-0.259)	16 (-0.1901)	15 (-0.1546)	14 (-0.0858)
Italy	18 (-0.2206)	19 (-0.2207)	17 (-0.1608)	16 (-0.1433)	15 (-0.0778)
Ireland	19 (-0.2009)	20 (-0.203)	21 (-0.0986)	19 (-0.0845)	20 (-0.0302)
New Zealand	20 (-0.1909)	21 (-0.1991)	18 (-0.1532)	17 (-0.1336)	17 (-0.0712)
Spain	21 (-0.1382)	22 (-0.1436)	20 (-0.1043)	n.a.	n.a.
Kuwait	22 (-0.1191)	23 (-0.1212)	19 (-0.1061)	18 (-0.1214)	10 (-0.1482)
Israel	23 (-0.0924)	24 (-0.0872)	23 (-0.0769)	20 (-0.0828)	18 (-0.0435)
Cyprus	24 (-0.0682)	25 (-0.0748)	24 (-0.0253)	24 (0.0151)	n.a.
Portugal	25 (-0.0346)	26 (-0.043)	26 (-0.009)	23 (-0.0213)	22 (-0.003)
Korea, Republic	26 (-0.0334)	27 (-0.0419)	28 (0.0073)	26 (0.0552)	26 (0.0491)
Bahamas	n.a.	28 (-0.02)	22 (-0.0856)	n.a.	n.a.
Bahrain	27 (0.001)	29 (-0.0054)	27 (0.0002)	22 (-0.0294)	n.a.
Greece	28 (0.0139)	30 (0.0155)	25 (-0.0183)	21 (-0.0392)	21 (-0.03)
Malta	n.a.	31 (0.029)	29 (0.0383)	30 (0.0711)	n.a.
Malaysia	29 (0.0866)	32 (0.0677)	31 (0.0426)	27 (0.058)	32 (0.068)
Czech Republic	n.a.	33 (0.0856)	n.a.	n.a.	n.a.
Argentina	30 (0.0966)	34 (0.092)	35 (0.0845)	28 (0.061)	23 (0.0155)
Slovenia	n.a.	35 (0.1001)	n.a.	n.a.	n.a.
Barbados	n.a.	36 (0.103)	30 (0.0412)	n.a.	n.a.
Oman	31 (0.1259)	37 (0.118)	n.a.	n.a.	n.a.
Trinidad & Tobago	32 (0.1411)	38 (0.1292)	34 (0.0835)	31 (0.0716)	27 (0.0492)
Panama	34 (0.1485)	39 (0.1321)	33 (0.0802)	29 (0.0613)	28 (0.0496)

cont.ed

Table 2 cont.ed.

Country	1997	1997_P	1990_P	1985_P	1980_P
Uruguay	33 (0.1414)	40 (0.136)	32 (0.0714)	25 (0.0479)	25 (0.0449)
Thailand	35 (0.1522)	41 (0.1374)	40 (0.1156)	37 (0.1325)	39 (0.0868)
South Africa	36 (0.1809)	42 (0.1762)	37 (0.1011)	n.a.	n.a.
Chile	37 (0.1822)	43 (0.1803)	41 (0.1256)	34 (0.1178)	33 (0.0775)
Indonesia	40 (0.1988)	44 (0.1806)	44 (0.1334)	41 (0.1476)	55 (0.1008)
Mexico	38 (0.1913)	45 (0.1829)	48 (0.1463)	39 (0.1402)	30 (0.0612)
Mauritius	39 (0.192)	46 (0.1849)	45 (0.1355)	50 (0.1624)	n.a.
Tunisia	42 (0.2057)	47 (0.1957)	43 (0.1293)	n.a.	n.a.
Hungary	41 (0.1997)	48 (0.1991)	36 (0.0868)	35 (0.1228)	n.a.
Jordan	45 (0.2152)	49 (0.2051)	38 (0.1133)	33 (0.113)	38 (0.0853)
Costa Rica	43 (0.2118)	50 (0.2062)	51 (0.1552)	45 (0.1531)	31 (0.0653)
Venezuela	44 (0.2135)	51 (0.2104)	39 (0.1133)	32 (0.0803)	24 (0.0361)
Slovak Republic	n.a.	52 (0.2184)	n.a.	n.a.	n.a.
Peru	48 (0.2275)	53 (0.2185)	67 (0.1754)	44 (0.1511)	35 (0.0791)
Jamaica	47 (0.2272)	54 (0.22)	47 (0.1436)	40 (0.1459)	36 (0.0797)
Brazil	46 (0.2216)	55 (0.225)	42 (0.1271)	36 (0.1271)	29 (0.0601)
China	50 (0.2361)	56 (0.2256)	46 (0.1425)	n.a.	n.a.
Turkey	49 (0.2325)	57 (0.2286)	49 (0.1472)	n.a.	n.a.
Philippines	51 (0.2455)	58 (0.2362)	63 (0.1739)	42 (0.1478)	41 (0.0871)
Guatemala	54 (0.2474)	59 (0.2389)	58 (0.1681)	56 (0.1735)	37 (0.0832)
Paraguay	52 (0.2461)	60 (0.2401)	69 (0.1759)	54 (0.1717)	49 (0.0929)
Morocco	53 (0.2474)	61 (0.2401)	68 (0.1756)	59 (0.1799)	52 (0.0965)
Bolivia	56 (0.2548)	62 (0.2468)	64 (0.1749)	73 (0.2053)	51 (0.0957)
Nicaragua	59 (0.2624)	63 (0.2523)	88 (0.207)	61 (0.1808)	45 (0.09)
Colombia	55 (0.2544)	64 (0.2533)	60 (0.1715)	52 (0.1649)	40 (0.087)
Sri Lanka	60 (0.2645)	65 (0.2554)	72 (0.1789)	63 (0.185)	58 (0.1026)
Poland	57 (0.2565)	66 (0.2575)	54 (0.1585)	n.a.	n.a.
Papua New Guinea	61 (0.2673)	67 (0.2605)	53 (0.1573)	51 (0.1644)	n.a.
Botswana	58 (0.2581)	68 (0.2617)	61 (0.1716)	70 (0.1992)	n.a.
Haiti	66 (0.2735)	69 (0.264)	73 (0.1791)	58 (0.1761)	53 (0.0971)
Ecuador	62 (0.2684)	70 (0.2652)	62 (0.1729)	48 (0.1619)	42 (0.0884)
Cote d'Ivoire	65 (0.2731)	71 (0.2666)	52 (0.1561)	38 (0.1396)	n.a.
Dominican Republic	63 (0.2698)	72 (0.2668)	59 (0.1708)	55 (0.1732)	47 (0.0914)
El Salvador	64 (0.2708)	73 (0.2668)	79 (0.1926)	n.a.	44 (0.0886)
Honduras	67 (0.2742)	74 (0.2676)	65 (0.1749)	53 (0.1713)	43 (0.0885)
Senegal	68 (0.2771)	75 (0.27)	55 (0.1587)	43 (0.148)	48 (0.0927)
Guyana	70 (0.2789)	76 (0.2746)	n.a.	n.a.	n.a.
Egypt	69 (0.2787)	77 (0.2753)	74 (0.1796)	65 (0.1895)	60 (0.1047)
Cameroon	73 (0.2861)	78 (0.2806)	57 (0.168)	46 (0.1543)	50 (0.0948)

cont.ed

Table 2 cont.ed.

Country	**1997**	**1997_P**	**1990_P**	**1985_P**	**1980_P**
Niger	75 (0.289)	79 (0.2814)	71 (0.1775)	68 (0.1958)	62 (0.1116)
Kenya	74 (0.289)	80 (0.2839)	70 (0.1764)	57 (0.1744)	57 (0.1018)
Bulgaria	72 (0.2859)	81 (0.2848)	n.a.	n.a.	n.a.
Namibia	71 (0.2821)	82 (0.2862)	n.a.	n.a.	n.a.
Zimbabwe	77 (0.291)	83 (0.2876)	82 (0.1976)	64 (0.1891)	56 (0.1013)
Benin	79 (0.2934)	84 (0.2876)	n.a.	n.a.	n.a.
Pakistan	78 (0.2932)	85 (0.289)	n.a.	n.a.	n.a.
Iran	76 (0.2892)	86 (0.2901)	56 (0.1634)	49 (0.1621)	34 (0.0778)
Bangladesh	81 (0.2959)	87 (0.2908)	n.a.	n.a.	n.a.
India	83 (0.2961)	88 (0.2918)	66 (0.1753)	60 (0.1801)	59 (0.1033)
Mali	84 (0.2982)	89 (0.2929)	78 (0.1898)	n.a.	n.a.
Congo, Republic	82 (0.2959)	90 (0.2933)	n.a.	n.a.	n.a.
Uganda	86 (0.3003)	91 (0.2949)	84 (0.2021)	74 (0.2131)	n.a.
Togo	85 (0.2989)	92 (0.295)	75 (0.1807)	62 (0.1824)	54 (0.0998)
Algeria	80 (0.2947)	93 (0.2959)	50 (0.1509)	47 (0.1564)	46 (0.0901)
Sierra Leone	89 (0.3025)	94 (0.2971)	76 (0.187)	71 (0.2049)	n.a.
Ukraine	87 (0.3004)	95 (0.3001)	n.a.	n.a.	n.a.
Romania	88 (0.3017)	96 (0.3029)	n.a.	n.a.	n.a.
Malawi	91 (0.3105)	97 (0.3067)	81 (0.1959)	67 (0.1933)	n.a.
Madagascar	90 (0.3103)	98 (0.3074)	77 (0.189)	n.a.	n.a.
Chad	92 (0.3166)	99 (0.3143)	86 (0.2039)	72 (0.205)	n.a.
Zambia	93 (0.3186)	100 (0.3178)	85 (0.2022)	n.a.	n.a
Ghana	94 (0.3198)	101 (0.3188)	91 (0.2125)	77 (0.2221)	63 (0.1119)
Congo, Dem. Rep.	n.a.	102 (0.3201)	87 (0.2047)	75 (0.2146)	65 (0.1143)
Central African Rep.	95 (0.3211)	103 (0.3202)	83 (0.2011)	69 (0.1991)	n.a.
Syria	96 (0.3261)	104 (0.329)	89 (0.2092)	76 (0.2154)	64 (0.1135)
Nigeria	97 (0.3326)	105 (0.334)	80 (0.1941)	66 (0.1926)	61 (0.1092)
Guinea-Bissau	98 (0.3424)	106 (0.3453)	90 (0.2113)	n.a.	n.a.

Notes:

1. The subscript P denotes the parsimonious model.
2. The ranking and indices of corruption across model specifications has been sorted according to the ranking and index of the parsimonious model of 1997.

Table 3: Model estimates across different time periods

	(1) **1991-97**	(2) **1986-90**	(3) **1981-85**	(4) **1976-80**
Causes				
Rule of law	-0.09	-0.09	-0.10	-0.05
	(2.35**)	(2.48**)	(2.04**)	(2.51**)
School enrolment	-0.16	-0.10	-0.11	-0.16
	(2.67*)	(2.51**)	(2.06**)	(3.65*)
Indicators				
Cement	1.00	1.00	1.00	1.00
Private credit	-2.88	-3.76	-3.34	-3.55
	(2.82*)	(2.65*)	(2.06**)	(3.53*)
GDP per capita	-3.31	-4.71	-4.64	-4.79
	(2.86*)	(2.70*)	(2.12**)	(3.86*)
Restrictions	2.57	3.30	3.17	2.23
	(2.78*)	(2.57**)	(2.02**)	(2.64*)
Number of countries	106	91	77	65
p-value	0.79	0.09	0.13	0.26
RMSEA	0.00	0.09	0.09	0.06
GFI	0.99	0.95	0.95	0.95
AGFI	0.96	0.87	0.86	0.87
NFI	0.99	0.96	0.96	0.96

Notes:

1. t-statistics in parentheses.
2. Levels of significance: 1 percent (*), 5 percent (**), 10 percent (***).

Table 4: Economic loss of corruption for the parsimonious specification.

Country	**1997**$_P$	**1990**$_P$	**1985**$_P$	**1980**$_P$
Norway	11.2	19.92	21.93	32.44
Denmark	11.92	18.24	20.18	29.78
Germany	12.49	19.65	n.a.	n.a.
Netherlands	13.02	22.01	22.84	33.04
Austria	13.99	22.56	22.82	33.47
Sweden	15.13	20.35	21.44	32.26
United States	15.98	22.01	23.46	33.41
France	17.92	24.59	23.81	33.44
Belgium	18.77	28.13	29.03	35.54
Hong Kong, China	20.17	n.a.	n.a.	n.a.
Finland	20.58	23.69	26.02	35.68
Singapore	23.16	32.41	33.73	42.42
Iceland	23.98	26.82	28.22	35.82
United Kingdom	26.35	30.72	34.87	40.23
Canada	28.46	30.51	30.3	37.6
Australia	28.61	32.96	35.21	39.55
Italy	31.03	34.81	35.92	40.06
Ireland	32.15	38.74	39.64	43.06
New Zealand	32.39	35.29	36.53	40.47
Spain	35.9	38.38	n.a.	n.a.
Kuwait	37.31	38.27	37.3	35.61
Israel	39.46	40.12	39.74	42.22
Cyprus	40.24	43.37	45.93	n.a.
Portugal	42.25	44.4	43.62	44.78
Korea, Republic	42.33	45.44	48.46	48.07
Bahamas	43.71	39.56	n.a.	n.a.
Bahrain	44.63	44.98	43.12	n.a.
Greece	45.95	43.81	42.49	43.08
Malta	46.81	47.39	49.46	n.a.
Malaysia	49.25	47.66	48.64	49.27
Czech Republic	50.38	n.a.	n.a.	n.a.
Argentina	50.78	50.31	48.83	45.95
Slovenia	51.29	n.a.	n.a.	n.a.
Barbados	51.48	47.57	n.a.	n.a.
Oman	52.42	n.a.	n.a.	n.a.
Trinidad & Tobago	53.14	50.25	49.49	48.08
Panama	53.32	50.04	48.84	48.1
Uruguay	53.56	49.48	48	47.81
Thailand	53.65	52.28	53.34	50.46
South Africa	56.1	51.36	n.a.	n.a.

cont.ed

Table 4 cont.ed.

Country	**1997**$_P$	**1990**$_P$	**1985**$_P$	**1980**$_P$
Chile	56.36	52.91	52.42	49.87
Indonesia	56.38	53.4	54.29	51.34
Mexico	56.53	54.21	53.83	48.84
Mauritius	56.66	53.53	55.23	n.a.
Tunisia	57.33	53.14	n.a.	n.a.
Hungary	57.55	50.46	52.73	n.a.
Jordan	57.93	52.13	52.11	50.36
Costa Rica	58	54.77	54.64	49.1
Venezuela	58.26	52.13	50.05	47.25
Slovak Republic	58.77	n.a.	n.a.	n.a.
Peru	58.77	56.05	54.52	49.97
Jamaica	58.87	54.04	54.19	50.01
Brazil	59.19	53	53	48.77
China	59.23	53.97	n.a.	n.a.
Turkey	59.41	54.27	n.a.	n.a.
Philippines	59.89	55.95	54.31	50.47
Guatemala	60.06	55.59	55.93	50.23
Paraguay	60.14	56.08	55.82	50.84
Morocco	60.14	56.06	56.34	51.07
Bolivia	60.56	56.02	57.94	51.01
Nicaragua	60.91	58.05	56.39	50.66
Colombia	60.98	55.81	55.39	50.47
Sri Lanka	61.11	56.27	56.66	51.45
Poland	61.24	54.98	n.a.	n.a.
Papua New Guinea	61.43	54.91	55.36	n.a.
Botswana	61.51	55.81	57.56	n.a.
Haiti	61.65	56.29	56.1	51.1
Ecuador	61.73	55.89	55.2	50.55
Cote d'Ivoire	61.81	54.83	53.79	n.a.
Dominican Republic	61.83	55.76	55.91	50.75
El Salvador	61.83	57.14	n.a.	50.57
Honduras	61.88	56.02	55.79	50.56
Senegal	62.03	55	54.32	50.83
Guyana	62.32	n.a.	n.a.	n.a.
Egypt	62.36	56.32	56.95	51.58
Cameroon	62.7	55.59	54.72	50.96
Niger	62.75	56.19	57.34	52.02
Kenya	62.91	56.12	55.99	51.4

cont.ed

Table 4 cont.ed.

Country	$\mathbf{1997}_P$	$\mathbf{1990}_P$	$\mathbf{1985}_P$	$\mathbf{1980}_P$
Bulgaria	62.96	n.a.	n.a.	n.a.
Namibia	63.05	n.a.	n.a.	n.a.
Zimbabwe	63.14	57.46	56.92	51.37
Benin	63.14	n.a.	n.a.	n.a.
Pakistan	63.23	n.a.	n.a.	n.a.
Iran	63.3	55.29	55.22	49.88
Bangladesh	63.34	n.a.	n.a.	n.a.
India	63.41	56.04	56.35	51.5
Mali	63.48	56.96	n.a.	n.a.
Congo, Republic	63.5	n.a.	n.a.	n.a.
Uganda	63.6	57.74	58.44	n.a.
Togo	63.61	56.39	56.5	51.27
Algeria	63.66	54.51	54.85	50.67
Sierra Leone	63.74	56.78	57.92	n.a.
Ukraine	63.93	n.a.	n.a.	n.a.
Romania	64.11	n.a.	n.a.	n.a.
Malawi	64.35	57.35	57.19	n.a.
Madagascar	64.39	56.91	n.a.	n.a.
Chad	64.83	57.85	57.92	n.a.
Zambia	65.05	57.75	n.a.	n.a.
Ghana	65.11	58.39	59	52.04
Congo, Dem. Rep.	65.19	57.9	58.53	52.19
Central African Republic	65.2	57.68	57.55	n.a.
Syria	65.75	58.19	58.58	52.14
Nigeria	66.07	57.24	57.14	51.87
Guinea-Bissau	66.79	58.32	n.a.	n.a.

Notes:

1. The subscript P denotes the parsimonious model.
2. The losses of corruption have been sorted according to the ranking of the parsimonious model of 1997.

Appendix

The appendix provides the definitions of the variables and their sources.

Variables used in tables 1 and 3

Age of democracy: Number of years since 1900 a country has a democracy score continuously greater than zero. Source: Marshall and Jaggers (2000).

Cement: Cement consumption measured in thousand tons adjusted by GDP and population density. Source: Cembureau (1998, 1999).

GDP per capita: Domestic product divided by mid-year population. Source: World Bank (2003).

Latitude: Distance in degrees from the equator, Easterly and Sewadeh (2001).

Legal origin: Dummies for British, French, German and Socialist legal origin. Source: Easterly and Sewadeh (2001).

Private credit: Private credit by deposit money banks and other financial institutions as a share of GDP. Source: Beck *et. al.* (1999).

Restrictions: Range 0 (no restrictions) to 4 (fully restricted). Consists of dummies for the existence of payments restrictions, multiple exchange rates, surrender requirements and restrictions on current transactions. Source: Dreher and Siemers (2003). This is a continuous variables, since it is averaged over seven (for the period 1991-1997) and five years (for the periods 1976-1990).

Rule of law: 0-10 (0 = low; 10 = high) score for the quality of the legal system and property rights. Source: Gwartney *et. al.* (2003).

School enrolment rate: Ratio of total enrolment to the population of the age group that officially corresponds to the level of education shown. Secondary education completes the provision of basic education that began at the primary level. Source: World Bank (2003).

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