Corruption and the Effects of Economic Freedom

Pieroni, Luca and d'Agostino, Giorgio

University of Perugia, University of the West of England

19 November 2009

Corruption and the Effects of Economic Freedom

Pieroni, L. and d'Agostino, G.
University of Perugia and University of the West of England

Abstract

The predictions that economic freedom is beneficial in reducing corruption have not been found to be universally robust in empirical studies. The present work reviews this relationship by using firms' data in a cross-country survey and argues that approaches using aggregated macro data have not been able to explain it appropriately. We model cross-country variations of the microfounded economic freedom-corruption relationship using multilevel models. Additionally, we analyze this relationship by disentangling the determinants for several components of economic freedom because not all areas affect corruption equally. The results show that the extent of the macro-effects on the measures of (micro)economic freedom for corruption, identified by the degree of economic development of a country, can explain why a lack of competition policies and government regulations may yield more corruption. Estimations for Africa and transition economy subsamples confirm our conjectures.

JEL : H10; H11; H50; K20; O5

KEYWORDS : Corruption, economic freedom, multilevel models

11th November 2009

1. Introduction

The failure of markets is a classic justification for government intervention in the economy. In reality, governments often intervene in markets that are not at all affected by failure or imperfections. Misguided government policies interfering with efficient markets have been a central concern to economists for a long time and great efforts have been made to document that the effects of the excess of regulation may cause the seeking of privileges, the hampering of free private entrepreneurial activity and dejection in international exchanges. This means that diminishing these effects should be sufficient to shrink government intervention.

This perspective is also extended for corruption phenomena. As argued by Acemoglu and Verdier (2000), government intervention transfers resources to the private sphere creating room for corruption. This view also sustains that "extensions of privatization and market competition are an effective cure for a corrupt state". On the other hand, as noted by Hodgson and Jiang (2007), corruption may be the reason why market failure exists. Interests of powerful sectoral lobbies can lead policy makers into inefficient actions or make them unresponsive to specific requests to regulate sectors.

In this line of research, much attention has been recently devoted to testing the relationship between economic freedom and corruption under the predictions that economic freedom is beneficial in reducing corruption. We follow the suggestions originally developed with microdata (firms) in mind by Milgron and Roberts (1992) and propose, as explanatory keys, firms' vector indices of economic freedom linked with corruption. We can justify our empirical choice because some components of

economic freedom have a marked microfounded relationship with bribe phenomena in economic activities.

Our research is related to a number of empirical papers that test whether more freedom lowers corruption, implying that economic freedom acts as corruption deterrent (Chafuen and Guzmàn, 2000; Paldam, 2002). Our work is closest in spirit to Graeff and Mehlkop (2003), who consider how specific components of economic freedom affect corruption. Furthermore, we find inspiration from a large literature on corruption that undermines the strength of public institutions and hampers economic growth and development (and vice-versa). Classical references include Shleifer and Vishny (1993), Mauro (1995), Bardhan (1997) and Meon and Sekkat (2005). Our work is also related to the empirical analyses that use microdata to investigate the determinants of corruption (Swamy et al., 2001; Svensson, 2003; Mocan, 2008). Finally, we refer to the works of Hodgson (2006) and Hodgson and Jiang (2007) that extend the role of corruption to the private sector and justify the extensive unsuccessful privatization and the market competition in affecting corruption.

We motivate our analysis by observing conflicting empirical evidence of the hypothesis that more economic freedom reduces corruption, irrespective of the fact that economic freedom is used as an aggregate indicator, subdivided by its components or tested for subsamples of countries. Billger and Goel (2009) show that, among the most corrupt nations, greater economic freedom does not appear to cut corruption. Rather, it may exacerbate corruption issues indicating that nations respond differently to levels of economic freedom because their dimension is associated with country's developing conditions. Serra (2006) identifies these factors by indicators

of economic prosperity and democracy. Furthermore, Graeff and Mehlkop (2003) arguing against the use of an aggregate indicator to evaluate their effects provide support for a counter-intuitive effect of the size of government on corruption. Finally, it is generally argued that corruption differs across "regulated" and "freedom" countries given the possible non-linearities between corruption and its causes. The key question here is that corruption has different social costs across countries because it creates transaction costs and uncertainties in the private sector. This justifies that government interventions may be larger than how sustained for retaining some state intervention to deal with market failures and in some countries good government regulations become relevant in cutting corruption.

Even if by some remote chance the lack of economic freedom is a major cause of corruption for every economy, there must be something else that strongly drives corruption which can explain these results. We consider the broadest class of random effect models to investigate the relationship between economic freedom and corruption and propose a selective strategy in which nested and non-nested multilevel models are tested. We contribute to the previous literature by extending the micro-founded economic freedom determinants of corruption with a model that identifies differences in corruption across countries. Many earlier papers cited above qualify their empirical tests by using aggregate macro data. But estimations using aggregated macro data are not able to reproduce the expected relationships when economic freedom is disaggregated by its components.

We begin our work by documenting the basic facts regarding the key variables of our empirical specification. We then present a multilevel model, a more realistic

framework to test the hypotheses of our work. The remainder of the paper estimates the parameters of the selected models obtained by the sequential test strategy. Although the results in the full sample are almost all in line with the predictions of the standard economic predictions, attention to the firms' heterogeneous responses and cross-country effects is crucial for explaining the puzzle of heterogeneous outcomes when the sample changes. As a result, in African countries and transition economies, government regulations are able to cut inefficiencies and corruption which arise from deficits in economic prosperity and efficient institution rules.

2. Economic freedom and Corruption linkages

2.1. Basic facts

In empirical studies, many difficulties lie in obtaining proper measures of corruption that identify and describe its linkage with the components of economic freedom. By using survey data, Trasparency International measures the known corruption perception index (CPI), highly used to describe the dynamics of corruption. As also argued by Gorodnichenko and Sabirianova (2007), the perception-based indices of corruption do not provide a robust estimation of bribery within countries. However, these indicators remain informative for dynamics or aggregate comparison across countries.

On the other hand, economic freedom can represent the degree to which the policies and institutions of countries intervene in a society (Gwartney et al., 2000). Their magnitude can affect individual incentives, the productive effort and the effectiveness of resource allocation (de Haan and Sturm, 2003; North and Thomas,

1973). The official statistics record that, in recent periods, economic freedom has improved. As measured by the index of Economic Freedom of the World (EFW), the average level increased to 6.6 in 2000 from 5.8 in 1990, and it has been rising in this first decade of the 21^{st} century as well.

In Figure 1, the EFW (for 2000) index is displayed as a rough prediction of its effects on cross-country corruption based on the Transparency International measure. As expected, it does not show surprising results. As the EFW rises (less)corruption increases linearly.

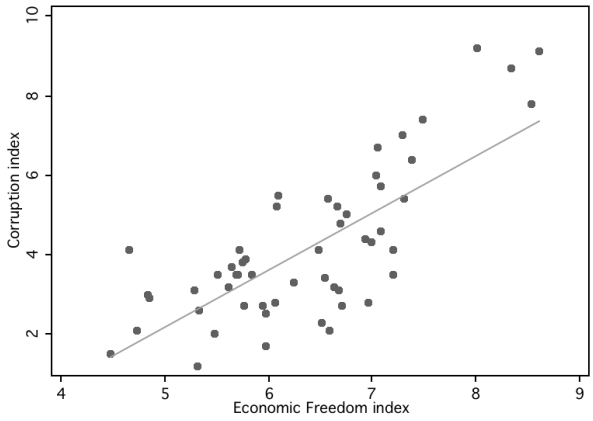


Fig. 1. Summary index score of economic freedom and corruption

Figure 2 shows the same relationship for the sub-sample of African countries. We verify that a nonlinear humped-shaped relationship fits the data very well. Anticipating one thesis of this paper, a prominent role is played by different government interventions that determine an unpredictable relationship between economic freedom and corruption. However, corruption may also arise from sectors with large economic freedom. As argued in Lambsdorff (2007) not all aspects of economic freedom deter corruption because some regulations may increase the transaction costs

of corruption deals. In these cases, whether policy-makers are unresponsive to the demand for regulation "free" competition and the lack of government regulations should be considered as a fallacy of policy formulation. When this behaviour is associated with a weak legal apparatus of recognition and enforcement of the state, as recognized in less developed countries, corruption may strongly emerge because spontaneous mechanisms of economic freedom are conditioned by local rules that allow imposes private bribes, frequently as taxation, in order to improve business. Under these conditions, competition and government regulations are expected to cut corruption.

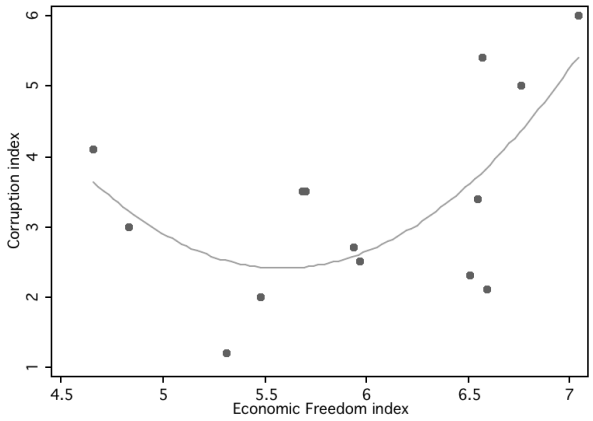


Fig. 2. Summary index score of economic freedom and corruption, sub-sample for Africa.

There is another source of issues regarding the economic freedom indicator used in the empirical literature. As shown in Graeff and Mehlkop (2003), the summary index score of economic freedom competes against its multidimensional representation of freedom[1]. The existence of ambiguous correlations between components of economic

[1]The Fraser Index (2000), a frequently used index of economic freedom, consists for example of 23 components.

freedom and its aggregate measure as well as the weight of the suppression effects in aggregate may produce biases in explaining corruption effects. As an extension of Figure II, it is possible to predict that the composition effects may be emphasized if we collect data only for developing economies. We postpone discussion of these aspects until the next sub-section.

2.2. The components of economic freedom and corruption

We do an exercise by aggregating the firms' indicators of economic freedom and corruption at the country level. We concentrate our attention on their descriptive statistics obtained by the World Business Environment Survey (WBES), postponing the description of the dataset in Section 4. We preserve the macro-level of the data for comparison with the empirical analyses yielded in the economic literature[2]. We have chosen our variables to be adaptable to the areas of the database "economic freedom of the world" (Gwartney et al., 2000). We single out five principal areas: (I) market competition; (II) government regulation of private entrepreneurial activity; (III) the ability of the financial system to support private firms; (IV) property rights and the protection of contracts; (V) the regulation of export. Within of these economic freedom areas, we extract indicators of interest described in Table 1. Figure 3 highlights the results of the descriptive analysis. To make easy reading the graph, contrary to the scale of the Transparency International index, corruption increases in the y axis, while economic freedom decreases moving to the right of the x axis,

[2]We remark that our aim is to give some descriptive insights to the relation to be tested. This is statistically equivalent to aggregating all individual level variables to the group level and carrying out ordinary least squares, for example, by doing regression over group means. A problem with this technique is that within-group information variation is lost (Kreft and Leeuw, 1998).

except for the regulation of trade (panel e), in which the score rises. As is shown in panels a to e, it is not possible to delineate a clear picture concerning the statistical co-movements between these economic freedom indices and corruption. Both for market competition (panel a) and government regulation components (panels b to e), the graph dispersions are not able to confirm the expected relationships suggested by standard theory. Furthermore, these graphs clearly highlight the existence of groups of countries in the data because the effects of the components of economic freedom on corruption have not occurred everywhere in the same way. That is, it emerges that part of the variation of these relationships can be interpreted in terms of unobserved differences between countries.

A way to account for the magnitude of these differences across countries is to estimate the aforementioned relationships by a multilevel framework. Because we use the individual firms' observations in line with the theoretical microfounded relationships, we show that on average the economic responses of firms are differentiated across countries. Namely, it is assumed that microdata are not completely independent such as the results are affected by these clustered structures of the underlying data. Put it differently, the perception of corruption and economic freedom of firms in the same country is more homogeneous that firms in differents countries. Below, we will model this cross-country variability by including a set of aggregated indicators that include the level of democracy or differences in economic development. In line with the above classification, we model property rights and protections of contracts at the micro-level as a condition for firms to legitimate contracts and exchanges and,

in general, the quality of institutions[3].

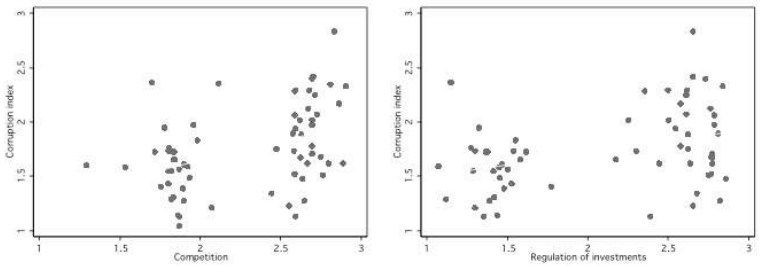
Without losing of generality, a random intercept model is extended to the remaining economic freedom components (panel f-h), although they consistently show that more freedom in the financial system, export regulation and property right protection lowers corruption. The objective of making general statements about phenomena for a larger set of groups suggest, therefore, of assuming a specification in which the intercept varies randomly across country units (Snijders and Bosker, 1999).

3. Econometric specification

In this section we provide a comprehensive description of the multilevel probit model. The interest in these models is a natural improvement to the basic econometric framework when micro-data contain clusters resulting from non-independent observations. Firstly, the more highly correlated the observations are within clusters, the more likely that ignoring clustering would result in biases in estimations and inference. Secondly, the absence of a behavioural model of economic freedom components on corruption makes the analysis still essentially descriptive addressing the use of latent class models.

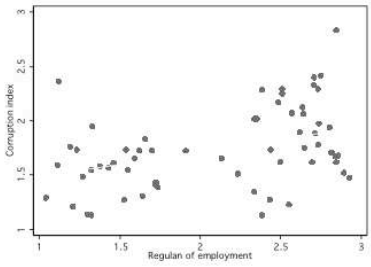
We consider a general formulation of a two-level model. We observe y_{ij}, a binary response for corruption propensity within firms i and related to country j and x_{ij}, a set of explanatory variables at the firm level. We assume that a latent continuous

[3]A criticism to model the quality of institutions on corruption at the micro-level might be based on the low variability of preferences and expectations in face to firms. Mocan (2008) yields a model in which it is assumed that an increase in the quality of the institutions in a country, which would increase the probability of apprehension, would in turn reduce the propensity to ask for a bribe.

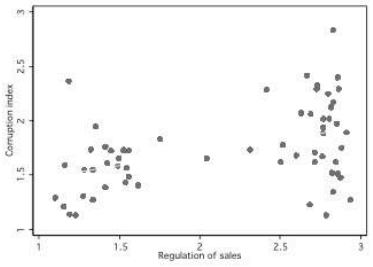


(a) Competition (Area I)

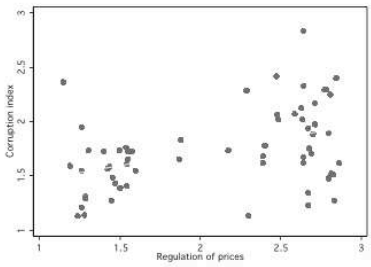
(b) Private investment regulation (Area II)



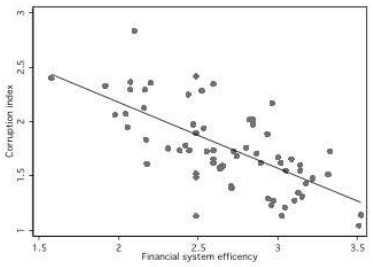
(c) Employment regulation (Area II)



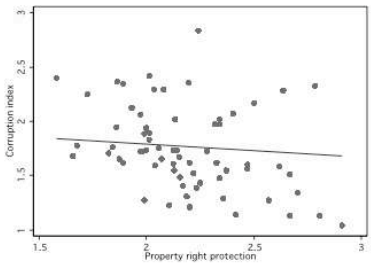
(d) Sales regulation (Area II)



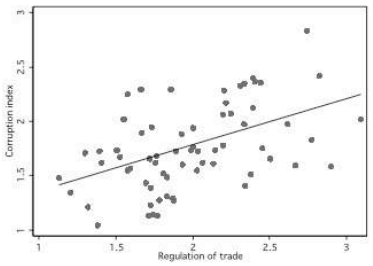
(e) Prices regulation (Area II)



(f) Fiscal market efficiency (Area III)



(g) Property right protection (Area IV)



(h) Export regulation (Area V)

Note: the figures are built by aggregating individual data of economic freedom components and corruption at the country level. The economic freedom areas used to share economic freedom components are derived by Gwartny et al. (2000). For further information on sources, see section 4.1.

Fig. 3. Economic freedom components and corruption, full sample.

variable $y_{ij}*$ exists underlying y_{ij}. We observe our binary response variable y_{ij} directly, but not $y_{ij}*$. We know that $y_{ij} = 1$ if $y_{ij}* > 0$ and $y_{ij} = 0$ if $y_{ij}* \leq 0$. We write the multilevel model for $y_{ij}*$ as

$$y_{ij}* = \beta_{0j} + \beta_1 x_{ij} + \sum_{h=1}^{H} \beta_h x_{i0} + e_{ij} \qquad where \quad e_{ij}|x_{ij} \sim N(0, \pi) \tag{1}$$

where β_{0j} are country specific intercepts and β_1 is the regression coefficient of each economic freedom component. Since we are interested in assessing the impact of the different typologies of economic freedom separately, equation (1) can be seen as a companion matrix that includes the nine indicators, x_{ij}, in the diagonal and otherwise zero. We also include in (1) the firms' fixed effects, x_{i0}, evaluated by the parameters β_h, while e_{ij} are the first level residual terms. Under the hypothesis of a random effect model, we can explicit β_{oj} as

$$\beta_{0j} = \gamma_{00} + \gamma_{01} w_{0j}^1 + u_{0j} \qquad where \quad u_{0j}|x_{ij} \sim N(0, \psi) \tag{2}$$

where γ_{00} is the intercept and γ_{01} are the coefficients of the vector of observed macro-covariates of the second stage to allow us to identify cross-country variation, w_{0j}^1. u_{0j} is the random effect of level two related to the country-specific intercept β_{0j}. The assumption that part of variability of the fit model can be identified by the between-country covariates, w_{0j}^1, does not prevent that the unobserved variability of the country effects may generate dependence between firms' economic freedom components, x_{ij}. Below we turn to the specification of an extended model that contains parameters associated with issues of endogeneity and to the implementation

of nested restriction tests.

Conditioned to the random effect u_{0j}, a probit model is specified by assuming that e_{ij} has a standard normal distribution. As common in this literature, clusters j are assumed independent, the covariance between different firms, $Cov(e_{ij}e_{i'j}) = 0$, and the two level error terms are not correlated, $Cov(u_{0j}, e_{ij}) = 0$, such that we can write the reduced form of the model as

$$y_{ij}* = \gamma_{00} + \gamma_{01}w^1_{0j} + \beta_1 x_{ij} + \sum_{h=1}^{H} \beta_h x_{i0} + u_{0j} + e_{ij} \tag{3}$$

Assuming that u_{0j} is normally distributed, the strategy for estimating the model parameters is to integrate the unobserved random effect, u_{0j},

$$f(y_j|x_j, w^1_j) = \int f(y_j|x_j, w^1_j, u_{0j})g(u_{0j})du_{0j}, \tag{4}$$

where $g(.)$ represents the normal density function[4]. As a result, the unconditional estimation does not determine a closed expression. Maximum likelihood estimation has to resort to approximation procedures such as numerical integration. Rabe-Hesketh et al. (2002) proposed an algorithm by using the posterior mean and variance of the random effects, which are calculated by building on the work of Naylor and Smith (1982)[5]. If the assumed distribution is normal, the numerical quadrature

[4]For the sake of simplicity, we include the fixed effects of the first level in the intercept parameter (γ_{00}).

[5]Although marginal quasi-likelihood (MQL) and penalized quasi-likelihood (PQL) are largely used in statistical literature, these are found to generate downwardly biased estimates (Hedeker, 2008).

approach yields a deviance(Υ) that can be readily used for likelihood-ratio tests. This statistic is given as $\Upsilon = 2(\ln f(y|\widetilde{\vartheta}) - \ln f(y|\widehat{\vartheta})$, where $\ln f(y \mid \widetilde{\vartheta})$is the loglikelihood for the saturated model and $\ln f(y \mid \widehat{\vartheta})$ is the loglikelihood for the model of interest. Some nested specifications can be obtained by the imposition of parameter restrictions calling for a simple likelihood ratio test on the parameter(s) restrictions,

$$LR = 2\left(\ln\ f_{full}(y_{ij}|\theta \neq 0) - \ln\ f_{restr}\ (y_{ij}|\theta = 0)\right) \tag{5}$$

which has an approximate χ^2 distribution with a number of degrees of freedoms equal to the imposed restrictions on the parameters.

From the multilevel model there is no insurance that the unexplained variability among different countries' corruption propensity does not include the effect of omitted macro-variables related to institutions rules and economic growth indicators which, in turn, is correlated with the x_{ij}. For this reason, we model an extended specification of the (3) that includes endogeneity issues. Following Snijders and Berkhof (2004), the aforementioned dependence can be expressed as a regression,

$$w_{0j}^2 = \alpha_{00} + \alpha_{01}\bar{x}._{\,j} + \varepsilon_{0j} \tag{6}$$

where $\bar{x}._{\,j}$ is the cluster mean of x_{ij}. By inserting equation (6) into (3), the random intercept model depends on $\bar{x}._{\,j}$, while the reduced form of the model is given as

$$y_{ij}* = \gamma_{00}^* + \gamma_{01}w_{0j}^1 + \alpha_{01}\bar{x}._{\,j} + \beta_1 x_{ij} + \sum_{h=1}^{H}\beta_h x_{i0} + u_{0j}^* + e_{ij} \tag{7}$$

where $\gamma^*_{00} = \gamma_{00} + \alpha_{00}$, and $u^*_{0j} = u_{0j} + \varepsilon_{0j}$. The exclusion from the analysis of the cluster mean, $\bar{x}._j$, when $\alpha_{01} \neq 0$, yields a biased estimator of β_1.

It is worth noting that control variables for political, economic and institutional characteristics of the country, which may also be those correlated with both corruption and economic freedom components, reduce the endogeneity yielded by the unobserved components of the random effect model. As a restriction of the model in equation (7), we assess the macro-variables effects by imposing the vector $\gamma_{01} = 0$. Formally,

$$y_{ij}* = \gamma^*_{00} + \alpha_{01}\bar{x}._j + \beta_1 x_{ij} + \sum_{h=1}^{H} \beta_h x_{i0} + u^*_{0j} + e_{ij} \tag{8}$$

Figure IV summarizes the nested relationships among models, showing the relevant restrictions on the likelihood function of equation (7). A sequential strategy of the model selection process can be implemented reasonably by partitioning observed and unobserved macro-variates, $W_{0j} = \left[w^1_{0j}; w^2_{0j}\right]$. A double route for testing nested models arises with respect to our focus, because it is not determined *a priori* if fixed macro-indicators are able to cut endogeneity significantly. Assuming that the restrictions of the vector of parameters $\theta_1 = \theta|\gamma_{01} = 0$ and $\theta_2 = \theta|\alpha_{01} = 0$ are not rejected separately, before passing to the next step and testing the restricted models against the benchmark random intercept model, i.e. a model without fixed effects and random coefficients, we have to decide if a best model exists identifying the cross-country variation in the data. By defining the conditional function density for the restricted models, $f(y|x, \theta_1)$ and $g(y|x, \theta_2)$, conventional and adjusted (Vuong 1989) LR tests are used for these non-nested specifications (step 2, Figure IV). The

null hypothesis of model equivalence, $H_0 : E\left[\log \frac{f(y|x,\theta_1)}{g(y|x,\theta_2)}\right] = 0$, is tested against competing model, $H_1 : E\left[\log \frac{f(y|x,\theta_1)}{g(y|x,\theta_2)}\right] > 0$ or $H_1 : E\left[\log \frac{f(y|x,\theta_1)}{g(y|x,\theta_2)}\right] < 0$. If H_0 is rejected, in the first case we prefer $f(.)$ to $g(.)$ and vice-versa if the result is in line with the second hypothesis. Finally, the best model is tested against the basic "random effect" model adding, $\sum_{h=1}^{H} \beta_h x_{i0} = 0$, if restricted a model with $\gamma_{01} = 0$ or $\alpha_{01} = 0$ was found.

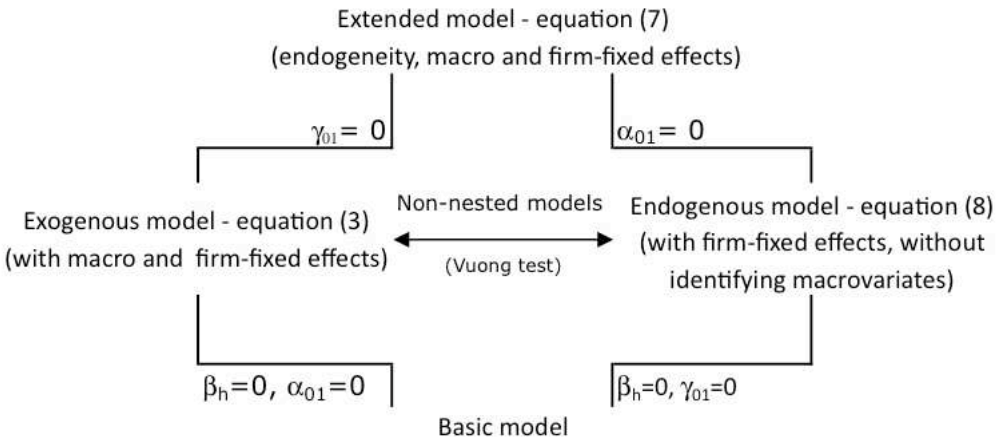


Fig. 4. Strategy for testing nested and non-nested models.

4. Estimations

4.1. Data and empirical models

The data used in the empirical analysis are taken from the Voices of the Firms 2000 of the World Business Environment Survey (WBES), a cross-sectional survey of industrial and service enterprises conducted in mid-1999 by the World Bank and some other agencies. This survey represents the most comprehensive source of micro-data for analyzing both corruption and economic freedom by firms' perception responses.

The WBES survey covers 67 countries in which, on average, more than 100 firms were interviewed. Appendix 1 reports the list of countries by macro-regions and the specific number of firms interviewed. This survey provides detailed information on private viewpoints regarding taxation, government regulation and the financial sector, as well as on perceived corruption raised from the business experience. On the contrary, there is a lack of information concerning controlled and participated enterprises. Although some information on assets, sales, ownership, employees and enterprise growth were collected, it is not enough to fill up detailed balance sheet information and profit and loss statements, reducing the possibility to control firm heterogeneity by economic performances.

In the empirical analysis below we use the discrete variable of perceived corruption as dependent variable. This index (*apay*) measures "how usual it is for firms to have to pay some irregular additional payments to obtain a service from the public administration". This variable (from 1 to 6) indicates the increase of perception regarding the degree of corruption in the line of business in which operates. The response to the corruption items offers an interpretation not only concerning his direct experience but is assumed to include the behaviour of the closest firms in the same environment. This index also endorses the operational definition of corruption that includes the private sector and stands in clear contrast with characterizations of corruption that focus solely on the public sector. Following Hodgson and Jiang (2007), the role of corruptive phenomena in the private sector, in fact, conceptually extends the interactions between private and public sectors (and their institutions) and provides different implications of the state intervention on corruption.

In line with the econometric specification discussed above, we aggregate modalities to generate a dichotomous variable assuming 0 for low corruption and 1 for perceived high corruption[6]. Thus, the corruption index is assumed to be expressible as a (non)linear combination of each economic freedom component and variables that account for the firm's fixed effects as well as for a set of macro-variables, that are able to identify the level(or differences) of the economic development of the countries.

Table 1 reports the description of the explanatory variables selected. The foregoing discussions and the implementation of tests to choose the adequate model require, however, argumentations over the economic freedom indicators generated by the firms' survey. Specifically, the economic freedom components rest on suggestions taken from the empirical literature and are intended to break up the determinants of the summary index score described in section 2. Ades and Di Tella (1999) and Svensson (2005) argue that a positive degree of competitiveness in a country (*comp*)(AREA I, Table 1) reduces the probability of corruption. In this approach, a non-competitive market serves to feed corruption by a rent channel that consolidates a non-market system of the bureaucrats' behaviour and constrains the flow of information from a competition environment out of the firms' control. Emerson (2006) presents a model of the interaction between corrupt government officials and industrial firms to show that corruption is antithetical to competition. As argued by Lambsdorff (2007), the empirical results are sensitive from which measure of competition is used. Below, we test the hypothesis by using the number of firms as a proxy of competition, because

[6]For a comprehensive review of the aggregate corruption perception indexes see Kaufmann *et al.* (1999).

Table 1
Data and variable descriptions

	VARIABLE	DESCRIPTION	RANGE	AREA	SOURCE
Dependent variable					
	apayn	Corruption perception index	Polycotomous variable from 1 to 6 (1 lowest corruption, 6 highest corruption). This variable is summarized as a dichotomous variable from 0 to 1, where 0 (no corruption) 1 (corruption)		WBES2000
Economic freedom components					
	comp	The degree of competitivness in the country (number of enterprises in the market)	From 0 to 3. 0 (no competitors) until 3 (more than 3 competitors)	Area I	WBES2000
	ginv	Government intervention on investments	From 0 to 3. 0 (no government intervention) until 3 (full government intervention)	Area II	WBES2000
	gemp	Government intervention on employment	From 0 to 3. 0 (no government intervention) until 3 (full government intervention)	Area II	WBES2000
	gsle	Government intervention on sales	From 0 to 3. 0 (no government intervention) until 3 (full government intervention)	Area II	WBES2000
	gpce	Government intervention on prices	From 0 to 3. 0 (no government intervention) until 3 (full government intervention)	Area II	WBES2000
	$fagree$	Financial system ability to provide financing to the private sector	From 0 to 1. 0(financing), 1 (no financing)	Area III	WBES2000
	$fconst$	Presence of financial constraints	From 0 to 4. 0 (no financial constraints) until 4 (financial constraints)	Area III	WBES2000
	$frkreg$	Government regulation on trade	From 0 to 3. 0 (no government intervention) until 3 (full government intervention)	Area V	WBES2000
	prprot	Legal system ability to protect property rights and contracts	From 1 to 4. 1 (inefficient legal system) to 4 (efficient legal system)	Area IV	WBES2000
Micro fixed effects					
	size	Number of workers in the firm			WBES2000
	type	Legal organization of the firm	0 (individual owner) 1 (family) 2 (group) 3 (bank) 4 (supervisory board) 5 managers 6 (government)		WBES2000
Macro variables					
	GDP	Gross domestic product per-capita			WDI
	INV	Private investments as share of GDP			WDI
	GOV	Government spending as share of GDP			WDI
	$GINI$	Gini coefficient of distribution of income			WDI
	$CIVIL$	Civil liberty index	From 1 to 6. 1 (no civil liberties) until 6 (full civil liberties)		WAO

Note: "WBES2000" stands for World Business Environment Survey, published by the world Bank in 2000, "WDI" stands for World Development indicators and "WAO" stands for World Audit Organization.

the survey does not contain an explicit indicator of entry barriers of new firms, except for foreign firms. The limits of implementing this index are known, specifically in developing countries, where the barriers can be addressed to avoid the entry of foreign firms. As a result, local firms competing with quality rather than prices are forced to establish myopic behaviour, without a specific worldly wisdom for high-quality reputation. Under these conditions, competition may even increase rather than decrease corruption.

Among the components of economic freedom, corruption is assumed to be influenced by government regulation components (AREA II). Because some specific effects strictly depend on the structure and efficiency of the market, it would be wrong to see corruption as consequences of excessive regulation or to imagine that complete laissez-faire will always be the answer (Bliss and Di Tella, 1997). The perspective that government regulation hampers productive effort, encourages rent seeking and increases the discretionary power of a few public officers still reigns throughout government institutions and scholars (Graeff and Mehlkop, 2003; Paldam, 2002), though it is argued that when government regulation is weak or almost absent, an increase in market rules is crucial to develop a solid productive sector (Hodgson, 2003)[7].

These features have at least two important implications when examining corruption practices in developing country economies. First, results from developed countries should not be directly extended to developing countries' settings without

[7]Developing countries are often characterized by weak law enforcement, a large informal sector, underdeveloped capital markets, and informal credit and insurance networks. As an example, informal arrangements, such as family networks of credit and insurance, have been found to very much influence the impact of interventions, limiting the beginning of corruption.

a serious reflection upon their differences. In fact, to the trade-off between benefits and dis-benefits of state intervention leading with market failures (Acemoglu and Verdier, 2000), we have to add the different impact of negative externalities of corruption in any context. Second and foremost, empirical research has tended to focus on the impact of the overall size of the government budget relative to GDP, often ignoring the interactions of each government regulation component. The test that the size of government is positively correlated with the level of corruption is weak. In fact, Elliott (1997) and Adsera (2003) obtain reverse findings, while Graeff and Mehlkop (2003) and Billger and Goel (2009) show ambiguous results that can only be slightly disentangled by observing the relation in a sub-sample of countries or conditioning the distribution of corruption variable across countries, respectively. These evidences also suggest another avenue. That is, that the particular types of government expenditure might have a different potential, and perhaps more important, to cause corruption with respect to the size of government. Heterogeneity of goods and services supplied in free market are an important source of transaction costs that may be reduced by government regulations, though the planning these interventions may bring large problems of corruption. In our empirical analyses, we differentiate the components of government regulation and control for the levels of development of a country in assessing their impact on corruption. The sign and the magnitude of the government regulation indicators on corruption, *i.e.* government interventions on investments ($ginv$), on employment ($gemp$), on sales ($gsle$) and on prices ($gpce$), becomes therefore an empirical issue.

It has been postulated that the ability of the formal financial system to provide

financing to the private sector ($fagree$) reduces the corruption effects (AREA III). This relationship is unquestionably mitigated by a different degree (or quality) of financial institutions of the countries. As a result, low levels of the country quality of financial institutions may yield a reverse causation of the estimated relationship. Safavian et al. (2001), investigating data from small businesses in Russia, reports that the enterprises more harried by corruption also apply more often for external finance. However, Brunetti et al. (1997) ranking the levels of corruption found that the second most significant impediment to doing business without corruption is the lack of financing. We include the effects of financial constraints on corruption ($fconst$) that is expected to be in their pathological or inefficient expression in the developing or transition countries. It is worth noting that liquidity constraints often emerges in the transition economies, although the financial system may be able to provide financing for the private sector. A feature of these economies is that a high level of investment projects, associated with a potentially inefficient financial system, requires a higher level of intermediation costs. As argued in Ahlin and Pang (2008), these costs related to the magnitude of investment are directly associated to corrupt payments. On the other hand, if corruption is costly for firms, it feeds the demand for corruption as taxation and keeps these financial constraints in the supply of financing.

The legal system's ability to protect property right contracts ($prprot$, AREA IV) is widely suggested as being a policy intervention to reduce corruption in the world economies. 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 (Acemoglu and Verdier, 1998). This

implies that corruption increases. On the contrary to the current literature, we specify a microfounded relationship because firms are able to account for failures in operation of the free market and in line with an extended definition of corruption for private spheres.

Finally, government regulation on export and international trade ($frkreg$, AREA V) is assumed to increase the level of corruption. There are at least three reasons for explaining the hypothesized empirical evidences. Firstly, this effect is linked with the relation between firm rents in a noncompetitive market and import licensing. Krueger (1974) argues that when the number of licenses is fixed, the firm is encouraged to compete to obtain the largest amount of trade licensing. A rational firm will shift productive plans to rent intensive activities and it could turn to bribing transactions to win trade licensing. Secondly, trade barriers may favour inefficient local firms to foreign competitors and forms of corruption may easily arise. Finally, import barriers create an artificial scarcity of specific commodities, channelling part of the non-competitive higher prices towards corrupt bureaucrats that, in developing countries or transition economies, may lead to underground economies. The empirical evidence has provided questionable support of a negative sign in the relation between the extension of international trade and corruption (Treisman, 2000; Torrez, 2002).

In empirical applications, the first level of equations (3), (7) and (8) is usually assumed to be also a function of firms' factors affecting corruption rather than the specific economic freedom components. As largely discussed by Beck et al. (2002), the extent of corruption effects depends on the firm's size ($size$), as well as on its legal organization ($type$) and the sector in which it operates ($sector$). These variables

are included in all model specifications as fixed effects within countries.

Above we have justified multilevel (economic) models because the corruption perception of firms and its relation with economic freedom components depends on country's economic conditions and it is also constrained and mould by institutions (in Hodgson sense) self-reinforcing and self-perpetuating characteristics. Thus, we assume that the random intercept model is determined by (macro) country-factors, leaving to the statistical significance of the means of the economic freedom indicators to check mutual interaction and interdependence (endogeneity)[8]. A set of these indicators in this work are assumed to explain an unobserved variability induced by differences across the country development conditions. Traditional macroeconomic indicators are the gross domestic product per-capita (GDP) [9], the private investment share in GDP (INV) and the Gini-coefficient of distribution of income ($GINI$). Moreover, (La Porta et al., 1999). In the multilevel model we also include the share of government spending in GDP (GOV). As shown by La Porta et al. (1999), the size of the state and its quality represents a key variable to explain differences across countries in corruption.

In addition, we include the civil liberties index ($CIVIL$) as a proxy of the level of democracy in a country (Bliss and Di Tella, 1997). It is known that a strong democratic regime enforces the reliability of public action, decreasing the firms' market power and reducing illegal profit gains[10]. The relevance of including this indicator

[8]This assumption makes symmetric the investigated statistical relationships. However, as sustained by Archer (1995), these relationships are realistically asymmetric since institutions typically precede the activities of individuals.

[9]We use capital letters to distinguish the macro-variables.

[10]Treisman (2000) suggests, among other things, that more developed and more long-standing

for our analysis is justified because the rise of democracy is found to decrease corruption (Emerson, 2006) and, in general, economic growth (Bardhan, 1997; Dreher and Herzfeld, 2005). This leads to assume that as democracy increases corruption seems to fall, irrespective of the level of corruption of a country. On the other hand, the significant impacts of democracy on economic freedom components are well known in this literature (Lundstrom, 2005). It is worth noting that since the quality of the institutions has a direct impact on corruption the very low level of the civil liberties index in developing countries decreases the possibility of controlling for the legal system's ability, to protect property rights and prevent corruption. It is not difficult, in turn, to predict a reduction of the certainty of property rights (Acemoglu and Verdier, 1998) though, once more, endogeneity issues may arise as a result in estimations.

4.2. Results

The choice of the most appropriate specification consists in testing, for each equation, the models presented in Section 3 and summarized in Figure 4. Parsimonious models obtained by placing the relevant restrictions on the likelihood function and are interpreted as special cases of endogenous multilevel probit model (7). Conventional and adjusted likelihood ratio formulation is reported in Table 2.

In the first row, model (7) is tested against model (8) in which macro-effect restrictions are imposed (i.e. $\gamma_{01} = 0$). The results of the LR-test for the nine econometric specifications corresponding to each economic freedom variable clearly reject

democratic countries are less corrupt.

Table 2
Specification tests, full sample.

		comp	ginv	gemp	gsle	gpce	fagree	fconst	prprot	frkreg
Extended model (equation 7)	LRtest	905.56	811.83	821.0637	809.92	813.35	904.48	932.81	836.65	896.28
V.S Endogenous model (equation 8)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Extended model (equation 7)	LRtest	0.70	1.33	2.21	1.62	2.14	0.04	1.75	2.70	2.20
V.S Exogenous model (equation 3)		(0.40)	(024)	(0.13)	(0.20)	(0.14)	(0.83)	(0.18)	(0.10)	(0.13)
Endogenous model (equation 8)	LRtest	905.56	3326.89	3495.53	3467.49	3514.36	3603.52	2880.63	3753.51	3295.41
V.S Basic model		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Exogenous model (equation 3)	LRtest	4450.37	4137.39	4314.38	4275.79	4325.57	4507.96	3715.54	4683.63	4189.50
V.S Basic model		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Exogenous model (equation 3)	Vuong	7.93	17.67	18.00	15.47	11.47	8.47	8.05	-3.74	10.17
V.S Endogenous model (equation 8)	test	(0.00)	(0.00)	(0.00)	(4.20)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Note: we report the $p - values$ in parenthesis. The Vuong test (1989) for non-nested models is carried out under standard normal distribution. The extended model (equation 7) includes endogeneity, macro and firm-fixed effects. The endogenous model (equation 8) includes endogeneity and firm fixed-effects. The exogenous model (equation 3) includes macro and firm-fixed effects.

the hypotheses tested and indicate that these variables are relevant in identifying corruption differences across countries. On the contrary, as shown in the second row, we never reject the endogeneity restriction, $\alpha_{01} = 0$, because the empirical LR-test is always lower than the critical value at the usual percentile. To complete the analysis, we test model specification (3) against the basic random effect model in which fixed micro-effects and country identifying variables are restricted to zero ($\beta_h = 0$ and $\gamma_{01} = 0$). The LR-test rejects the restricted basic model confirming that equation (3) is the best model to rationalize the data. By completing the selection strategy, the Voung test (1989) is implemented testing exogenous random effect model **(3)** against non-nested random effect model with endogeneity (8). The Vuong test statistic leads to the rejection of the hypothesis of model equivalence for each specification and to favouring the model in equation (3). If we evaluate the restrictions from the endogenous random effect model, with firm-fixed effects restricted, the test provides further support to the model chosen (Table 2, row five).

Maximum-likelihood estimates are presented in Table 3. We remark that the use

Table 3
Corruption and Economic freedom components, full sample.

	comp		ginv		gemp		gsle		gpce		fagree		fconst		prprot		frkreg	
comp	0.015																	
	(0.043)																	
ginv			0.084	**														
			(0.038)															
gemp					0.131	***												
					(0.038)													
gsle							0.081	**										
							(0.039)											
gpce									0.122	***								
									(0.037)									
fagree											-0.018							
											(0.063)							
fconst													-0.113	***				
													(0.024)					
frkreg															-0.218	***		
															(0.035)			
prprot																	0.082	***
																	(0.025)	
firm size	-0.122	***	-0.144	***	-0.140	***	-0.135	***	-0.139	***	-0.139	***	-0.113	***	-0.123	***	-0.125	***
	(0.034)		(0.037)		(0.036)		(0.037)		(0.036)		(0.036)		(0.036)		(0.034)		(0.035)	
sector	-0.053	**	-0.056	**	-0.057	**	-0.053	*	-0.054	**	-0.051	*	-0.045		-0.048	*	-0.058	**
	(0.026)		(0.028)		(0.027)		(0.028)		(0.028)		(0.027)		(0.027)		(0.026)		(0.027)	
type	-0.016		-0.017		-0.020		-0.017		-0.016		-0.010		-0.014		-0.015		-0.016	
	(0.016)		(0.016)		(0.016)		(0.016)		(0.016)		(0.017)		(0.016)		(0.016)		(0.016)	
GDP	-0.000	***	-0.000	**	-0.000	**	-0.000	**	-0.000	**	-0.000	***	-0.000	***	-0.000	***	-0.000	***
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
GINI	-0.024	***	-0.020	**	-0.019	**	-0.020	**	-0.018	**	-0.024	***	-0.025	***	-0.025	***	-0.023	***
	(0.008)		(0.009)		(0.009)		(0.009)		(0.009)		(0.007)		(0.008)		(0.007)		(0.008)	
INV	-0.052	***	-0.037	**	-0.035	**	-0.036	**	-0.035	**	-0.050	***	-0.050	***	-0.048	***	-0.055	***
	(0.015)		(0.018)		(0.017)		(0.018)		(0.017)		(0.015)		(0.016)		(0.015)		(0.015)	
GOV	0.180	***	0.173	***	0.172	***	0.174	***	0.170	***	0.182	***	0.174	***	0.165	***	0.184	***
	(0.044)		(0.044)		(0.043)		(0.044)		(0.043)		(0.043)		(0.045)		(0.042)		(0.044)	
CIVILN	-0.094	*	-0.123	**	-0.119	**	-0.124	**	-0.121	**	-0.095	*	-0.086		-0.098	*	-0.092	*
	(0.053)		(0.058)		(0.057)		(0.058)		(0.057)		(0.052)		(0.055)		(0.051)		(0.054)	
Constant	1.386	**	0.928		0.753		0.901		0.735		1.363	**	1.691	**	1.952	***	1.210	*
	(0.671)		(0.764)		(0.753)		(0.769)		(0.753)		(0.641)		(0.671)		(0.633)		(0.667)	
$\rho_{benchmark}$	0.328	***	0.286	***	0.289	***	0.288	***	0.282	***	0.328	***	0.315	***	0.311	***	0.317	***
ρ_{id_macro}	0.095	***	0.093	***	0.090	***	0.093	***	0.091	***	0.088	***	0.098	***	0.087	***	0.098	***
N	3372		2959		2989		2962		2974		3132		3128		3410		3192	

Note: the dependent variable is the dichotomous index of corruption, $apayn$ (γ). We report in parenthesis the standard errors, while the asterisks stand for the p-value significance levels.
We have that $* \ p < 0.1$, $* * \ p < 0.05$, $* * * \ p < 0.01$.

of a multilevel approach instead of a normal logit regression insures that we avoid misleading significance effects due to violations of the assumption of independent errors with a constant variance. This effect is confirmed in our regression results, in which the multilevel regressions display lower levels of significance compared to the logit regression with the same model specification[11]. To support this result, we report the intra-class correlation (ρ) for each estimated specification[12]. For each equation, about 30 percent of the total variability of corruption is attributable to the countries' heterogeneity. Although there are considerable differences in the magnitude of the coefficients both significance and direction of the influence conform in the majority of cases. According to it, the degree of economic prosperity is able to explain gains in efficiency of the economic and social system and to control for corruption (Mauro, 1995). The hypothesis that high-income inequality corresponds to perceptions of unfair state operations and makes the incidence of corruption more likely (Smelser, 1971) seems confirmed. Also the importance of the civil liberty index in reducing corruption is in line with theoretical expectations, while an oversized state affects the efficiency of expenditure and corruption seems to rise irrespective of its level.

Analogous to the country characteristics, we find very consistent patterns at the firm level except that the legal organization of the firm (*type*). The probability of corruptive practises in bigger firms is pervasively found to be $12 - 13$ percent lower independently of the economic freedom equation used. Contrary to that, the indus-

[11]Estimation results obtained on these sub-samples are available from the authors.

[12]As usual, we measure the relationship of the benchmark model by the intraclass correlation (ICC) given as, $\rho = Corr(u_{0j} + e_{ij}, u_{0j} + e_{i'j}) = \frac{\psi}{\psi+\theta} \; for \quad i' \neq i$, where ψ is the proportion of the between-country residual variance with respect to the total residual variance.

trial sector has a higher (on average 5 percent) propensity to experiment corruption, possibly reflecting the better market independence of services to cope with smaller businessmen on starting and/or developing economic activities.

Government regulations on investment, employment, sales and prices increase corruption (Table 3, columns $2-5$). Inefficiencies caused by an over-regulated economic system seem, therefore, to be able to distort private productive activity and to influence corruptive behaviours. Because of the critical role that the labour market plays in the process of economic development (see, e.g., Caballero and Hammour, 2000; Foster et al., 2002; Bartelsman et al., 2004), understanding whether labour market institutions actually help or hinder corruption phenomena stands out as an important task. Although very similar effects across countries are found when looking at individual components of government regulations, protection of employment registers the highest propensity (0.131) in affecting corruption. As expected, where labour market institutions are developed, adding government employment regulations can weigh down the processes of agreement and facilitate corruption practises obtained while mediating among firms, workers and unions. Similarly, the others government regulation indicators significantly affect the reduction of corruption.

In columns 6 and 7, we present the estimated outcomes related to financial market constraints. As expected, according to the compositional effects of countries with different degrees of financial development, we find that constraints in private and public financing projects ($fconst$) increase the probability of corruption while, quite surprisingly, financial systems ($fagree$) do not seem to affect it. Our estimations also comply with the general knowledge on the importance of trade regulation ($frkreg$)

in increasing corruption found by the works of Ades and Di Tella (1997, 1999), Sung and Chu (2003) and Gerring and Thacker (2005).

By far the largest and most significant effect on corruption is exerted by the legal system to protect property rights and contracts (-0.218). We find that limiting the possibility to confiscate private property or repudiating contracts produces positive externalities and seems to determine general improvements in the quality of institutions. As discussed in Glaeser et al. (2001, p. 853), however, this result strictly depends on the difficulty in enforcing complex private contracts and on the potential advantages of a parallel developed framework for organizing private transactions.

Opposite to that, we find no significance of the degree of competition (*comp*). As discussed above, the effects on corruption of the competition level among firms is uncertain. Heavy competition could incite them to pay commissions in order to make up for their weak negotiating power and get market shares as well as a lower competition incites them to anticipate significant rents and to pay bribes in order to get new markets. We anticipate that for subsamples of countries heavy competition, when associated with restrictions on trade, may determine a rise of corruption.

We test the robustness of our results considering two sub-samples, Africa and Eastern Europe countries. We justify this strategy because comparing the level of corruption of African economies with the rest of the world is traditionally argued that these shortfalls of "good" behaviour are the result of differences in infrastructures, macroeconomic mismanagement and weak administrations that affect the microfounded relationships investigates. For example, following Transparency International for the years around 2000, the corruption index for the African region is about 3.35/10,

while the world mean is about 4.00/10. Also the Eastern Europe countries are an interesting case study because of their choice to pass to a freer market economy and democratic regimes during the 90s (*i.e.,* transition economies). As reported in Graeff and Mehlkop (2003), with the exception of Estonia, Transparency International rates the most former communist countries as being highly corrupt. On the other hand, although the liberalization policies in transition countries have been extremely relevant during last decade, the same source of data confirms lesser economic freedom (5.5/10) with respect to the world mean (6.23/10). In particular, the reforms in public sector activities, namely privatization, did not achieve one of their objectives (in 2000 and even after that year) to reduce corruption[13].

Table 4
Specification tests, sub-sample of the African countries.

		comp	ginv	gemp	gsle	gpce	fagree	fconst	prprot	frkreg
Extended model (equation 7)	LRtest	516.08	520.87	517.44	516.18	522.39	527.15	472.14	515.48	499.57
V.S Endogenous model (equation 8) l		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Extended model (equation 7)	LRtest	8.90	0.37	6.58	1.23	0.42	2.80	3.21	6.53	1.61
V.S Exogenous model (equation 3)		(0.40)	(0.54)	(0.01)	(0.26)	(0.51)	(0.09)	(0.07)	(0.01)	(0.20)
Endogenous model (equation 8)	LRtest	144.46	355.28	365.61	349.49	347.02	342.25	351.47	395.47	336.40
V.S Basic model		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Exogenous model (equation 3)	LRtest	651.63	875.78	876.47	864.45	868.99	866.60	820.41	904.43	834.36
V.S Basic model		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Exogenous model (equation 3)	Vuong	43.01	6.61	94.35	75.23	33.69	40.38	23.37	12.93	27.73
V.S Endogenous model (equation 8)	test	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Note: we report the $p - values$ in parenthesis. The Vuong test (1989) for non-nested models is carried out under standard normal distribution. The extended model (equation 7) includes endogeneity, macro and firm-fixed effects. The endogenous model (equation 8) includes endogeneity and firm fixed-effects. The exogenous model (equation 3) includes macro and firm-fixed effects.

[13]The main cause of this failure is clearly discussed by Hodgson (2007) who indicates that "under the communist regimes, informal economic networks often spanned and surpassed ethnic divisions. But political crises and economic recessions.....have inhibited the establishment of a market system with clear and general rules .... affecting economic legality". Specifically, the privatization process in the former USSR, characterized by the sale of state assets, was marked by an increase in corruption because many ideas of traditionalism upheld and were not included in the decisional process criteria of rationality and effectiveness. This offered at oligarchy an opportunity to accumulate illegal fortunes (Sachs, 2005).

Table 5
Specification tests, sub-sample of the Transition economies.

		comp	ginv	gemp	gsle	gpce	fagree	fconst	frkreg	prprot
Extended model (equation 7)	LRtest	259.13	230.42	239.79	244.58	247.68	257.20	241.48	255.47	235.25
V.S Endogenous model (equation 8)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Extended model (equation 7)	LRtest	0.00	0.09	0.15	3.58	3.00	0.97	6.20	0.36	1.87
V.S Exogenous model (equation 3)		(1.00)	(0.76)	(0.69)	(0.05)	(0.08)	(0.32)	(0.01)	(0.54)	(0.17)
Endogenous model (equation 8)	LRtest	289.90	294.99	298.15	285.59	295.65	294.71	251.08	290.79	271.98
V.S Basic model		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Exogenous model (equation 3)	LRtest	549.03	525.32	537.78	526.60	540.33	550.95	486.35	545.90	505.36
V.S Basic model		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Exogenous model (equation 3)	Vuong	49.99	84.77	85.76	7642	103.51	24.88	18.72	-39.25	31.44
V.S Endogenous model (equation 8)	test	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Note: we report the $p - values$ in parenthesis. The Vuong test (1989) for non-nested models is carried out under standard normal distribution. The extended model (equation 7) includes endogeneity, macro and firm-fixed effects. The endogenous model (equation 8) includes endogeneity and firm fixed-effects. The exogenous model (equation 3) includes macro and firm-fixed effects.

We rerun the selection strategy reported in Figure 4. We confirm an exogenous multilevel specification for almost all the corruption equations of these subsamples, except for someone where endogeneity is relevant. In these cases it is suggested the need of including the mean of the firms' variables to account for these issues (Table 4-5, row 2).

Tables 6 and 7 present maximum-likelihood estimates. Quite surprisingly, we find that significant residual variance of the second level exceeds 20 percent in many equations of Africa, showing that country's information plays a relevant role in explaining corruption. This is also the case of transition countries although the significant variation of the intercept of country level is on average slightly more than 10 percent. The explanatory variables at country level have the expected significant effects in most cases, with some exceptions. Neither GDP and $CIVILN$ for African countries nor INV for transition economies exerts a relevant impact on corruption, while both large significance and differences of the size of government appears to explain the most of the country's variability. Its positive impact emphasizes the thesis that

inefficiencies generated by a wide expenditure feed corruptive practises as a misuse of recurrent government budget. Additionally, we anticipate that the inclusion of the country-mean of the explicative variables (i.e., *gemp* and *pprot* for Africa and $gsle$ and $fconst$ for transition economies) can generate a loss of their significance.

The estimated relationships both for these subsamples point out changes in government regulation components ($ginv$), ($gemp$), ($gsle$) and ($gpce$), suggesting that these government interventions are more likely to hinder corruption. These results, in line with Elliott's (1997) argumentations, confirm that the types of government activity provided can directly affect corruption and, indirectly, control for the size of the state expenditure.

Not surprisingly, we find a positive impact of the degree of competition ($comp$) on corruption. As previously mentioned, this result is affected by the high levels of trade barriers that are able to favour local firms and activities and may yield a greater propensity to corrupt bureaucrats. In line with the findings of Gupta et al. (2001), more competition among prevalent local firms, that also share similar norms and rules, incites them to pay commissions to enhance their profitability.

The negative sign of property rights (m_prprot) strengthens the perception that institutional rules help to sustain economic activities and reduces corruptive phenomena in African countries. As expected, the control for endogeneity produces insignificant estimated coefficients for GOV and $CIVILN$. This implies that not only properly functioning property right rules but also sustained political interventions are necessary to improve the issue related to corruption and defend the structure of institutional rules because they do not guarantee the absence of large social costs.

However, in the models that include endogeneity, the microfounded relationships can also show an opposite sign in the estimated coefficient, with respect to those of the country-mean. This is evident for government regulation on employment for Africa ($gemp$), as well as of government regulation on sales in transition economies ($gsle$). While the costs of corruption for Africa are difficult to be reduced by micro-regulation of $gemp$ (as shown by the insignificant value of the coefficient), the minimization of corruption will depend on the effectiveness of institutional labour designs, net of the development level of a country. On the contrary, transition economies may internalize advantages of $gsle$ on corruption by applying policies that not give incentives for an efficient regulation on sales assignments that cuts the costs of corruption.

As suggested by the strategy tests, the financial system ($fconst$) in transition countries is estimated with the additional country-mean regressor as well. The significance of this parameter, together with that at the firm level, strengthens the idea that better financial systems are beneficial for combating corruption and enhancing economic growth. Although this result is generally accepted, when we analyze corruption outcomes for economies in transition they are more complex for the existence of interaction with investments in the private sector. As an example, the lack of institutional rules for the financial system in the former communist economies, soon after the period of reform, has been grounds for increasing phenomena of corruption in growing investments. The significance of the parameter of private investments (INV) confirms the hypothesis of detrimental financial system effects on corruption at least in short run.

5. Concluding remarks

The standard economic model predicts that government intervention transfers resources from the private sector and generates room for corruption. Provided that economic freedom rises sufficiently, the level of corruption tends to fall and keeps falling as the quality of institutions continues to rise. This mechanism received support from conventional estimates of the aggregate economic freedom indicators though the work of Graeff and Mehlkop (2003) documenting that the response of corruption to the components of economic freedom appears to be contradictory. Furthermore, the corruption literature has emphasized the importance of microfounding relationships as an explanation for its determinants (Mocan, 2008).

The purpose of this paper has been to complement previous approaches by estimating cross-country economic freedom and corruption relationships based on multilevel models. In terms of the topic we study, our contribution is to incorporate simultaneously the empirical facts presented in Section 2.2 and to test the previous relationships by a vast sample of firms' data in developing and developed countries. We estimate these relationships correcting for the unobserved variability in the degree of development of a country (or groups). The indicators of economic prosperity, income distribution and democracy at the country level are able to explain why some countries have higher level of corruption. We capture heterogeneity in estimations and remove the empirical issues linked with aggregate data. At the microeconomic level, we can explain when government regulation interventions are incentives and when they are discouragements. A further result of our model is that competition may be bad for corruption and will be so in less developed countries. In those coun-

tries, a specific competition among national firms emerges by including the cost of corruptive practises though these detrimental effects are mediated by the presence of non-competitive rent-seeking sectors that, by lobbies, use pressure instruments to block competitive policies.

If combating corruption is one of the main objectives of the incumbent government, this paper notably suggests that a lack of competition policies and government regulations may actually yield more corruption in less developed countries while standard receipts of greater freedom may be applied in developed countries.

Our model links financial systems or property rights to corruption which are considered positive mechanisms for growth. We answer the question whether these components of economic freedom lead to reduce corruption and we find that, in general, this hypothesis holds. Our model also shows a high and significant variability across countries and the inclusion of identifying country-effects makes the relationship more robust and confirms that democracy and the macroeconomic indicators determine greater efficiency in combating corruption.

The policy makers' line of intervention in less developed countries and transition economies appears to be clear although powerful interests, also distant from theoretical discussions concerning the trade-off between government intervention or not, have influenced the governments to take no action at all, making them almost unresponsive to answer the need to regulate some sectors. As emerges from the empirical analysis, outside the developed countries, policies should be addressed to implement complementary strategy to reduce corruption and costs of the economic growth, selecting (or not) heavy government interventions within sectoral businesses.

REFERENCES

Acemoglu, D., Verdier, T., 1998. Property rights, corruption and the allocation of talent: a general equilibrium approach. Economic Journal 108 (450), 1381–1403.

Acemoglu, D., Verdier, T., 2000. The choice between market failures and corruption. American Economic Review 90 (1), 194-211.

Ades, A., Tella, R. D., 1997. The new economics of corruption: a survey and some new results. Political Studies 45 (3), 496–515.

Ades, A., Tella, R. D., 1999. Rents, competition, and corruption. American Economic Review 89 (4), 982–993.

Adsera, A., 2003. Are You Being Served? Political Accountability and Quality of Government. Journal of Law, Economics and Organization 19 (2), 445-490.

Ahlin, C., Pang, J., 2008. Are financial development and corruption control substitutes in promoting growth? Journal of Development Economics 86 (2), 414–433.

Archer, M.S., 1995. Realistic social theory. The Morphogenetic approach. Cambridge University Press. Cambridge.

Bardhan, P., 1997. Corruption and development: A review of issues. Journal of Economic Literature 35 (3), 1320–1346.

Bartelsman, E. J., Haltiwanger, J., Scarpetta, S., 2004. Microeconomic evidence of creative destruction in industrial and developing countries. Policy Research Working Paper Series, 3464, The World Bank.

Beck, T., Demirguc-Kunt, A., Maksimovic, V., 2002. Financial and legal constraints to firm growth - Does size matter? Policy Research Working Paper Series, 2784, The World Bank.

Billger, S. M., Goel, R. K., 2009. Do existing corruption levels matter in controlling corruption: Cross-country quantile regression estimates. Journal of Development Economics 90 (2), 299 - 305.

Bliss, C., Di Tella, R., 1997. Does competition kill corruption? Journal of Political Economy 105 (5), 1001–23.

Brunetti, A., Kisunko, G., Weder, B., 1997. Institutional obstacles to doing business: region-by-region results from a worldwide survey of the private sector. Policy Research Working Paper Series, 1759, The World Bank.

Caballero, R. J., Hammour, M. L., 2000. Creative destruction and development: Institutions, crises, and restructuring. Annual World Bank Conference on Development Economics, 213-241.

Chafuen, A., Guzmàn, E., 2000. Economic Freedom and Corruption. In O'Driscoll, G., Holmes, K., Kirkpatrick, M., (eds.) 2000 Index of Economic Freedom. The Heritage Foundation. Washington.

de Haan, J., Sturm, J.-E., 2003. Does more democracy lead to greater economic freedom? new evidence for developing countries. European Journal of Political Economy 19 (3), 547–563.

De La Croix, D., Doepke, M., 2009. To Segregate or to Integrate: Education Politics and Democracy. Review of Economic Studies 76 (2), 597-628.

Dreher, A., Herzfeld, T., 2005. The Economic Costs of Corruption: A Survey and New Evidence. EconWPA 0506001, Public Economics.

Elliot, K. A., 1997. Corruption as an international policy problem: overview and recommendations. vol. 3. Institute for international economics, Washington DC.

Emerson, P. M., 2006. Corruption, competition and democracy. Journal of Development Economics 81 (1), 193–212.

Foster, L., Haltiwanger, J., Krizan, C., 2002. The link between aggregate and micro productivity growth: Evidence from retail trade. National Bureau of Economic Research, 9120.

Gerring, J., Thacker, S. C., 2005. Do Neoliberal Policies Deter Political Corruption? International Organization 59 (01), 233-254.

Glaeser, E., Saks, R. E., 2006. Corruption in America. Journal of Public Economics 90 (6-7), 1053–1072.

Gorodnichenko, Y., Sabirianova P. K., 2007. Public sector pay and corruption: Measuring bribery from micro data. Journal of Public Economics 91 (5-6), 963–991.

Graeff, P., Mehlkop, G., 2003. The impact of economic freedom on corruption: different patterns for rich and poor countries. European Journal of Political Economy 19 (3), 605–620.

Gupta, S., de Mello, L., Sharan, R., 2001. Corruption and military spending. European Journal of Political Economy 17 (4), 749–777.

Gwartney, J., Lawson, R., Samida, D., 2000. Economic Freedom of the World 2000. Technical report. The Fraser Institute, Vancouver.

Hedeker, D., 2008. Multinomial models for ordinal and categorial variables. In de Leeuw, J., Kreft, I., (ed.) Handbook of multilevel analysis, 273-274. Springer.

Hodgson, G., 2003. The hidden persuaders: institutions and individuals in economic theory. Cambridge Journal of Economics 27, 159–175.

Hodgson, G., 2006. Institutions, Recessions and Recovery in the Transitional Economies, Journal of Economic Issues 90 (4), 875–894.

Hodgson, G., Jiang, S., 2007. The economics of corruption and the corruption of economics: an institutionalist perspective. Journal of Economic Issues 91 (4), 1043–1061.

Kaufmann, D., Kraay, A., Zoido-Lobaton, P., 1999. Aggregating governance indicators. Policy Research Working Paper Series, 2195. The World Bank, Washington DC.

Kreft, G. G., de Leeuw, J., 1998. Introducing multilevel modeling. Thousand Oaks, Sage.

Krueger, A. O., 1974. The political economy of the rent-seeking society. American Economic Review 64 (3), 291–303.

Lambsdorff, J. G., 2007. The institutional economics of corruption and reform: Theory, evidence and policy. Cambridge University Press, Cambridge.

Leite, C., Weidmann, J., 1999. Does Mother Nature Corrupt: Natural Resources, Corruption, and Economic Growth. IMF Working Papers, Vol. 99/85.

Lundstrom, S., 2005. The effect of democracy on different categories of economic freedom. European Journal of Political Economy 21 (4), 967–980.

Mauro, P., 1995. Corruption and growth. The Quarterly Journal of Economics 110 (3), 681–712.

Mauro, P., 1998. Corruption and the composition of government expenditure. Journal of Public Economics 69 (2), 263–279.

Meon, P. G., Sekkat, K., 2005. Does corruption grease or sand the wheels of growth? Public Choice 122 (1), 69–97.

Milgrom, P., Roberts, J., 1992. Motivation: Contracts, Information and Incentives. In Economics, Organization and Management. Prentice Hall.

Mocan, N., 2008. What determines corruption? international evidence from micro data. Economic Inquiry 46, 493-510.

Naylor, J. C., Smith, A. F. M., 1982. Applications of a Method for the Efficient Computation of Posterior Distributions. Applied Statistics 31 (3), 214-225.

North, D. C., Thomas, R. P., 1973. The Rise of the Western World: A New Economic History. Cambridge University Press. Cambridge.

North, D. C., 1990. Institutions, Institutional Change and Economic Performance. Cambridge University Press. Cambridge.

Paldam, M., 2002. The big pattern of corruption, economics, culture and the seesaw dynamics. European Journal of Political Economy 18, 215- 240.

Rabe-Hesketh, S., Skrondal, A., Pickles, A., 2002. Reliable estimation of generalized linear mixed models using adaptive quadrature. Stata Journal 2 (1), 1-21.

Rose-Ackerman, S., 1999. Corruption and Government: Causes, Consequences, and Reform. Cambridge University Press. Cambridge.

Sachs, J., 2005. The End of Poverty: how we can make it happen in our lifetime. Penguin Books. London.

Safavian, M. S., Sheldon, I., Graham, D. H., Gonzalez-Vega, C., 2001. The differential impact of corruption on microenterprises in russia. Annual meeting American Agricultural Economics Association. Chicago.

Serra, D., 2006. Empirical determinants of corruption: A sensitivity analysis. Public Choice 126(1), 225-256.

Shleifer, A., Vishny, R. W., 1993. Corruption. The Quarterly Journal of Economics 108 (3), 599–617.

Smelser, N., 1971. Stability, instability and the analysis of political corruption. Little Brown, 7–29. Boston.

Snijders, T. A. B., Bosker, R., 1999. Multilevel Analysis: An introduction to basic and advanced multilevel modeling. SAGE.

Snijders, T. A. B., Berkhof, J., 2004. Diagnostic checks for multilevel models. In de Leeuw, J., Kreft, I., (ed.) Handbook of quantitative multilevel analysis. Thousand Oaks, Sage.

Sung, H.-E., Chu, D., 2003. Does Participation in the Global Economy Reduce Political Corruption: An Empirical Inquiry. International Journal of Comparative Criminology 3, 94-118.

Svensson, J., 2005. Eight questions about corruption. Journal of Economic Perspectives 19 (3), 19–42.

Swamy, A., Knack, S., Lee, Y., Azfar O., 2001. Gender and Corruption. Journal of Development Economics 64, 25-55.

Tavares, S., 2005. Does Rapid Liberalization Increase Corruption? EconWPA 0507003, Public Economics.

Treisman, D., 2000. The causes of corruption: a cross-national study. Journal of Public Economics 76, 399– 457.

Vuong, Q. H., 1989. Likelihood ratio tests for model selection and non-nested hypotheses. Econometrica 57 (2), 307-33.

Wei, S. J., 2000. How taxing is corruption on international investors? Review Economics and Statistics 82 (1), 1-11.

Table 6
Corruption and Economic freedom components, sub-sample of the African countries.

	comp		ginv		gemp		gsle		gpce		fagree		fconst		prprot		frkreg	
comp	0.172	*																
	(0.103)																	
ginv			-0.289	***														
			(0.104)															
gemp					-0.150													
					(0.097)													
m_gemp					2.489	**												
					(0.969)													
gsle							-0.288	**										
							(0.134)											
gpce									-0.198	*								
									(0.105)									
fagree											-0.426	***						
											(0.162)							
fconst													-0.133	**				
													(0.059)					
prprot															-0.217	***		
															(0.074)			
m_prprot															-2.065	**		
															(0.814)			
frkreg																	0.248	***
																	(0.059)	
firm size	-0.097		-0.160	**	-0.137	*	-0.115		-0.133	*	-0.105		-0.104		-0.136	*	-0.091	
	(0.075)		(0.075)		(0.074)		(0.075)		(0.074)		(0.076)		(0.079)		(0.074)		(0.076)	
sector	0.040		0.013		0.027		0.023		0.027		0.040		0.037		0.039		0.039	
	(0.045)		(0.044)		(0.044)		(0.044)		(0.044)		(0.045)		(0.046)		(0.044)		(0.045)	
type	-0.090	**	-0.088	**	-0.095	**	-0.071	*	-0.074	*	-0.044		-0.091	**	-0.097	**	-0.076	*
	(0.041)		(0.040)		(0.040)		(0.040)		(0.040)		(0.042)		(0.043)		(0.040)		(0.041)	
GDP	0.000		0.000		0.001	**	0.000		0.000		0.000		0.000		0.000		0.000	
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
GINI	-0.024	*	-0.020		-0.028	**	-0.021		-0.018		-0.028	**	-0.025	*	-0.048	***	-0.014	
	(0.014)		(0.014)		(0.014)		(0.014)		(0.013)		(0.014)		(0.014)		(0.016)		(0.014)	
INV	-0.048	**	-0.057	**	- 0.056	**	-0.044	*	-0.044	*	-0.045	*	-0.046	*	0.034		-0.050	**
	(0.023)		(0.023)		(0.023)		(0.023)		(0.023)		(0.024)		(0.025)		(0.038)		(0.024)	
GOV	0.371	***	0.368	***	0.429	***	0.387	***	0.391	***	0.321	***	0.393	***	- 0.161		0.352	***
	(0.112)		(0.111)		(0.116)		(0.112)		(0.112)		(0.113)		(0.119)		(0.207)		(0.113)	
CIVILN	0.005		0.043		0.042		0.025		0.042		-0.004		0.041		0.087		0.014	
	(0.065)		(0.063)		(0.063)		(0.064)		(0.064)		(0.064)		(0.069)		(0.067)		(0.066)	
Constant	-1.079		0.258		-7.148	**	-0.211		-0.656		0.133		-0.553		8.018	**	-1.422	
	(1.457)		(1.465)		(3.119)		(1.434)		(1.410)		(1.448)		(1.476)		(3.295)		(1.451)	
$\rho_{benchmark}$	0.227	***	0.237	***	0.133	***	0.226	***	0.223	***	0.210	***	0.234	***	0.035	***	0.225	***
ρ_{id_macro}	0.000	***	0.000	***	0.000	***	0.000	***	0.000	***	0.000	***	0.000	***	0.000	***	0.000	***
N	578		590		595		589		593		578		545		612		582	

Note: the dependent variable is the dichotomous index of corruption, $apayn$ (γ). We report in parenthesis the standard errors, while the asterisks stand for the p-value significance levels.
We have that $*\ p < 0.1$, $**\ p < 0.05$, $***\ p < 0.01$.

Table 7
Corruption and Economic freedom components, sub-sample of the Transition countries.

	comp		ginv		gemp		gsle		gpce		fagree		fconst		prprot		frkreg	
comp	0.138	**																
	(0.063)																	
ginv			-0.194	***														
			(0.058)															
gemp					-0.223	***												
					(0.068)													
gsle							-0.223	***										
							(0.060)											
m_gsle							1.161	*										
							(0.614)											
gpce									-0.123	**								
									(0.053)									
fagree											-0.021							
											(0.075)							
fconst													-0.161	***				
													(0.031)					
m_fconst													-0.717	**				
													(0.288)					
prprot															-0.215	***		
															(0.051)			
frkreg																	0.127	***
																	(0.036)	
firm size	-0.101	*	-0.145	**	-0.148	**	-0.163	***	-0.149	**	-0.121	**	-0.134	**	-0.107	*	-0.118	*
	(0.059)		(0.064)		(0.061)		(0.063)		(0.061)		(0.061)		(0.064)		(0.059)		(0.064)	
type	-0.071	***	-0.077	***	-0.066	***	-0.062	**	-0.068	***	-0.075	***	-0.057	**	-0.062	***	-0.066	**
	(0.024)		(0.026)		(0.025)		(0.026)		(0.025)		(0.025)		(0.027)		(0.024)		(0.026)	
GDP	-0.000	**	-0.000	*	-0.000	**	-0.000		-0.000		-0.000	**	-0.000		-0.000	**	-0.000	*
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
GINI	-0.018	**	-0.022	**	-0.019	**	-0.037	**	-0.018	*	-0.016	*	0.005		-0.012		-0.016	
	(0.009)		(0.010)		(0.009)		(0.015)		(0.009)		(0.009)		(0.013)		(0.009)		(0.010)	
INV	0.009		0.006		0.007		-0.008		0.013		0.009		0.033	*	0.019		0.016	
	(0.017)		(0.018)		(0.017)		(0.021)		(0.017)		(0.017)		(0.020)		(0.017)		(0.018)	
GOV	0.142	***	0.137	***	0.139	***	0.149	***	0.154	***	0.148	***	0.193	***	0.152	***	0.142	***
	(0.023)		(0.024)		(0.024)		(0.024)		(0.024)		(0.023)		(0.029)		(0.023)		(0.024)	
CIVILN	-0.099	**	-0.114	**	-0.100	*	-0.216	**	-0.111	**	-0.103	**	-0.049		-0.067		-0.141	***
	(0.049)		(0.054)		(0.053)		(0.085)		(0.052)		(0.050)		(0.059)		(0.050)		(0.053)	
Constant	-0.295		0.981		0.864		-1.072		0.345		0.059		0.727		-0.121		-0.178	
	(0.603)		(0.645)		(0.618)		(1.004)		(0.592)		(0.607)		(0.647)		(0.582)		(0.642)	
$\rho_{benchmark}$	0.112	***	0.100	***	0.109	***	0.107	***	0.106	***	0.111	***	0.103	***	0.107	***	0.107	***
ρ_{id_macro}	0.000	***	0.000	***	0.000	***	0.000	***	0.000	***	0.000	***	0.000	***	0.000	***	0.000	***
N	1706		1408		1517		1522		1539		1670		1432		1710		1429	

Note: the dependent variable is the dichotomous index of corruption, $apayn$ (γ). We report in parenthesis the standard errors, while the asterisks stand for the p-value significance levels.
We have that $* \ p < 0.1$, $* * \ p < 0.05$, $* * * \ p < 0.01$.

APPENDIX 1: LIST OF COUNTRIES BY MACRO-REGIONS

country name	Africa	Mena	Transition	East Asia	South Asia	Latin America	OECD	Total
Albania	0	0	163	0	0	0	0	163
Argentina	0	0	0	0	0	100	0	100
Bangladesh	0	0	0	0	50	0	0	50
Belize	0	0	0	0	0	50	0	50
Bolivia	0	0	0	0	0	100	0	100
Botswana	101	0	0	0	0	0	0	101
Brazil	0	0	0	0	0	201	0	201
Bulgaria	0	0	125	0	0	0	0	125
Cameroon	57	0	0	0	0	0	0	57
Canada	0	0	0	0	0	0	101	101
Chile	0	0	0	0	0	100	0	100
China	0	0	0	101	0	0	0	101
Colombia	0	0	0	0	0	101	0	101
Costa Rica	0	0	0	0	0	100	0	100
Cote d'Ivoire	97	0	0	0	0	0	0	97
Croatia	0	0	127	0	0	0	0	127
Czech Republic	0	0	137	0	0	0	0	137
Dominican Republic	0	0	0	0	0	111	0	111
Ecuador	0	0	0	0	0	100	0	100
Egypt. Arab Rep.	0	102	0	0	0	0	0	102
El Salvador	0	0	0	0	0	104	0	104
Estonia	0	0	132	0	0	0	0	132
France	0	0	0	0	0	0	100	100
Germany	0	0	0	0	0	0	100	100
Ghana	119	0	0	0	0	0	0	119
Guatemala	0	0	0	0	0	106	0	106
Haiti	0	0	0	0	0	103	0	103
Honduras	0	0	0	0	0	100	0	100
Hungary	0	0	129	0	0	0	0	129
India	0	0	0	0	210	0	0	210
Indonesia	0	0	0	100	0	0	0	100
Italy	0	0	0	0	0	0	100	100
Kenya	113	0	0	0	0	0	0	113
Lithuania	0	0	112	0	0	0	0	112
Madagascar	116	0	0	0	0	0	0	116
Malawi	55	0	0	0	0	0	0	55
Malaysia	0	0	0	100	0	0	0	100
Mexico	0	0	0	0	0	100	0	100
Namibia	95	0	0	0	0	0	0	95
Nicaragua	0	0	0	0	0	100	0	100
Nigeria	93	0	0	0	0	0	0	93
Pakistan	0	0	0	0	103	0	0	103
Panama	0	0	0	0	0	100	0	100
Peru	0	0	0	0	0	108	0	108
Philippines	0	0	0	100	0	0	0	100
Poland	0	0	225	0	0	0	0	225
Portugal	0	0	0	0	0	0	100	100
Romania	0	0	125	0	0	0	0	125
Russian Federation	0	0	525	0	0	0	0	525
Senegal	124	0	0	0	0	0	0	124
Singapore	0	0	0	100	0	0	0	100
Slovak Republic	0	0	129	0	0	0	0	129
Slovenia	0	0	125	0	0	0	0	125
South Africa	121	0	0	0	0	0	0	121
Spain	0	0	0	0	0	0	104	104
Tanzania	83	0	0	0	0	0	0	83
Thailand	0	0	0	422	0	0	0	422
Trinidad and Tobago	0	0	0	0	0	101	0	101
Tunisia	0	52	0	0	0	0	0	52
Turkey	0	0	150	0	0	0	0	150
Uganda	137	0	0	0	0	0	0	137
Ukraine	0	0	225	0	0	0	0	225
United Kingdom	0	0	0	0	0	0	102	102
United States	0	0	0	0	0	0	100	100
Venezuela. RB	0	0	0	0	0	100	0	100
Zambia	84	0	0	0	0	0	0	84
Zimbabwe	129	0	0	0	0	0	0	129
Total	1,524	154	2,429	923	363	1,985	807	8,185