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CORRUPTION AND THE EFFECTS OF ECONOMIC FREEDOM

Luca Pieroni – Giorgio d'Agostino

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Corruption and the Effects of Economic Freedom

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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; O50

KEYWORDS : Corruption, economic freedom, multilevel models

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20th September 2011

1. Introduction

Much attention has recently been devoted to testing the relationship between economic freedom and corruption, under the prediction that economic freedom is beneficial in reducing corruption[1]. As corruption data are largely available at aggregate (country) level, existing research has focused on explaining economic cross-country relationships. The findings are not generally far from the results of the standard theoretical hypothesis (Chafuen and Guzmàn, 2000; Paldam, 2002; Graeff and Mehlkop, 2003; Shen and Williamson, 2005; Carden and Verdon, 2010).

However, this literature also records conflicting evidence that more economic freedom reduces corruption when it is regressed on the entire distribution of corruption, subdivided by its components, or when the relationship is tested for subsamples of countries[2]. For example, Billger and Goel (2009) showed that, among the most corrupt nations, greater economic freedom does not appear to reduce corruption. Rather, it may exacerbate corruption issues indicating that nations respond differently to different levels of economic freedom because their dimension is associated with the country's developing conditions. Conversely, Graeff and Mehlkop (2003), arguing against the use of an aggregate indicator of economic freedom to evaluate their effects, provided support for a counter-intuitive influence of the size of government on corruption, as a specific component of economic freedom. The literature has also invoked an institutional dimension to explain some unexpected results. Lambsdorff (2007) argued that the need for government intervention may not be large enough if it is addressed to avoid market failures such as "good"government regulations may become significant in reducing corruption. This implies that the impact of economic freedom or its components on corruption may depend on the variability of government intervention efficiency across "regulated"and "freedom"countries.

In this paper, we test the relationship between economic freedom and corruption at the micro-level by accounting for differential effects in country institutions which are known to provide a more or less fertile breeding ground for corruption. We follow the suggestions originally developed with microdata (firms) in mind by Milgrom and Roberts (2008) and consider, as explanatory keys of corruption, firms' indices of economic freedom. We justify our empirical choice because many components of economic freedom have a natural micro-founded relationship with bribe phenomena. This choice is also in line with the idea of a multidimensional effect of freedom on corruption. From microdata, we build different dimensions of economic freedom, functionally in line with the macro literature, in which the bias due to suppression effects in aggregate is reduced. We assume that unexplained, insignificant or mitigated relationships of corruption with the components of economic freedom may be explained by differences in a number of country characteristics. That is, unlike (non-linear) models which include conditioning variables at macro level to explain why the effect of economic freedom on corruption is not uniform, we specify the broadest class of multilevel models and and propose a selective strategy in which nested and non-nested multilevel models are tested. Our contribution is to randomly model unexplained firms' heterogeneity across countries, with the double aim of keeping the micro-founded relationships robust and of identifying the socio-economic and institutional factors responsible for these cross-country differences at country level. We believe that this empirical framework should be able to mitigate the mismatch between macro and micro evidence.

[1]Berggren (2003) defines economic freedom as "'a composite that attempts to characterise the degree to which an economy is a market economy, that is, the degree to which it entails the possibility to enter into voluntary contracts within the framework of a stable and predictable rule of law that upholds contracts and protects private property, with a limited degree of interventionism in the form of government ownership, regulations and taxes"'.

[2]See Lambsdorff (2007) for a review on works in which the relationship between economic freedom and corruption is insignificant or in which the impact of economic freedom increases corruption.

Our research is related to a number of empirical papers testing whether more freedom lowers corruption (Chafuen and Guzmàn, 2000; Paldam, 2002), although we have focused on the framework of Graeff and Mehlkop (2003) which considers how specific components of economic freedom affect corruption. We also find inspiration from a large literature on corruption that undermines the strength of public institutions and hampers economic growth and development (and vice versa). Some classical references include Shleifer and Vishny (1993), Mauro (1995), Bardhan (1997), Treisman (2000) and Méon and Sekkat (2005). Our work is also related to the empirical analyses which use microdata to investigate corruption and its determinants (Swamy et al., 2001; Svensson, 2005; Mocan, 2008). Lastly, we refer to the works by Hodgson (2006) and Hodgson and Jiang (2007) which extend the role of institutions in affecting corruption.

We begin our work by documenting the basic facts regarding the key variables of our empirical specification. We then give some insights concerning data extracted from the World Business Environment Survey (WBES) and how we derive variables for the empirical analysis. The next Section presents the various specifications of the multilevel models, a more realistic framework to test the hypotheses of our work. The rest of the paper estimates the parameters of the selected models obtained by the sequential test strategy. Although the results in the full sample are sufficiently in line with the literature of standard economic predictions, attention to firms' heterogeneous responses and cross-country effects is crucial in explaining the puzzle of heterogeneous outcomes when the sample changes. The results highlight the fact that government regulation interventions in African countries and transition economies may reduce corruption, whereas the large variability across countries is identified not only by differences in economic prosperity, but also by the country's quality institutions.

2. Economic freedom and links with Corruption

2.1. Basic facts

In empirical studies, many difficulties lie in identifying proper measures of corruption. By means of survey data, Transparency International measures the known corruption perception index (CPI), frequently used to describe the dynamics of corruption. Although criticisms show that this perception-based index (as well as other similar ones) does not provide a robust estimate of bribery within countries, it may remain informative for dynamics or aggregate comparisons across countries[3].

In line with our aims, the economic freedom index published by Economic Freedom of the World (EFW) is designed to measure a country's institutions and policies comparatively (Gwartney and Lawson, 2000). It is traditionally argued that its magnitude affects individual incentives, productive effort, and the effectiveness of resource allocation (North and Thomas, 1973; de Haan and Sturm, 2003). The key ingredients of this index are mainly based on objective components (such as government consumption as a share of total consumption, or transfers and subsidies as a share of GDP), collected from external sources, i.e. International Monetary Fund, World Bank and World Economic Forum, as well as data based on surveys, expert panels, and case studies. The scores of these variables are summarised in five main areas of economic freedom[4]: i) the size of government; ii) legal structure and security of property rights; iii) access to finances and sound money; iv) freedom to trade internationally, and v) regulation of credit, labor, and business. The final score of the aggregate EFW index, which ranges from 1 to 10, where 10 is the maximum degree of economic freedom, obtained as means of these components.

[3]For a discussion on this topic, see for example Gorodnichenko and Sabirianova (2007).

[4]The number of collected variables to construct this index is not constant over time. For example, 21 components of economic freedom were considered in 2005, but 23 in 2008.

Official statistics have recorded that in recent periods, economic freedom has improved. As measured by the EFW index, the average level increased from 5.8 in 1990 to 6.6 in 2000, and has also been rising in this first decade of the 21st century. Figure 1 shows the EFW (for 2000) as a rough prediction of its effects on cross-country corruption based on the Transparency International measure. As expected, its results are not surprising. As the EFW rises (less)corruption increases linearly.

Figure 1: Cross-country relationship between economic freedom and (less)corruption

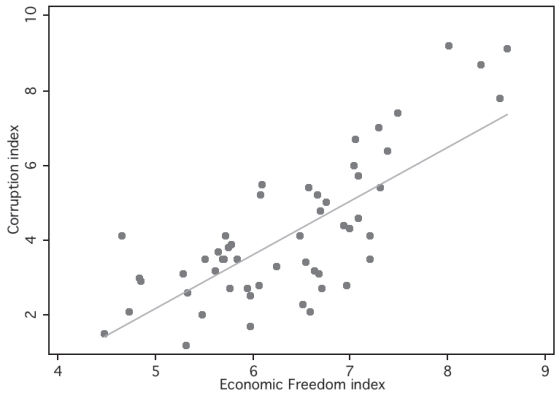


Figure 2 shows the same relationship for a subsample of African countries. We found that a nonlinear hump-shaped relationship fits the data very well. Although with cross-country regressions of economic freedom and corruption the expected relationship is in line with the prevailing views (e.g., see Graeff and Mehlkop (2003), for subsample estimations), a prominent role is played by sectoral differences in government interventions. This leads to other problems regarding the use of an economic freedom indicator 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. The existence of ambiguous correlations between components of economic freedom and its measure at macro level and the weight of suppression effects in aggregate may produce biases in explaining corruption effects.

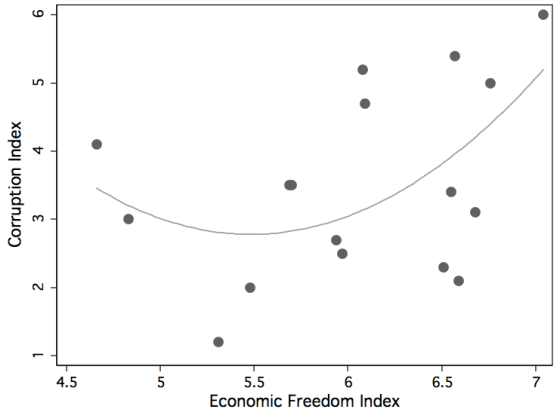
However, corruption may also arise from sectors with large economic freedom. As argued by Lambsdorff (2007), not all aspects of economic freedom deter corruption, because some regulations may increase the transaction costs of corruption deals. In these cases, whether policy-makers are unresponsive to the demand for regulation or not, "free"competition and lack of government regulations should be considered as a fallacy of policy formulation. When this behaviour is associated with a weak legal apparatus of acknowledgement and enforcement by the state, as recognised in less developed countries, corruption may emerge strongly because spontaneous mechanisms of economic freedom are conditioned by local rules which impose private bribes, frequently as taxation, to improve business.

As an extension of Figure 2, in the empirical section we prove that these composition effects can be highlighted when we collect data only for Africa.

2.2. Data

In this paper, we use data from the Voices of the Firms 2000 of the 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

Figure 2: Cross-country relationship between economic freedom and (less)corruption, African countries



comprehensive source of micro-data for analysing 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 lists the countries by macro-region and the specific number of firms interviewed. The survey provides detailed information, based on the direct views of firm managers, private viewpoints regarding taxation, government regulation, and the financial sector, and on corruption perceived raised in business experience. However, responses to corruption items offer an interpretation not only concerning direct experience; it is also assumed to include the behaviour of the closest sectoral firms in the same environment.

From the survey, we extracted the firms' responses to the corruption variable in six modalities: "How usual is it for firms to have to pay some kind of irregular extra payment in order to obtain services from the public administration?", where 6 indicates that firms "always"pay to obtain services. Here, for descriptive motivation, we summarise firms' responses in a mean of corruption index at country level. Instead, we will return in Section 4 to the derivation of the corruption variable as a binary specification of corruption item responses at firm level.

Following the questions arisen from the empirical literature, we identify five dimensions of economic freedom at micro level from the items of the WBES: (I) market competition; (II) government regulation of private entrepreneurial activity; (III) ability of the financial system to support private firms; (IV) property rights and the protection of contracts, and (V) regulation of export.

The dimensions proposed here differ from the economic freedom areas published by Gwartney and Lawson (2002), because we do not include the size of government currently recorded at aggregate level[5], but embody indicators which refer to market competition (Dimension I). In line with Ades and Di Tella (1999), we measure the absence of market dominance by the access of a unlimited number of enterprises and anti-competitive practises, to test whether they are favourable or detrimental, respectively, to corruptive activities. For the first index, discrete modalities are graded on a scale from 1 to 3, with 3 implying a lower degree of market dominance. Constraints based on anti-competitive practises are graded from 1 to 4, where 1 indicates the absence of obstacles to business activity. As in Ades and Di Tella (1999), we also include a specific indicator of market competition concerning the firm's ability to obtain information on laws and regulations (6 if the firm respondent disagrees concerning the ease of obtaining information, and 1 otherwise).

[5]See Graeff and Mehlkop (2003) for a discussion of the effect of government size and corruption.

Table 1: Data and variable descriptions

VARIABLES	DESCRIPTION	RANGE	DIMENSION	SOURCE
Dependent variable				
Corruption index	"It is common for firms in my line of business to have to pay some irregular additional payments to get things done."	Discrete variable from 1 to 6: 1 (never), 2 (seldom), 3 (sometimes), 4 (frequently), 5 (mostly), and 6 (always).		WBES2000
Economic freedom components				
Non-market dominance	"Regarding your firm's major product line, how many competitors do you face in your market?"	Discrete variable from 1 to 3: 1 (no competitors), 2 (3 or fewer), 3 (more than 3).	Dimension I	WBES2000
Anti-competitive behaviour	"Please judge on a four-point scale how problematic are the following factors for the operation and growth of your business."	Discrete variable from 1 to 4: 1 (no obstacle), 2 (minor obstacle), 3 (moderate obstacle), 4 (major obstacle).	Dimension I	WBES2000
Information constraints	"In general, information on the laws and regulations affecting my firm is easy to obtain."	Discrete variable from 1 to 6: 1 (fully agree), 2 (agree in most cases) 3 (tend to agree), 4 (tend to disagree), 5 (disagree in most cases), 6 (fully disagree).	Dimension I	WBES2000
Private investment regulation	"How often does the government intervene in the following types of decisions by your firm?"	Discrete variable from 1 to 6: 1 (never), 2 (seldom), 3 (sometimes), 4 (frequently), 5 (usually), 6 (always).	Dimension II	WBES2000
Employment regulation	"How often does the government intervene in the following types of decisions by your firm?"	Discrete variable from 1 to 6: 1 (never), 2 (seldom), 3 (sometimes), 4 (frequently), 5 (usually), 6 (always).	Dimension II	WBES2000
Sales regulation	"How often does the government intervene in the following types of decisions by your firm?"	Discrete variable from 1 to 6: 1 (never), 2 (seldom), 3 (sometimes), 4 (frequently), 5 (usually), 6 (always).	Dimension II	WBES2000
Prices regulation	"How often does the government intervene in the following types of decisions by your firm?"	Discrete variable from 1 to 6: 1 (never), 2 (seldom), 3 (sometimes), 4 (frequently), 5 (usually), 6 (always).	Dimension II	WBES2000
Financial constraints	"Financial system ability to provide financing to the private sector"	Binary variable: 0 (financing), 1 (no financing).	Dimension III	WBES2000
Financial obstacles	"Please judge on a four-point scale how problematic are the following factors for the operation and growth of your business."	Discrete variable from 1 to 4: 1 (no obstacle), 2 (minor obstacle) 3 (moderate obstacle), 4 (major obstacle).	Dimension III	WBES2000
Property rights and contract protection	"Judgement on legal system ability to protect property rights and contracts"	Discrete variable from 1 to 3: 1 (fully disagree), 2 (tend to agree), 3 (fully agree).	Dimension IV	WBES2000
Export regulation	"How often does the government intervene in the following types of decisions by your firm?"	Discrete variable from 1 to 3: 1 (never), 2 (seldom), 3 (sometimes), 4 (frequently), 5 (usually), 6 (always).	Dimension V	WBES2000
Firm's covariates				
Firm size	"Number of full-time employees"	Discrete variable from one to three: 1 (small, 50 or fewer employees), 2 (medium, 51-500 employees), 3 (large, 501 or more employees)		WBES2000
Firm sector	"Principal sector of business"	Discrete variable from one to five: 1(manufacturing), 2 (services), 3 (other), 4 (agriculture), 5 (construction)		WBES2000
Legal organisation of firm	"What is the legal organisation of this company?"	Discrete variable from one to five: 1 (single proprietorship) 2 (partnership) 3 (cooperative) 4 (corporation, privately-held) 5 (corporation listed on a stock exchange)		WBES2000
Macro covariates				
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	Ordered variable from 1 (no civil liberties) to 6 (full civil liberties)		WAO

Note: The label of the sources are: "WBES2000", World Business Environment Survey, by the World Bank in 2000; "WDI", World Development Indicators; "WAO" World Audit Organisation.

To compare the areas of Gwartney and Lawson (2002) with our micro-founded dimensions of economic freedom, we attribute our dimensions II and III to Gwartney and Lawson's (2002) fifth area (Regulation of Credit, Labor, and Business). In our dimension II, the respondent answers the question "How often does the government intervene...in decisions by your firm?". We use indicators of government regulation in private investment, employment sales and prices to measure the magnitude of this intervention. For all four indices, firms are graded on a scale from 1 to 6, where 6 means that the government intervenes in private activities. Dimension III includes indicators of financial constraint and obstacles. While in the first case a binary variable measures the lack of financing to the private sector, the nature of financial obstacles is ranked from 1 to 4, where 4 represents the extent of major obstacles.

In line with the Legal Structure and Security of Property Rights dimension in Gwartney and Lawson (2002), we use an index (from 1 to 3) which measures the ability of the legal system to protect "property right and contract", where 3 is the firms' perception of complete ability. Lastly, we define a dimension for export regulations in line with the Freedom to Exchange with Foreigners area, although a functional classification based on government intervention may also include it in dimension II. Table 1 lists the complete description of the corruption index, as well as the covariates of economic freedom at micro level.

Figures 3 and 4 show the results of the bivariate relationships of economic freedom components and corruption at country level by aggregating firms' responses. We preserve the aggregate level of the data for comparison with the usual empirical analyses observed in the economic literature[6].

Unlike the scale of the Transparency International index, corruption increases along the y-axis, whereas economic freedom decreases moving to the right of the x-axis. In many of the panels of these figures, clear pictures cannot be defined concerning the statistical significance between economic freedom indices and corruption. For non-market dominance, information constraints (Figure 3, panels a and c), government regulation components (Figure 3, panels d-e, and Figure 4, panels a-b) and property rights and contract protection (Figure 4, panels d), the dispersions do not confirm the expected relationships suggested by standard theory that more freedom reduces corruption. These graphs also clearly highlight the existence of grouped 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, some of the variability of these relationships may be interpreted in terms of unobserved differences across countries.

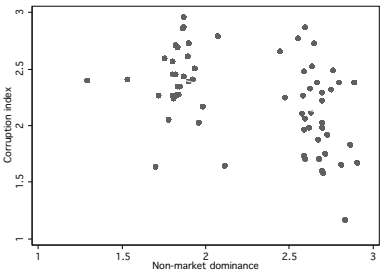
One way of accounting for the magnitude of these differences across countries is to specify the above relationships by a multilevel framework, assuming that on average the economic responses of firms are differentiated across countries. It is worth noting that, in line with the above classification, we model property rights and protection of contracts at the micro level as a condition for firms to legitimate contracts and exchanges[7].

Without losing generality, a multilevel model is also suggested as an extension to the remaining economic-freedom components, i.e., the absence of anti-competitive behaviours, more freedom in the financial system, export regulation, although in aggregate they consistently show that higher extents of freedom lower corruption (Figure 3, panel b, and Figure 4, panels c

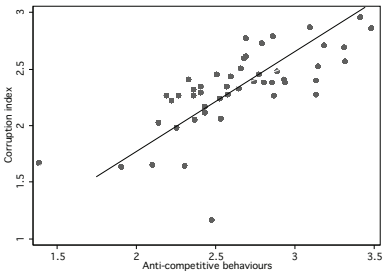
[6]We note that our aim is to give some descriptive insights to the relation to be tested. This is statistically equivalent to aggregating all individual level variables to group level and carrying out ordinary least squares, e.g. regression over group means. A problem with this technique is that within-group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

[7]A criticism in modelling the quality of institutions on corruption at micro level is based on the low variability of preferences and expectations in face to firms. Mocan (2008) developed 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 for asking for bribes.

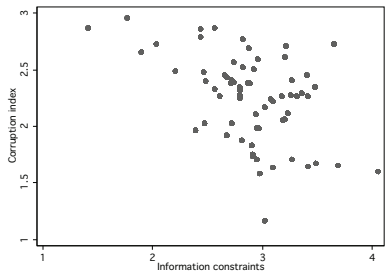
Figure 3: Economic freedom components and corruption, WBES sample.



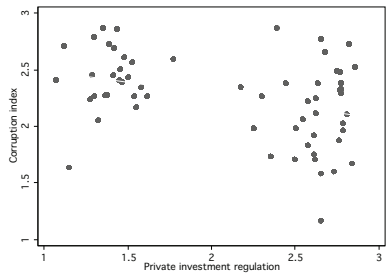
(a) Non-market dominance (Dimension I)



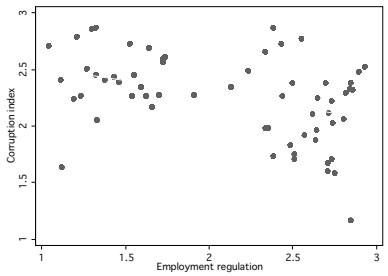
(b) Anti-competitive behaviours (Dimension I)



(c) Information constraints (Dimension I)



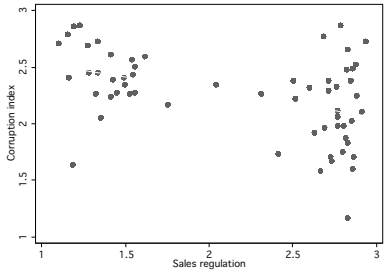
(d) Private investment regulation (Dimension II)



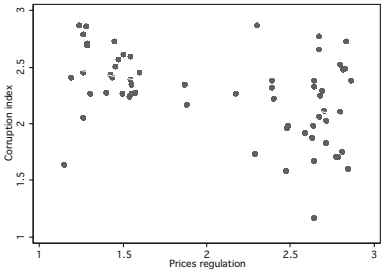
(e) Employment regulation (Dimension II)

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 Gwartney and Lawson (2000).

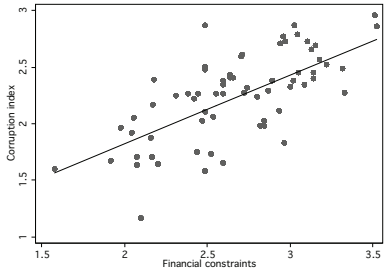
Figure 4: Economic freedom components and corruption, WBES sample.



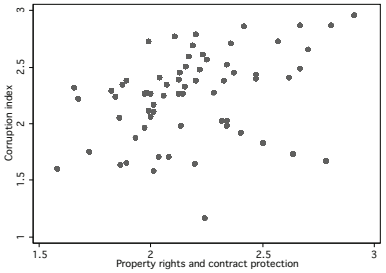
(a) Sales regulation (Dimension II)



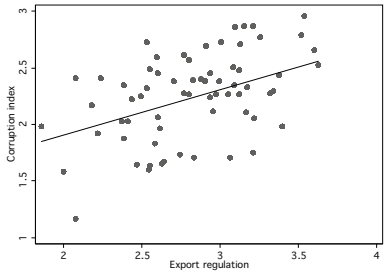
(b) Prices regulation (Dimension II)



(c) Financial constraints (Dimension III)



(d) Property rights and contract protection (Dimension IV)



(e) Export regulation (Dimension 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 Gwartney and Lawson (2000). We do not report the graph for financial constraints because is defined by a binary variable.

and e). The objective generalising the approach to a larger set of groups or indicators suggests that the unexplained variability at micro level can be used to identify the sources of a different or non-significant response in our relationship at macro level.

3. Econometric specification

This section provides a comprehensive description of the multilevel probit model. Interest in these models is a natural improvement on the basic linear and non-linear framework in which micro-data contain clusters resulting from non-independent observations. That is, when observations within clusters are correlated, it is more likely that ignoring clustering will result in biases in estimates and inferences.

Let us consider the 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 firm level. We assume that a latent continuous variable, $y_{ij}*$, underlies 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 $y_{ij}* \leq 0$. Thus, we can 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. As we are interested here in assessing the influences on corruption of the different types of economic freedom separately, (1) is considered as a companion matrix which includes economic freedom indicators x_{ij} in the diagonal and otherwise zero. In addition, (1), also includes other firms' covariates, x_{i0}, evaluated by parameters β_h; e_{ij} is the first-level residual term. Under the hypothesis of a random-effect model, we can explicit β_{0j} 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 the observed macro-covariates of the second stage which identify second-level variations, w_{0j}^1. u_{0j} is the random effect of two-level related to country-specific intercept β_{0j}. The assumption that part of the variability of the fit model can be identified by between-country covariates w_{0j}^1 does not avoid the possibility that the unobserved variability of the country effects may generate dependence between firms' economic freedom components x_{ij}. Subsequently, we turn to the specification of an extended model containing parameters associated with issues of endogeneity and implement of nested restriction tests.

Conditional on random effect u_{0j}, a probit model is specified by assuming that e_{ij} has standard normal distribution. It is commonly assumed that clusters j are independent, the covariance between different firms, $Cov(e_{ij}e_{i'j}) = 0$, and that two-level error terms are not correlated, $Cov(u_{0j}, e_{ij}) = 0$, so that we can write the reduced form of the model as[8]:

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

[8]The assumption that unobserved country characteristics are not correlated with unobserved firm characteristics excludes non-frequent cases in which firms are very successful in operating in corrupt countries.

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

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

where $g(.)$ represents the normal density function[9]. As a result, the unconditional estimate does not lead to a closed expression. Maximum likelihood estimation must resort to approximation procedures, such as numerical integration. RabeHesketh et al. (2002) proposed an algorithm using the posterior mean and variance of random effects, which were calculated by building on the work of Naylor and Smith (1982)[10]. If the assumed distribution is normal, the numerical quadrature approach yields a deviance (Υ) which can easily be 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 log-likelihood of the saturated model and $\ln f(y \mid \widehat{\vartheta})$ is the log-likelihood of the model of interest. Some nested specifications can be obtained by imposing parameter restrictions calling for a simple likelihood ratio test on parameter 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 freedom equal to the imposed restrictions on the parameters.

As anticipated, from the multilevel specification in equation (3), there is no certainty that the unexplained variability among different countries' corruption propensity does not include the effect of omitted macro-variables related to economic and political institutions which, in turn, may be correlated with x_{ij}.

While the standard approach to handling endogeneity in econometrics is estimation by instrumental variables, in the present context, where regressions are carried out for single economic freedom components, a simpler solution is to estimate the within-unit effects of x_{ij}, which can be achieved by controlling for cluster mean covariates[11]. Following Snijders and Berkhof (2004), the correlation between covariates and random effects may 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 (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 $u_{0j}^* = u_{0j} + \varepsilon_{0j}$. Exclusion from the analysis of the cluster mean, $\bar{x}._{\ j}$, when $\alpha_{01} \neq 0$, yields a biased estimator of β_1. Conversely, when $\alpha_{01} = 0$, we obtain the exogenous model of equation (3) as a restricted specification.

In many cases, however, it is of great interest to model dependence more extensively. Since endogeneity is often the result

[9]For the sake of simplicity, we include micro covariates of the first level in intercept parameter γ_{00}.

[10]Although marginal quasi-likelihood (MQL) and penalised quasi-likelihood (PQL) are largely used in the statistical literature, they are found to generate downwardly biased estimates (Hedeker, 2001).

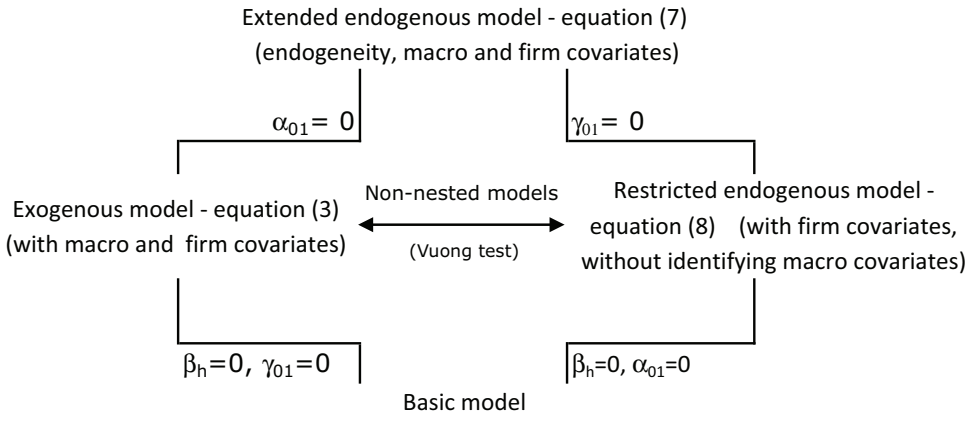
[11]Instrumental variables method was developed for multilevel analysis by Kim and Frees (2007).

of one or more unobserved variables, which influence both explanatory and dependent variables in the equation, restricting the model in (7) by imposing vector $\gamma_{01} = 0$, allows us to identify the importance of the conditional macrovariates in estimated relationships. We therefore obtain an endogenous random intercept model which only includes micro-covariates as controls, but it can also minimise the effects of unobservable country effects. 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 5 shows the nested relationships among models and the relevant restrictions on the likelihood function of (7). A sequential strategy of the model selection process can reasonably be implemented accounting for dependence between micro-covariates and random effects. A double route for testing nested models arises with respect to our focus, because we do not determine *a priori* whether macro-variates or unobserved functions which include the cluster of mean covariates as control can significantly produce endogeneity. We therefore partition the vector of the variables that should control dependence across levels, $W_{0j} = \left[w^1_{0j}; w^2_{0j}\right]$. By 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 for testing the restricted models against the benchmark random intercept model (a basic random intercept model without other micro-covariates except those of interest), we must decide whether a best model exists. By defining the conditional function density for restricted models, $f(y|x, \theta_1)$ and $g(y|x, \theta_2)$, conventional and adjusted (Vuong, 1989) LR tests were used for these non-nested specifications (step 2, Figure 5). The null hypothesis of model equivalence, $H_0 : E\left[\log \frac{f(y|x,\theta_1)}{g(y|x,\theta_2)}\right] = 0$, was 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. The best model is then tested against the basic "random intercept"model by adding, $\sum_{h=1}^{H} \beta_h x_{i0} = 0$, if a restricted model with $\gamma_{01} = 0$ or $\alpha_{01} = 0$ is found.

Figure 5: Strategy for testing nested and non-nested models

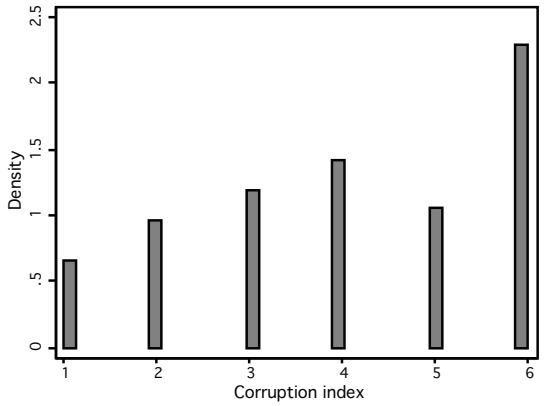


4. Estimates

4.1. Specification of empirical models

In line with the econometric framework discussed above, we collapsed the self-reported categorial variable of corruption into a binary variable. We group the perception of lower corruption, i.e. modalities from 1 to 3, and those of higher corruption (from 4 to 6), where 1 is assigned to the latter group. Gorodnichenko and Sabirianova (2007) suggested that, in abstract, this characterisation may lead to better discrimination between higher and lower degrees of corruption. We also justify this choice by the empirical distribution of the firms' responses to the survey question. As we see from Figure 6, the responses are not evenly distributed, but indicate an asymmetric distribution toward items with higher levels of corruption. This implies that the presence of intermediate items, which cannot efficiently distinguish between higher and lower degrees of corruption, may make the relationship with economic freedom more difficult to interpret from the policy-makers' point of view. Thus, we assume corruption index to be expressible as a (non)linear combination of each economic freedom component and variables conditional on the firms' characteristics, as well as a set of macro-variables capable identifying differences in economic development and the quality of institutions of countries.

Figure 6: Histogram of the corruption index by modalities of response



Note: Aggregate score responses of the modalities of corruptive practices, from 1 to 6: 1 (never), 2 (seldom), 3 (sometimes), 4 (frequently), 5 (mostly), and 6 (always).

We now use the dimensions and indicators of economic freedom proposed in Section 2 and discuss the empirical specification in line with the literature on corruption. Ades and Di Tella (1999) and Svensson (2005) argue that a positive degree of competition in a country (Dimension I, Table 1) reduces the probability of corruption. In this approach, a non-competitive market serves to feed corruption by a rent channel, which consolidates a non-market system of bureaucrats' behaviour and constrains the flow of information from a competition environment beyond firms' control. Emerson (2006) presented a model of the interaction between corrupt government officials and industrial firms to show that corruption is antithetical to competition. However, the competition-corruption link can either easily suffer from reverse causality or sometimes have a positive effect (Lambsdorff, 2007). To explain the first point, the perspective of income from corruptive activities may motivate private firms to pay bribes and politicians to offer market restrictions. For the second point, the unexpected relationship is justified when

quality-based competition instead of prices forces so that firms may be driven by myopic behaviours sustaining corruptive practises in delivering substandard quality products.

Here, we test the hypothesis of a negative correlation between competition and corruption by using an index of (non) market dominance; we measure the effectiveness of non-competitive practises through a subjective index of the obstacles to the growth of firms' business, and a more specific index related to the information on laws and regulations described above. This choice was partly due to the existence of missing data for African countries of the subjective, but more informative, index of anti-competitive behaviours. This means estimating the relationship of the latter index with corruption in subsamples excluding African countries. In line with Ades and Di Tella (1999), we include in the same regression a measure of (firms') market competition structure together with the perception of managers of laws and regulations against competition. If we assume that managers' responses also represent the perception of a competitive environment for business, corruption may be therefore viewed as a "'cause"' of the degree of competition (Lambsdorff, 2007). However, the degree of endogeneity, and its empirical omission, explain the difficulty of characterising empirically the effects of competition on corruption. We will make particular attention to these effects in the testing strategy to avoid model misspecifications.

Among the components of economic freedom, corruption is assumed to be influenced by government regulation components (Dimension II). As some specific effects depend closely on market structure and efficiency, it would be wrong to perceive corruption as the consequence of excessive regulation, or to assume that complete *laissez-faire* will always be the answer (Bliss and Di Tella, 1997). The view that government regulation hampers productive effort, encourages rent-seeking and increases the discretionary power of a few public officials, still reigns throughout government institutions and scholars (Graeff and Mehlkop, 2003; Paldam, 2002), although when government regulation is weak or almost absent, an increase in market rules is recognised as crucial to develop a solid productive sector (Hodgson, 2003)[12].

These features have at least two important implications when examining corruption practices in developing countries economies. First, results from developed countries should not be directly extended to developing countries' settings without serious reflection on their differences. To the trade-off between benefits and disbenefits of state intervention leading to market failures (Acemoglu and Verdier, 2000), we must add the different context influences of negative externalities of corruption. Second and even more importantly, empirical research has tended to focus on the effect of the overall size of the government budget relative to GDP, often neglecting the interactions of each component of government regulation. The test that size of government is positively correlated with level of corruption is weak: Elliot (1997) and Adsera (2003) obtained contrasting findings, and Graeff and Mehlkop (2003) and Billger and Goel (2009) reported ambiguous results which can only be slightly disentangled by observing the relation in a subsample of countries or conditioning the distribution of corruption variables across countries, respectively. These pieces of evidence also suggest that particular types of government interventions may have different potentials and, perhaps more importantly, may cause the onset of corruption with respect to the size of the government expenditure. Indeed, the heterogeneity of goods and services supplied in free markets is an important source of transaction costs which may be reduced by government regulations, although planning these interventions may lead to serious problems of corruption. In our empirical analyses, we evaluate the impact on corruption of the components of government regulation controlling for the levels of development of a country whereas the size of government is modelled as a component

[12]Developing countries are often characterised by weak law enforcement, a large informal sector, underdeveloped capital markets, and informal credit and insurance networks. For example, informal arrangements, such as family networks of credit and insurance, have been found to influence the consequences of interventions to a great extent, limiting the onset of corruption.

able to identify differences of governance across countries. The sign and magnitude of government regulation indicators on corruption, i.e., government interventions on investments, employment, sales and prices, therefore become an empirical issue.

It has been postulated that the ability of a formal financial system to provide financing to the private sector reduces corruption effects (Dimension III). This relationship may be mitigated by the different degree (quality or obstacles) of financial institutions of countries which, in the extreme case, instead of being a cause of corruption, may result from a low corruption environment. The view of significant effects of financial system ability on reduction corruption is sustained by Brunetti et al. (1997), that ranking levels of corruption from a worldwide survey, found that the second most significant impediment to doing business was the lack of financing. However, also where the financial system is able to provide financing for private sector, inefficiencies in improving business investments requires higher intermediation costs, that are directly associated with corruption payments Ahlin and Pang (2008). We proxy this financial obstacle by a subjective measure of firm impediment in the operation and growth of the business.

The ability of the legal system to protect property rights (Dimension IV) is widely suggested as being a policy intervention to reduce corruption in 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. In contrast with the current literature, we test this relationship at firm level, because it is assumed that the work experience of the firm allows them to estimate better failures in free market operations.

Lastly, government regulations on export and international trade (Dimension V) are assumed to increase the level of corruption. There are at least three reasons explaining the empirical evidence. First, this effect is associated with the relation between firm rents in a non-competitive market and import licensing. Krueger (1974) argued that, when the number of licenses is fixed, firms are encouraged to compete to obtain the largest amount of trade licensing. A rational firm may shift productive plans to rent intensive activities and, could then turn to bribing transactions to win trade licensing. Second, trade barriers may favour inefficient local firms more than foreign competitors, and forms of corruption may easily arise. Finally, import barriers create an artificial scarcity of specific commodities, channelling some of the non-competitive higher prices toward corrupt bureaucrats a practise which, in developing countries or transition economies, may lead to underground economies. However, 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-levels of (3), (7), and (8) are usually assumed to be a function of firms' factors affecting corruption. As amply discussed by Beck et al. (2002), the extent of a firm's self-reported corruption effects depends on its size, as well as on its legal organization and the sector in which it operates. We define firm size by the number of full-time employees in the firm and classify it into three categories: large (modality 3), if the full-time employees is greater than 500 employees; medium (2) if the number ranges between 51 and 500 employees; small (1) when number of employees is under 50. The principal sectors of business are subdivided into five traditional categories: manufacturing services, other, agriculture and construction, from 1 to 5, respectively. The legal organization of the firm is also built into an ordinal framework from 1 to 5, in which firms can assume a single proprietorship (modality 1), be in partnership, in a cooperative, in a privately held corporation or listed on a stock exchange (from 2 to 5, respectively). These variables are included in all model specifications as firms' control variables and are extensively described in Table 1.

Thus, we justify the specification of multilevel (economic) models because the perception of corruption by firms and its relation with economic freedom components not only depends on the country's economic conditions, but is also constrained

and modelled by institutional (in Hodgson's sense) self-reinforcing and self-perpetuating characteristics. It is assumed 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). A set of these indicators is assumed to explain unobserved variability induced by cross-country differences. Traditional macro-economic indicators are the gross domestic product per-capita (GDP)[13], the private investment share in GDP (INV), and the Gini coefficient of distribution of income ($GINI$). In the multilevel model, we also include the share of government spending in GDP (GOV). Indeed, as shown by La Porta et al. (1999), the size of the state and its composition are key variables in explaining the differences in good governance across countries.

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). The World Audit Organisation annually ranks countries in categories according to a checklist of political rights from 1 to 6, where 1 is taken as not free. It is known that a strong democratic regime enforces the reliability of public action, decreasing firms' market power and reducing illegal profit gains. The rise of democracy is found to decrease corruption (Emerson, 2006; Treisman, 2000) and, in general, economic growth (Bardhan, 1997; Dreher and Herzfeld, 2005). This leads us to assume that, as democracy increases, corruption is weakened, irrespective of the level of corruption of a country. The significant influence of democracy on economic freedom components is also well-known. This should strengthen the possibility of controlling for the legal system's ability to protect property rights and prevent corruption (Lundstrom, 2005). However, estimates should not exclude the existence of endogeneity issues because, as has been widely shown, lower levels of corruption at country level may be responsible for a reduction in the certainty of property rights[14].

4.2. Results

The choice of the most appropriate specification consists of testing, for each equation, the models presented in Section 3 and shown in Figure 5. Parsimonious models are obtained by testing the relevant restrictions on the likelihood function, and are interpreted as special cases of endogenous multilevel probit models (7). Conventional and adjusted likelihood ratio formulation is reported in Table 2.

Table 2: Random intercept models: specification tests, full sample

		Non-market dominance & information constraints	Anti-competitive behaviour	Private investment regulation	Employment regulation	Sales regulation	Prices regulation	Financial constraint	Financial obstacles	Property rights and contract protection	Export regulation
Extended endogenous model (equation 7) vs. Restricted endogenous model (equation 8)	LRtest	1421.671 (0.00)	586.19 (0.00)	811.83 (0.00)	821.0637 (0.00)	809.92 (0.00)	813.35 (0.00)	904.48 (0.00)	932.81 (0.00)	836.65 (0.00)	896.28 (0.00)
Extended endogenous model (equation 7) vs. Exogenous model (equation 3)	LRtest	2.58 (022)	2.08 (021)	1.33 (024)	2.21 (0.13)	1.62 (0.20)	2.14 (0.14)	0.04 (0.83)	1.75 (0.18)	2.70 (0.10)	2.20 (0.13)
Restricted endogenous model (equation 8) vs. Basic model	LRtest	406.41 (0.00)	2560.29 (0.00)	3326.89 (0.00)	3495.53 (0.00)	3467.49 (0.00)	3514.36 (0.00)	3603.52 (0.00)	2880.63 (0.00)	3753.51 (0.00)	3295.41 (0.00)
Exogenous model (equation 3) vs. Basic model	LRtest	1809.97 (0.00)	2914.48 (0.00)	4137.39 (0.00)	4314.38 (0.00)	4275.79 (0.00)	4325.57 (0.00)	4507.96 (0.00)	3715.54 (0.00)	4683.63 (0.00)	4189.50 (0.00)
Exogenous model (equation 3) vs. Restricted endogenous model (equation 8)	Vuong test	8.432 (0.00)	24.677 (0.00)	17.67 (0.00)	18.00 (0.00)	15.47 (4.20)	11.47 (0.00)	8.47 (0.00)	8.05 (0.00)	-3.74 (0.00)	10.17 (0.00)

Note: We report the $p-values$ in brackets. Vuong (1989) test for non-nested models is carried out under standard normal distribution. Extended endogenous model (Equation 7) includes endogeneity, macro and firm covariates. Restricted endogenous model (Equation 8) includes endogeneity and firm covariates. Exogenous model (Equation 3) includes macro and firm covariates.

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

[13]We use capital letters to distinguish macro covariates.

[14]See Acemoglu and Verdier (1998) for a discussion.

hypothesis test, and indicate that these variables are important in identifying corruption differences across countries. Instead, as shown in the second row, we never rejected endogeneity restriction $\alpha_{01} = 0$, because the empirical LR test was always lower than the critical value at the usual percentile. To complete the analysis, we tested model specification (3) against the basic random effect model, in which firm's covariates 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 (3) is the best model to rationalise the data. The Voung (1989) test completes the selection strategy by testing exogenous random effect model (3) against the model with endogeneity (8) restricted for macro covariates. The Vuong test statistic leads to the rejection of model equivalence for each specification selecting the model (3). If we also evaluate restrictions with respect to the benchmark specification, the test provides further support to the model chosen (Table 2, row five).

The maximum-likelihood estimates are listed in Table 3. Note that the use of a multilevel approach instead of probit regression ensures that we avoid misleading significance effects due to violation of the assumption of independent errors with constant variance. This effect was confirmed in our regression results, in which the multilevel regressions display lower levels of significance when compared with the probit regression with the same model specification[15]. To support statistically this result, we report the intra-class correlation (ρ) for each estimated specification. For each equation, on average about 30 percent of the total variability of corruption economic freedom component link is attributable to the differences across countries. To emphasise the interpretative role of multilevel models, we identify this source of variability in each relationship by the second-level indicators. Although there are considerable differences in the magnitude of the macrocovariate coefficients, both significance and signs are consistent with expectations in the majority of cases. Accordingly, the degree of economic prosperity (GDP) is capable of explaining gains in the efficiency of the economic and social system and controlling for corruption (Mauro, 1995). The hypothesis that high-income inequality (by GINI index) corresponds to perceptions of unfair state operations and makes the incidence of corruption more likely (Smelser, 1971) seems to be confirmed. In addition, the importance of the civil liberty index (CIVIL) in reducing corruption is in line with theoretical expectations, whereas an oversized state (GOV) affects the efficiency of expenditure and corruption increases, irrespective of its level.

Like the country characteristics, we found very significant coefficients for the control covariates at firm level, except for legal organization of the firm. The probability of corruptive practices in larger firms is pervasively found to be 12-13 percent lower, irrespective of the equation of economic freedom used. In addition, the industrial sector is found to have a higher (on an average, 5 percent) propensity to suffer undergo corruption, perhaps reflecting better market independence of services to cope with smaller businesses starting and/or developing economic activities.

Government regulations on investment, employment, sales, and prices increase corruption (Table 3, columns 3-6). Inefficiencies caused by an over-regulated economic system can distort private productive activity and influence corruptive behaviour. Because of the critical role that the labour market plays in the process of economic development, understanding whether labour market regulations actually help or hinder corruption phenomena stands out as an important task (Caballero and Hammour, 2000; Foster et al., 2002; Bartelsman et al., 2004). Although very similar effects are found across countries when looking at individual components of government regulations, we note that protection of employment has the highest propensity (0.131) to affect corruption. It is worth noting that, where labour market institutions are developed, adding government employment regulations can weigh down the processes of agreement and facilitate corruption practices obtained while mediating among firms, workers and unions. Similarly, the other government regulation indicators significantly affect the reduction of corruption.

Columns 7 and 8 of Table 3 show the estimated influences of financial market related to corruption. According to the

[15]The results of the estimates obtained by probit models are available from the authors.

Table 3: Corruption and economic freedom components, full sample

	Non-market dominance & information constraints		Anti-competitive behaviour		Private investment regulation		Employment regulation		Sales regulation		Prices regulation		Financial constraint		Financial obstacles		Property rights and contract protection		Export regulation	
Non-market dominance	0.012																			
	(0.044)																			
Information constraints	0.075	***																		
	(0.018)																			
Anti-competitive behaviour			0.148	***																
			(0.026)																	
Private investments regulation					0.084	**														
					(0.038)															
Employment regulation							0.131	**												
							(0.038)													
Sales regulation									0.081	**										
									(0.039)											
Prices regulation											0.122	**								
											(0.037)									
Financial constraint													-0.018							
													(0.063)							
Financial obstacles															-0.113	**				
															(0.024)					
Property rights and contract protection																	-0.218	**		
																	(0.035)			
Export regulation																			0.082	**
																			(0.025)	
Firm size	-0.113	***	-0.101	**	-0.144	**	-0.140	**	-0.135	**	-0.139	**	-0.139	**	-0.113	**	-0.123	**	-0.125	**
	(0.035)		(0.040)		(0.037)		(0.036)		(0.037)		(0.036)		(0.036)		(0.036)		(0.034)		(0.035)	
Firm sector	-0.046	*	-0.111	***	-0.056	**	-0.057	**	-0.053	*	-0.054	**	-0.051	*	-0.045		-0.048	*	-0.058	**
	(0.027)		(0.037)		(0.028)		(0.027)		(0.028)		(0.028)		(0.027)		(0.027)		(0.026)		(0.027)	
Legal organization of firm	-0.013		-0.004		-0.017		-0.020		-0.017		-0.016		-0.010		-0.014		-0.015		-0.016	
	(0.016)		(0.018)		(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)		(0.000)		(0.000)	
GINI	-0.024	***	-0.021	**	-0.020	**	-0.019	**	-0.020	**	-0.018	**	-0.024	**	-0.025	**	-0.025	**	-0.023	**
	(0.007)		(0.009)		(0.009)		(0.009)		(0.009)		(0.009)		(0.007)		(0.008)		(0.007)		(0.008)	
INV	-0.050	***	-0.040	**	-0.037	**	-0.035	**	-0.036	**	-0.035	**	-0.050	**	-0.050	**	-0.048	**	-0.055	**
	(0.015)		(0.018)		(0.018)		(0.017)		(0.018)		(0.017)		(0.015)		(0.016)		(0.015)		(0.015)	
GOV	0.175	***	0.105	**	0.173	**	0.172	**	0.174	**	0.170	**	0.182	**	0.174	**	0.165	**	0.184	**
	(0.042)		(0.050)		(0.044)		(0.043)		(0.044)		(0.043)		(0.043)		(0.045)		(0.042)		(0.044)	
CIVIL	-0.097	*	-0.177	**	-0.123	**	-0.119	**	-0.124	**	-0.121	**	-0.095	*	-0.086		-0.098	*	-0.092	*
	(0.052)		(0.070)		(0.058)		(0.057)		(0.058)		(0.057)		(0.052)		(0.055)		(0.051)		(0.054)	
Constant	1.084	*	1.447	*	0.928		0.753		0.901		0.735		1.363	**	1.691	**	1.952	**	1.210	*
	(0.654)		(0.784)		(0.764)		(0.753)		(0.769)		(0.753)		(0.641)		(0.671)		(0.633)		(0.667)	
$\rho_{benchmark}$	0.297	**	0.244	**	0.286	**	0.289	**	0.288	**	0.282	**	0.328	**	0.315	**	0.311	**	0.317	**
ρ_{id_macro}	0.124	**	0.130	**	0.093	**	0.090	**	0.093	**	0.091	**	0.088	**	0.098	**	0.087	**	0.098	**
N	3331		2568		2959		2989		2962		2974		3132		3128		3410		3192	

Note: Dependent variable is binary index of corruption. We show in brackets the standard errors, while the asterisks indicate significant p-value levels ($* \ p < 0.1$, $* * \ p < 0.05$). Two measures of intraclass correlations correspond to the benchmark model, without firm and macro covariates ($\rho_{benchmark}$) and to the model with restrictions in the macro covariates (ρ_{id_macro}).

compositional effects of countries with different degrees of financial development, we found that constraints in private and public financing projects increase the probability of corruption, whereas rather surprisingly, financial system efficiency does not seem to affect it. Our estimates also comply with general knowledge on the importance of trade regulation in increasing corruption found by Ades and Di Tella (1997, 1999), Sung and Chu (2003) and Gerring and Thacker (2005).

So far, the largest and most significant effect on corruption is exerted by the legal system to protect property rights and contracts (-0.218). We found that limiting the possibility of confiscating private property or repudiating contracts produces positive externalities, and can determine general improvements in the quality of institutions. However, as discussed in Glaeser et al. (2001) this result closely depends on the difficulty of enforcing complex private contracts and on the potential advantages of a parallel developed framework for organising private transactions.

There is no evidence that the absence of market dominance leads to lower corruptive practises (column 1). Conversely, the coefficient on the information constraints on laws and regulations is positive and significant at the 1-percent level. This suggests that firms in countries where information is effective in checking non-competitive practises have lower rents and lower corruption. This result is also consistent with the significant estimated coefficient of anti-competitive behaviours although, as mentioned above, this estimate excludes the African countries. Since the latter variable provides a general measure of the informational environment and support for growth of firms' business, we capture the fact that fewer obstacles in anti-competitive behaviour are effective in controlling corruption.

We test the robustness of our results by estimating two subsamples of countries for Africa and transition economies of Eastern Europe. We also show that aggregation of the responses obtained in the multi-indicators within the five economic freedom dimensions produces consistent estimates of individual relationships.

We first justify this choice by comparing the level of corruption of African economies with those of the rest of the world. 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. Transition countries are also an interesting case study, because of their choice to pass to a freer market economy and democratic regimes during the 1990s (i.e., transition economies). As reported by Graeff and Mehlkop (2003), with the exception of Estonia, Transparency International rates most former communist countries as being highly corrupt. Instead, although liberalisation policies in transition countries have been extremely important during the last decade, the same source of data records lesser economic freedom (5.5/10) with respect to the world mean (6.23/10). A specific determinant of this failure has been linked with reforms in public sector activities, i.e., privatization, which did not achieve one of the objectives (in 2000, and even after that year) to reduce corruption[16].

We again ran the selection strategy for the subsamples shown in Figure 5. We confirm an exogenous multilevel specification for almost all the corruption equations of these subsamples, except in the cases discussed below, where endogeneity was substantial. To assess this possibility empirically, we include the mean of the firms' variables which estimates the extended endogeneity random intercept model (equation 7). The complete results are shown in Tables 4 and 5.

Tables 6 and 7 present maximum-likelihood estimates. Quite surprisingly, we found that significant second-level residual

[16]The main cause of this failure is clearly discussed by Hodgson and Jiang (2007), who state 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 ".privatisation Specifically, the privatisation process in the former USSR, characterised by the sale of state assets, was marked by an increase in corruption because many ideas of traditionalism were upheld and not included in the decision-making process criteria of rationality and effectiveness. This offered an opportunity to accumulate illegal fortunes (Sachs, 2005).

Table 4: Random intercept models: specification tests, subsample of African countries

		Non-market dominance & information constraints	Private investment regulation	Employment regulation	Sales regulation	Prices regulation	Financial constraint	Financial obstacles	Property right and contract protection	Export regulation
Extended endogenous model (equation 7)	LRtest	509.25	520.87	517.44	516.18	522.39	527.15	472.14	515.48	499.57
vs. Restricted endogenous model (equation 8)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Extended endogenous model (equation 7)	LRtest	8.22	0.37	6.58	1.23	0.42	2.80	3.21	6.53	1.61
vs. Exogenous model (equation 3)		(0.01)	(0.54)	(0.01)	(0.26)	(0.51)	(0.09)	(0.07)	(0.01)	(0.20)
Restricted endogenous model (equation 8)	LRtest	152.67	355.28	365.61	349.49	347.02	342.25	351.47	395.47	336.40
vs. 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	636.33	875.78	876.47	864.45	868.99	866.60	820.41	904.43	834.36
vs. 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	16.81	6.61	94.35	75.23	33.69	40.38	23.37	12.93	27.73
vs. Restricted 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 brackets. Vuong (1989) test for non-nested models is carried out under standard normal distribution. Extended endogenous model (Equation 7) includes endogeneity, macro and firm covariates. Restricted endogenous model (Equation 8) includes endogeneity and firm covariates. Exogenous model (Equation 3) includes macro and firm covariates.

Table 5: Random intercept models: specification tests, subsample of Transition economies

		Non-market dominance & information constraints	Anti-competitive behaviour	Private investment regulation	Employment regulation	Sales regulation	Prices regulation	Financial constraint	Financial obstacles	Property rights and contract protection	Export regulation
Extended endogenous model (equation 7)	LRtest	255.16	233.79	230.42	239.79	244.58	247.68	257.20	241.48	255.47	235.25
vs. Restricted endogenous model (equation 8)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Extended endogenous model (equation 7)	LRtest	0.20	0.17	0.09	0.15	3.58	3.00	0.97	6.20	0.36	1.87
vs. Exogenous model (equation 3)		(0.90)	(0.67)	(0.76)	(0.69)	(0.05)	(0.08)	(0.32)	(0.01)	(0.54)	(0.17)
Restricted endogenous model (equation 8)	LRtest	277.95	260.58	294.99	298.15	285.59	295.65	294.71	251.08	290.79	271.98
vs. Basic model		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Exogenous model (equation 3)	LRtest	530.74	492.65	525.32	537.78	526.60	540.33	550.95	486.35	545.90	505.36
vs. Basic model		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Exogenous model (equation 3)	Vuong	63.68	52.66	84.77	85.76	7642	103.51	24.88	18.72	-39.25	31.44
vs. Restricted endogenous model (equation 8)	test	(0.00)	(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 brackets. Vuong (1989) test for non-nested models is carried out under standard normal distribution. Extended endogenous model (Equation 7) includes endogeneity, macro and firm covariates. Restricted endogenous model (Equation 8) includes endogeneity and firm covariates. Exogenous model (Equation 3) includes macro and firm covariates.

variance exceeds 20 percent in many equations for Africa, showing that the continent's variability plays an important 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. Covariates at country level have the expected significant effects in most cases, with some exceptions. Neither GDP and $CIVIL$ for African countries nor INV for transition economies have been found to exert any particular influence on corruption, whereas large differences in the size of government appear to explain most of the continent's variability. Its positive effect emphasises the hypothesis that inefficiencies generated by large expenditure feed corruptive practices as misuse of recurring government budgets. In addition, we anticipate that inclusion of the country mean of the explicative variables (i.e., employment regulation and property rights protection for Africa, and sales regulation and financial constraints for transition economies) can cause loss of their significance.

The estimated relationships for these subsamples reveal changes in government regulation components, suggesting that government interventions are more likely to hinder corruption. In line with Elliott's (1997) arguments, these results confirm that the types of government activities provided can directly affect corruption and indirectly control for the size of state expenditure.

Not surprisingly with respect to the non-standard literature, in the subsamples we find a positive and significant influence of anti-competitive behaviour on corruption. These results are in line with those of Gupta et al. (2001), in which more

competition among prevalent local firms, which also share similar norms and rules, incites them to pay commissions to enhance profitability. Attractive as this result sounds, we should emphasise that the nature of this correlation for African countries although non-excessively significant captures the simultaneity bias of corruptive practises.

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

However, in the model regressions which account for endogeneity, the micro-founded relationships may also show an opposite sign in the estimated coefficient, with respect to those obtained as an aggregate mean of the explicative variables. This is evident for government regulation on employment for Africa as well as sales in transition economies. Although the costs of corruption for Africa are difficult to reduce by micro-regulation of employment (as shown by the insignificant value of the coefficient), minimisation of corruption will depend on the effectiveness of institutional labour designs and net of the development level of a country. Instead, transition economies may internalize the advantages of sales regulation on corruption by applying policies which do not give incentives for efficient regulation on sales assignments cutting the costs of corruption.

As indicated by the strategy tests, the financial system's constraints in transition countries are estimated with the additional country mean regressor. The significance of this parameter, together with that at firm level, reinforces the idea that better financial systems are beneficial for combating corruption and enhancing economic growth. Although this result is generally accepted, when we analyse corruption outcomes for economies in transition, they are more complex, due to the existence of interaction with investments in the private sector. It is known that the lack of institutional rules for the financial system in the former communist economies, soon after the periods of reform, led to increasing corruption in growing investments. Furthermore, the significance of the parameter of private investments (INV) may also explain the existence of detrimental financial system effects on corruption, at least in the short term.

A potential source of concern in this literature is the overdispersion effect of specific economic freedom indicators in explaining corruption. Our results may indeed reflect the influence of sub-categories of economic freedom which specifically affect some aspects of corruption but not others. Here we present the multilevel and probit estimates of the economic freedom indices collected by the weighted mean of the estimated components within the dimensions. Thus, we standardise the response modalities in Dimension I and select the best model to rationalise the data in the multilevel regression. The coefficients of the dimensions I, II and III in Table 8, that include more economic freedom components, are shown to be close estimates of those reported for the disaggregated indicators, irrespective of sample and statistical method used. The result of this sensitivity analysis proves the usefulness to disentangle the economic freedom areas and, addressed to our work, the goodness of our previous conclusions.

Table 6: Corruption and economic freedom components, subsample of African countries

	Non-market dominance & information constraints		Private investment regulation		Employment regulation		Sales regulation		Prices regulation		Financial constraint		Financial obstacles		Property rights and contract protection		Export regulation	
Non-market dominance	0.144																	
	(0.107)																	
Mean of competitors	4.685																	
	(2.467)																	
Information constraints	0.115	**																
	(0.041)																	
Mean of information constraints	0.101	**																
	(0.625)																	
Private investment regulation			-0.289	**														
			(0.104)															
Employment regulation					-0.150													
					(0.097)													
Mean employment regulation					2.489	**												
					(0.969)													
Sales regulation							-0.288	**										
							(0.134)											
Prices regulation									-0.198	*								
									(0.105)									
Financial constraint											-0.426	**						
											(0.162)							
Financial obstacles													-0.133	**				
													(0.059)					
Property rights and contract protection															-0.217	**		
															(0.074)			
Mean of property rights and contract protection															-2.065	**		
															(0.814)			
Export regulation																	0.248	**
																	(0.059)	
Firm size	-0.078		-0.160	**	-0.137	*	-0.115		-0.133	*	-0.105		-0.104		-0.136	*	-0.091	
	(0.078)		(0.075)		(0.074)		(0.075)		(0.074)		(0.076)		(0.079)		(0.074)		(0.076)	
Firm sector	0.055		0.013		0.027		0.023		0.027		0.040		0.037		0.039		0.039	
	(0.046)		(0.044)		(0.044)		(0.044)		(0.044)		(0.045)		(0.046)		(0.044)		(0.045)	
Legal organization of firm	-0.097	*	-0.088	**	-0.095	**	-0.071	*	-0.074	*	-0.044		-0.091	**	-0.097	**	-0.076	*
	(0.042)		(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	-0.026	**	-0.020		-0.028	**	-0.021		-0.018		-0.028	**	-0.025	*	-0.048	**	-0.014	
	(0.024)		(0.014)		(0.014)		(0.014)		(0.013)		(0.014)		(0.014)		(0.016)		(0.014)	
INV	-0.103	*	-0.057	**	-0.056	**	-0.044	*	-0.044	*	-0.045	*	-0.046	*	0.034		-0.050	**
	(0.045)		(0.023)		(0.023)		(0.023)		(0.023)		(0.024)		(0.025)		(0.038)		(0.024)	
GOV	0.126	**	0.368	**	0.429	**	0.387	**	0.391	**	0.321	**	0.393	**	-0.161		0.352	**
	(0.439)		(0.111)		(0.116)		(0.112)		(0.112)		(0.113)		(0.119)		(0.207)		(0.113)	
CIVIL	0.020		0.043		0.042		0.025		0.042		-0.004		0.041		0.087		0.014	
	(0.083)		(0.063)		(0.063)		(0.064)		(0.064)		(0.064)		(0.069)		(0.067)		(0.066)	
Constant	-10.825		0.258		-7.148	**	-0.211		-0.656		0.133		-0.553		8.018	**	-1.422	
	(8.110)		(1.465)		(3.119)		(1.434)		(1.410)		(1.448)		(1.476)		(3.295)		(1.451)	
$\rho_{benchmark}$	0.200	**	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	571		590		595		589		593		578		545		612		582	

Note: Dependent variable is binary index of corruption. We show in brackets the standard errors, while the asterisks indicate significant p-value levels ($* \ p < 0.1, \ ** \ p < 0.05$). Two measures of intraclass correlations correspond to the benchmark model, without firm and macro covariates ($\rho_{benchmark}$) and to the model with restrictions in the macro covariates (ρ_{id_macro}).

Table 7: Corruption and economic freedom components, subsample of Transition countries

	Non-market dominance & information constraints		Anti-competitive behaviour		Private investment regulation		Employment regulation		Sales regulation		Prices regulation		Financial constraint		Financial obstacles		Property rights and contract protection		Export regulation	
Non-market dominance	0.136	**																		
	(0.063)																			
Information constraints	0.065	***																		
	(0.022)																			
Anti-competitive behaviour			0.151	***																
			(0.032)																	
Private investment regulation					-0.194	**														
					(0.058)															
Employment regulation							-0.223	**												
							(0.068)													
Sales regulation									-0.223	**										
									(0.060)											
Mean of sales regulation									1.161	*										
									(0.614)											
Prices regulation											-0.123	**								
											(0.053)									
Financial constraint													-0.021							
													(0.075)							
Financial obstacles															-0.161	**				
															(0.031)					
Mean of financial efficiency															-0.717	**				
															(0.288)					
Property rights and contract protection																	-0.215	**		
																	(0.051)			
Export regulation																			0.127	**
																			(0.036)	
Firm size	-0.085		-0.118	*	-0.145	**	-0.148	**	-0.163	**	-0.149	**	-0.121	**	-0.134	**	-0.107	*	-0.118	*
	(0.059)		(0.060)		(0.064)		(0.061)		(0.063)		(0.061)		(0.061)		(0.064)		(0.059)		(0.064)	
Legal organization of firm	-0.065	***	-0.058	**	-0.077	**	-0.066	**	-0.062	**	-0.068	**	-0.075	**	-0.057	**	-0.062	**	-0.066	**
	(0.024)		(0.025)		(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)		(0.000)		(0.000)	
GINI	-0.016	*	-0.017	*	-0.022	**	-0.019	**	-0.037	**	-0.018	*	-0.016	*	0.005		-0.012		-0.016	
	(0.009)		(0.009)		(0.010)		(0.009)		(0.015)		(0.009)		(0.009)		(0.013)		(0.009)		(0.010)	
INV	0.009		0.016		0.006		0.007		-0.008		0.013		0.009		0.033	*	0.019		0.016	
	(0.017)		(0.018)		(0.018)		(0.017)		(0.021)		(0.017)		(0.017)		(0.020)		(0.017)		(0.018)	
GOV	0.140	***	0.144	***	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)		(0.024)		(0.023)		(0.029)		(0.023)		(0.024)	
CIVIL	-0.094	*	-0.089	*	-0.114	**	-0.100	*	-0.216	**	-0.111	**	-0.103	**	-0.049		-0.067		-0.141	**
	(0.049)		(0.052)		(0.054)		(0.053)		(0.085)		(0.052)		(0.050)		(0.059)		(0.050)		(0.053)	
Constant	-0.589		-0.502		0.981		0.864		-1.072		0.345		0.059		0.727		-0.121		-0.178	
	(0.612)		(0.617)		(0.645)		(0.618)		(1.004)		(0.592)		(0.607)		(0.647)		(0.582)		(0.642)	
$\rho_{benchmark}$	0.098	**	0.098	**	0.100	**	0.109	**	0.107	**	0.106	**	0.111	**	0.103	**	0.107	**	0.107	**
ρ_{id_macro}	0.00	**	0.000	**	0.000	**	0.000	**	0.000	**	0.000	**	0.000	**	0.000	**	0.000	**	0.000	**
N	1704		1569		1408		1517		1522		1539		1670		1432		1710		1429	

Note: Dependent variable is binary index of corruption. We show in brackets the standard errors, while the asterisks indicate significant p-value levels ($* \ p < 0.1, \ ** \ p < 0.05$). Two measures of intraclass correlations correspond to the benchmark model, without firm and macro covariates ($\rho_{benchmark}$) and to the model with restrictions in the macro covariates (ρ_{id_macro}).

Table 8: Estimates of aggregate dimensions of economic freedom on corruption.

Dimensions of economic freedom	Multilevel model						Probit model					
	Full sample		African countries		Transition countries		Full sample		African countries		Transition countries	
Market competition constraints	0.214	***	0.258	***	0.243	***	0.216	***	0.293	***	0.218	***
	(0.44)		(0.052)		(0.074)		(0.042)		(0.501)		(0.057)	
Government regulation	0.174	***	-0.382	***	-0.534	***	0.093	***	-0.390	***	-0.375	***
	(0.049)		(0.091)		(0.170)		(0.048)		(0.084)		(0.120)	
Financial system ability	-0.153	***	-0.284	***	-0.333	***	-0.167	***	-0.275	***	-0.192	**
	(0.050)		(0.058)		(0.108)		(0.043)		(0.056)		(0.088)	

Note: The multilevel model adopt the specification described in equation (3), whereas the pobit model includes in it only country dummy and firms control-variables.

5. Concluding remarks

The standard economic model predicts that government intervention transfers resources from the private sector and generates room for corruption. If economic freedom increases sufficiently, then the level of corruption tends to fall and keeps falling as the quality of institutions continues to improve. This mechanism has received support from conventional cross-country estimates, although Graeff and Mehlkop (2003) document that the response of corruption to the components of economic freedom appears to be contradictory. The recent corruption literature has also emphasised the importance of modelling micro-founding relationships as an explanation for its determinants (Mocan, 2008).

The purpose of this paper is to complement previous approaches by estimating economic freedom and corruption relationships based on multilevel models. In terms of this topic, our contribution incorporates the empirical facts presented in Section 2 and tests the effect of the components of economic freedom by using the vast sample of firms' data in developing and developed countries. We estimate these relationships by modelling for unobserved cross-country variability. Provided that the difference across countries accounts on average for one-third of the economic freedom corruption link, we identify the reasons for great differences in corruption in some traditional macro-economic and institutional indicators. By removing the empirical issues linked with clusters of data, we can explain why indicators of market competition change their effects when estimates are carried out in subsamples which includes only developing countries or transition economies. Thus, we may find that market competition may be bad for corruption when institutions are weak and this will be so in less developed countries even if, in general, the aggregate index confirms that competition reduces corruption.

In addition, we can correctly identify when government regulation interventions are incentives and when they are discouragements for corruption. Although combating corruption is one of the main objectives of the incumbent government, this paper does suggest that a lack of government regulations may actually yield more corruption in less developed countries, while standard recipes for greater freedom may be applied in developed countries.

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

The line for policy-makers' intervention in less developed countries and transition economies appears to be clear, although powerful interests, distant from theoretical discussions concerning the trade-off between government intervention, have influenced several governments to take no action at all, making them almost unresponsive to the need to regulate some sectors. According to the empirical analysis, outside developed countries, policies should be addressed to implement complementary

strategies to reduce corruption and the costs of economic growth, choosing proper government interventions within appropriate sectors.

APPENDIX 1 List of countries by macro regions.

Country	Africa	Mena-region	Transition economies	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

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