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The role of political competition in the link between electoral systems and corruption: an extension

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Abstract

This work provides an extension to an international context of the analysis made by Alfano, Baraldi and Cantabene (2013) on the role of political competition as a channel through which electoral systems affect corruption. Our result conflicts with that found by empirical literature on that topic that makes plurality rules the most virtuous in terms of corruption. Political scientists must be cautious in designing the degree of proportionality of electoral rules without take into account the variation in political competition that follows.

Keywords

Political competition; electoral systems; corruption.

JEL Classification

D72; C23; K42.

Introduction

The choice of an electoral system is one of the most important institutional decisions for any democracy. A country's electoral system is the method used to calculate the number of elected positions in government that individuals and parties are awarded after elections. In other words, it is the way that votes are translated into seats in parliament or in other areas of government. There are many different types of electoral systems in use around the world, and even within individual countries, different electoral systems may be found in different regions and at different levels of government (e.g., for elections to school boards, city councils, state legislatures, governorships, etc.). The choice of a particular electoral system has a profound effect on the future political life of the country;the electoral system guarantees the representation of voters' desires and, once chosen, often remains fairly constant. Voting systems are generally divided into majoritarian/plurality rule and proportional representation (PR) with a number of variations and methods. In a democratic system, the mechanism of representation of political parties is also characterized by the degree of political competition among political parties and by the conflict between voters and candidates (the political corruption).

This work deals the effect of electoral systems on the level of corruption of a country. The wide literature studying the causes of corruption (Tanzi, 1998; Rose-Ackerman, 1999), considers the electoral system a most important political determinant of corruption. Indeed, in the public sector, corruption arises and persist when bureaucrats and politicians possess discretionary power which allows to extract economic rents. This happens when institutions (political, bureaucratic, juridical and economic) are weak (Aidt, 2011). Electoral rules characterize those institutions, as to the degree of political competitiveness among political parties. The theoretical literature investigating the relationship between the electoral system and corruption seems to conclude that the way in which electoral rules affect corruption depends on contrasting forces while the empirical literature suggests that countries with proportional systems have much more widespread corruption than countries with majoritarian systems (see subsection 2.1).

That literature, theoretical and empirical, seems to completely neglect the role played by political competition in the link between the electoral system and corruption. Political competition (defined as the competition among political parties to collect votes at elections, that is, as the competition for political power (Bardhan and Yang, 2004)) may be an important channel through which the electoral system affects corruption. Both the electoral system and political competition use the same mechanism to affect corruption: the accountability of incumbent politicians but, as for electoral rules, political competition may drive corruption in opposite directions. Moreover, we may believe that the electoral system has some effect on the degree of political competitiveness among political parties. Here we are interested in underlining that the literature, in particular the empirical literature, did not consider that political competition might affect corruption in combination with electoral systems. Alfano, Baraldi and Cantabene (2013) (hereafter ABC) were the first to attempt this unexplored issue. The deep analysis of the complex web wrapping electoral systems, political competition and corruption motivated the hypothesis formulated by ABC that the electoral system may affect corruption *directly* and *indirectly*, via political competitions.The two effects may drive corruption in the same direction or in the opposite one; the total effect of the degree of proportionality of the electoral formula on corruption is the sum of the two effects. ABC use the suitable Italian scenario and the Gallagher disproportionality index as a measure of the degree of proportionality of an electoral system to test their hypothesis. They find that the way in which corruption is affected by the proportionality degree of an electoral system (that is, the total effect) depends on how the degree of political competition reacts to changes in the degree of proportionality of the electoral rule. The last issue is still unexplored. This powerful result underlines that it can be

misleading to analyze the impact of electoral rules on corruption regardless of the role of political competition, and further investigations are encouraged.

We pick up the invitation of the authors. We extend the testing hypothesis of ABC to an international context, on a cross-country panel data and we use different measures of corruption, available at the cross-country level, in order to check the robustness of results.

Our finding confirmed that of ABC. Firstly, the *direct* effect of the degree of proportionality on corruption is positive: an increase in proportionality of the electoral rule is beneficial for corruption. This result conflicts with that of previous empirical literature on a cross-country basis. The interpretation of this contrasting result is linked to the measure of the proportionality degree of the electoral system we used which allowed us properly to consider all electoral systems variants in an empirical setting. Secondly, as in ABC, we find that the *indirect* effects matter: political competitiveness is a channel through which the electoral system affects corruption and the direction of its effect depends on the degree of proportionality of the electoral system.

The paper is organized as follows. Section 2 summarizes the ABC framework and shows the extension we made to their model. Section 3 describes the empirical model and variables we used. Section 4 explores the empirical strategy and shows the results. Section 5 presents the concluding remarks.

The framework and the extension

Before describing our work, we briefly summarize the general framework of the existing literature on the link between electoral systems and corruption which the ABC analysis refers to.

The ABC framework

The theoretical literature has explored the impact of electoral rules on corruption according to two dimensions: the district size (i.e. the number of seats in a district) and the electoral formula (i.e. how votes are translated into seats). Regarding the district size, PR promotes competition among politicians reducing the possibility of rent for incumbents (Myerson, 1993; Ferejohn, 1986); instead, looking at the electoral formula, the greater accountability of politicians induced by majoritarian representations provides a lower incentive for corruption than in PR (Persson and Tabellini, 1999a,b; 2000). Therefore, from the theoretical point of view, the effect of the electoral system on corruption goes in opposite directions. The empirical literature suggests that countries with proportional systems have much more widespread corruption than countries with majoritarian systems (Persson et al., 2003; Gagliarducci et al., 2011; Kunicova and Rose-Ackerman, 2005).

The study of effects of political competition on the economic variables is limited. Political competition may affect economic performance via the quality of politicians (Besley et al., 2010; Padovano and Ricciuti, 2009; Alfano and Baraldi, 2012). In the political economy literature, the concept of political competition seems close to that of accountability for incumbents (Persson et al., 1997): if political competition is intense, the incumbent politician is more accountable for his actions in office and has an incentive for good performances because, otherwise, he can be easily removed and replaced by the public, with challengers. Therefore, according to this concept, an intense political competition leads to less corruption (Mulligan and Tsui, 2006).Otherwise, when political competition is intense, the electoral base of each party tends to be smaller, the probability of re-election reduces and politicians have an incentive to adopt myopic behavior maximizing rents during their remaining time in office, and corruption increase (Stigler, 1972). Also for political competition, its effect on corruption is difficult to define.

While it is widely documented that the party system is largely determined by the choice of the electoral system (Duverger, 1954; Cox, 1997; Lijphart, 1994; 1999; Sartori, 1976; Taagepera and Shugart, 1989), there is no evidence about the relationship between the latter and political competitiveness among parties. The number of political parties competing at the elections does not measure the degree of political competitiveness among them. As Sartori (1976) pointed out, for political competition, it is important, indeed, to consider the relative size of political parties (this will justify the choice of the Herfindahl index).

The electoral system and political competition use the same mechanism in order to affect corruption and it is not hard to assume that the electoral system has some effect on the degree of political competition.

This last consideration, within the framework of political determinants of corruption, motivated the ABC analysis. ABC advance in the empirical literature on the link between electoral systems and corruption in two ways. Firstly, they were the first that consider the role of political competition in the relationship between the electoral system and corruption. They argued that electoral systems, political competition and corruption are wrapped in a complex web and formulate the hypothesis that there is a *direct* and an *indirect* effect of electoral rules on corruption, the latter via political competition. Secondly, they distinguished electoral systems by using a continuous measure of their degree of proportionality (the Gallagher disproportionality index), differently from previous works which did that by using dummy variables (Persson et al., 2003). Indeed, the electoral rules a country decides to adopt defines the way in which votes obtained by political parties are translated into seats in Parliament; it defines the degree of proportionality of the electoral system. Therefore, in order to properly consider electoral systems in an empirical setting, a measure of its degree of proportionality is the correct way. A further advantage of such a measure of proportionality is the possibility to consider mixed electoral rule, beside the PR and majoritarian. Indeed, *mixed electoral systems*, combining PR and majoritarian elements, are more likely to be characterized by intermediate degrees of proportionality. ABC exploited the Gallagher disproportionality index (Gallagher, 1991) in order to treat Italian mixed systems, that is, to differentiate mixed rules that alternate according to their degree of proportionality during the time span they consider for the analysis. They computed the Gallagher index using the electoral outcomes of the Senate elections from 1979 to 2006 for the 20 Italian regions.

ABC tested their hypothesis on a sample of the 20 Italian regions since 1979 to 2005 arguing that it is a suitable scenario because of the particular characteristics of corruption and the electoral system. The hypothesis of the ABC analysis is that *direct* and *indirect* effects of electoral rules on corruption may drive corruption in the same direction or in the opposite direction depending on how the degree of political competition reacts to variations in the degree of proportionality of the electoral rule; therefore, the total effect of the electoral system on corruption is the sum of the two described effects.

ABC measure the degree of political competitiveness among political partiesthrough the normalized Herfindahl index over the votes of each political party at elections from 1979 to 2006. The *indirect* effect of the electoral system on corruption has been caught by an interaction variable constructed by multiplying the two political indices just above described.

As a dependent variable, ABC used the number of crimes against public administration and estimated a distributed lag model, where corruption is regressed on the past values of regressors. The reason of the choice of a distributed lag model relies on the kind of dependent variable they used. Indeed, corruption crimes perpetuated in a given year may be actually detected contemporaneously or with lags; crimes committed at different times can be detected contemporaneously; there is a lag between the beginning of the investigation and the conclusion of the penal action. Thus, the empirical model should allow for lags between the year the crime

is committed and that of the sentence, that justifies the estimation of a distributed lag model, where corruption is regressed on the past values of regressors, with lags from 2 to 4 years.

ABC found the following results:

- The *direct* effect of the degree of disproportionality of an electoral rule on corruption is positive: the more the degree of proportionality of the electoral system the less the level of corruption.
- The *indirect* effect shows that the way in which political competition affects corruption depends on the degree of proportionality of the electoral rule: there is a threshold of the degree of proportionality that allows us to separate an increase from a decrease of corruption due to an increase in the concentration of votes in the hands of political parties.
- The *total* effect depends on how political competition reacts to changes in the degree of proportionality. If the Gallagher index is below the threshold and if it is assumed that political competition moves in the same direction as the degree of proportionality of the electoral rule, the beneficial (negative) effect on corruption of an increase (decrease) in the degree of proportionality of the electoral system is reinforced by an increase (decrease) in political competition; otherwise,if the two indexed move in opposite direction, the two effects go in opposite direction and the total effect on corruption is indeterminate. When, instead, the value of the Gallagher index goes up to that threshold and an increase (decrease) in political competition follows an increase (decrease) in proportionality, the *direct* and *indirect* effects drive corruption in opposite directions; if the variations of the two political variables are reversed, the overall effect on corruption is the same. Table 1 below offers a graphical illustration of the ABC results.

Table 1. Effects of the degree of proportionality of the electoral system on corruption

Effect on the level of corruption		*Below the threshold*		*Above the threshold*	
	Direct (ΔGDI)	+ (-)	+ (-)	+ (-)	+ (-)
	Indirect (ΔNHI)	+ (-)	- (+)	+ (-)	-(+)
	Total	+ (-)	+/-	+/-	+ (-)

Authors' elaboration

The authors conclude, firstly, that this "within country" result contrasts with the previous cross-country one that, instead, stated that countries with PR have much more widespread corruption thancountries with majoritarian representations (Persson et al., 2003); secondly, that, assuming a variation in the degree of proportionality of the electoral system only, is not sufficient to establish what is the consequent trend of corruption; how political competition reacts to some changes in the degree of proportionality should allow us to draw conclusions. The relationship between the electoral system and political competition still remains unexplored.

The extension

The hypothesis that ABC test and the results they found are very interesting within the political determinants of corruption framework. But, as they suggest, further investigations in that topic are needed. The present work tries to fill some weaknesses of the ABC analysis; in detail, we are referring to:

1) the "within-country" analysis. Italy certainly provides a suitable scenario, but results (as the authors stressed) could be unresponsive to other realities;

2) the Gallagher index, although it is on the Italian regional basis, was computed under the same electoral rule over time. That is, changes in the Italian electoral

system during the period under exam concerned all the regions at the same time. This is the reason why the Gallagher index showed little variability across regions (indeed, it ranges from 0.02 to 0.52);

3) the cross-sectional dimension of the Italian panel data is short (N = 20 Italian regions); this may create some problem in estimations using the system GMM technique which, instead, is designed for panel with short T and long N.

Thus, we test the same hypothesis as ABC to a cross-country scenario. We conduct the empirical analysis on a panel of 85 countries over 28 years (from 1984 to 2010). This extension to ABC's work allows us to compare our results with those previously found by the literature. It seems very interesting to the light of the more suitable measure we used to distinguish electoral systems and their degrees of proportionality that were never done before. Moreover, the panel dimensions are perfect to exploit the system GMM estimation technique.

The empirical model and variables

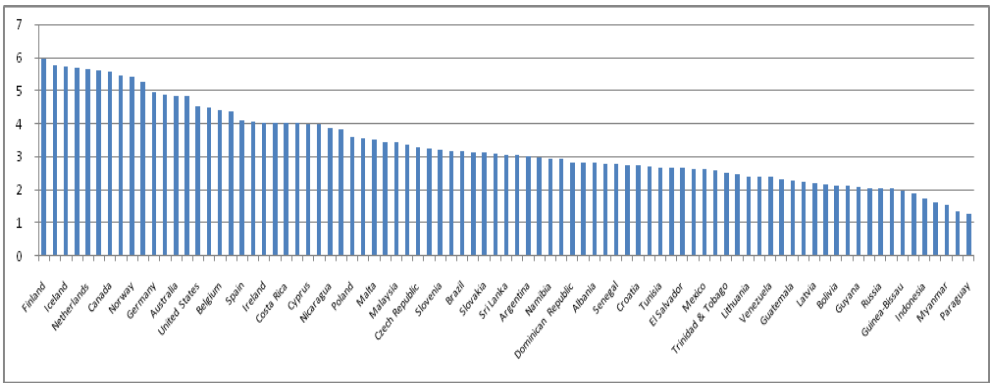
The estimated equation of country *i* at time *t* is

$$Corr_{i,t} = \sum Corr_{i,t-j} + \beta_1 GDI + \beta_2 HI + \beta_3 (GDI * HI) + \sum \delta\, regressors_{i,t} + \\ + \alpha_i + \mu_t + \varepsilon_{i,t} \qquad (1)$$

Where α_i is a country specific effect, μ_t is a time-specific effect. The dependent variable is the Corruption index (thereafter *Corr*) provided by the International Country Risk Guide - ICRG. (Even though the ICRG database includes a collection of records for about 150 countries, our analysis is cut off from some countries which showed few observations. Therefore we reduced the dataset to 85 countries. Table A1, Appendix, provides a full description of the variable.) It is a measure of "perceived" corruption and is one of the three most popular indices based on corruption perception. The other two are the Corruption Perception Index (by Transparency International) and the Control of Corruption index (by the World Bank). It summarizes the valuation of corruption within the political system; in particular, it deals with the warning for foreign investments. The Corruption index ranges in an interval [0 to 6] where 0 represents the highest risk of corruption and 6 is the lowest risk; it provides the longer time series of corruption data, from 1984 to 2010. Tables A2 and A3, Appendix, show respectively the descriptive statistics of Corr and partial correlation.

Figure 1 below shows an overview of the Corruption index distribution for different countries. For each country in the figure we calculated the mean over years (1984-2010). To the left with a high index value (meaning low corruption risk) we find the Scandinavian countries and the three countries of Oceania (Australia, New Zealand and Papua New Guinea). European countries in the dataset show low/medium levels of corruption while countries in Asia, Africa and South America have the highest value.

Figure 1. Mean of Corruption index over the years



The dynamic panel data model (as equation (1)) can be identified only for stationary time series cross-sectional data; therefore, a panel test for unit roots on the dependent variable *Corr* is needed. We perform the Fisher-type test developed by Maddala and Wu (1999). A Fisher-type test combines the p-values from N independent unit root tests. It is based on the p-values of individual unit root test; the null hypothesis is that all series are non-stationary against the alternative that at least one series in the panel is stationary. We chose this test because it does not require a balanced panel. At 1 percent we reject the null hypothesis of non-stationary series, thus our dependent variable does not show unit root. We perform the Fisher-type test including drift and 1, 2 and 3 lags in the individual ADF regressions. We always reject the null. The test is not shown.

Two lags of the dependent variable are introduced in the estimated equation because of the dynamic of corruption (Aidt, 2003). Estimations of equation (1) without lags of Corr showed autocorrelation of residuals. In order to solve this problem, we introduced two lags of the dependent variable in the right-side of equation (1).

The two regressors of our interest are political indices.

The first one, as mentioned above, is the Gallagher disproportionality index. As in ABC, we use it as a measure of the degree of proportionality of the electoral system. As for the within-country analysis, this is a novelty also in the cross-country empirical literature on the effects of electoral systems on corruption. The Gallagher index (or least squares index) is a representation index of political parties within a Parliament; it may be considered as a very good proxy for the degree of proportionality of an electoral system because the electoral system that guarantees a greater representation of political parties is a more proportional one while the less representative one is less proportional. Moreover, empirical studies have shown that a majoritarian system produces a higher level of disproportionality than a proportional representation system (Lijphart, 1994; Anckar, 2001), whereas a mixed-electoral system produces an intermediate level (Powell and Vanberg, 2000; Anckar, 2001). The Gallagher index (thereafter *GDI*) is constructed as

$$GDI = \sqrt{\frac{1}{2}\sum_i (v_i - s_i)^2}$$

where v_i and s_i are respectively the share of votes and of seats of a single political party (i=1,....,n political parties) at elections in each country in the time span under consideration. The index may range from 0 to 100 with 100 indicating perfect proportionality between seats and votes and 0 meaning that the only seat at stake goes to the winner (in which case the index equals the percentage of votes obtained by the defeated candidate). Clearly the bounds of the *GDI* (0 and 100) are only theoretical values. Among the investigated countries, the *GDI* ranges from 0.26 to about 33 (see table A2, Appendix, for the descriptive statistics of the *GDI*). The dataset comprises countries that experienced majoritarian, proportional and mixed systems. The upper bound of the *GDI* (33.25) is very far from the theoretical value of 100 of perfect disproportionality. This means that also countries under plurality rules have a relatively strong proportionality. Therefore, all the three systems have a certain degree of proportionality; moving from PR to majoritarian systems, such degree of proportionality decreases.

The other political index measures the political competitiveness among political parties at elections. It is the Herfindahl index (HI) calculated as:

$$HI = \sum_{i=1}^{n} v_i^2$$

where v_i is the vote share of a single political party at elections in each country from 1984 to 2010 and *n* is the number of political parties at each election. It ranges from 0 (theoretically perfect competition with *n* equally sized parties) to 1 (monopoly) and it is open on the lower bound. The Herfindahl index is usually used to measure the size of firms in relation to an industry; therefore, it is an indicator of the amount of competition among them. Following Stigler (1972), which interprets competition in the market for votes as competition in the goods' market (the more competitive the parties, the more responsive the political system will be to the desires of the majority), an index of goods' market power seems the correct way to measure the market for votes' power. ABC employed the normalized Herfindahl index because of its desirable properties for that kind of analysis. We are forced to use the standard Herfindahl index because we are unable to collect the number of political parties at elections in each country, required to construct the normalized Herfindahl index. Table A2, Appendix, summarizes the descriptive statistics of this index.

The *direct* effect of the degree of proportionality on corruption is caught by the coefficient *β1* in eqaution (1). The *indirect* effect is caught by the coefficient *β3* of the interaction term *GDI*HI*.

De Haan and Seldadyo (2005) in their survey on the causes of corruption, detect tens of such determinants. Among them, we chose, as control variables, those we believed the more suitable for the analysis we will perform. Therefore, control variables are:

- Per capita *GDP*, in natural log (*lngdp*); it controls for structural differences in economic development (De Haan and Seldadyo, 2005). We expect its positive correlation with perceived corruption (Ades and Di Tella, 1999; La Porta et al., 1999; Treisman 2000). Hall and Jones (1999) and Kaufmann et al. (1999) question the causal relationship between corruption and income: the per capita GDP is high because of low corruption. For this reason we treat lngdp as endogenous.
- Population (*pop*); it controls for country size. Empirical literature found contrasting evidence (Knack and Azfar, 2003; Tavares, 2003).
- Government stability (*gov_stab*); it controls for quality of government. The higher the quality of government, the lower the probability of corruption (de Haan and Seldadyo, 2005).
- Democratic accountability (*dem*); it controls for the level of democracy of a country. There is a general consensus that democracy reduces corruption (de Haan and Seldadyo, 2005).
- Freedom of press (*press*); it controls for democratic governance. Informed voters are better able to hold elected officials accountable for their policy decisions; the greatest part of people get their information via the media (Snyder and Stromberg, 2008). This variable is found to be negatively correlated with corruption (Brunetti and Weder, 2003).
- Law and Order (*law_order*); it controls for the rule of law as a measure of the confidence that agents have in the rules of society, the effectiveness of judiciary and the enforceability of contracts (de Haan and Seldadyo, 2005). A stronger rule of law reduces the likelihood of corruption to take place. Also in this regard, an issue of causality may emerge: agents may have trust in the rule of law because corruption is low. In order to take this problem into account, in some estimations we treat law_order as endogenous.
- Woman (*wom*); it is the proportion of seats held by women in national parliaments (percentage); it controls for the gender dimension of corruption meaning that conventional wisdom states that women in public life can be an

effective anticorruption strategy because women are less corruptible than men (Dollar et al., 1999; Goetz, 2004; Sung, 2003).

- General government consumption expenditure (*G*); it controls for government size. There is no consensus among authors on the theoretical relationship between government size and corruption (Abdiweli and Hodan, 2003; Bonaglia et al., 2001; Fisman and Gatti, 2002). We normalize general government consumption expenditure in percentage of GDP and per capita.
- Net enrollment primary rate, in natural log (*lnschool*); it controls for the human capital development. Empirical literature found contrasting evidence (Ali and Isse, 2003; Frechette, 2001). Tables A.1, A.2 and A.3, Appendix, show respectively the detailed description of all the variables, the statisticsand the correlation matrix.
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We follow standard practice of counting a country as democratic according to its rate of Polity IV political freedom score; we define as a democracy a country which scores a Polity IV index greater than +3 in the year of the election (Gleditsch and Hegre, 1997). See table A.1 for a detailed description of this index and table A.2 for its descriptive statistics.

In order to generalize the estimation results, we will provide robustness checks by using other measures of corruption available at cross-country level.

Empirics

Empirical strategy

Equation (1) is a dynamic panel data model which has been estimated using Arellano-Bover (1995)/Blundell-Bond (1998) system GMM estimators;[1] estimation results are shown in Table 2.The empirical analysis has been conducted on a panel of 85 countries over 28 years (from 1984 to 2010). In order to control for heteroskedasticity, every estimated equation has cluster-robust standard errors. The second-last raw of Table 2 (see sub-section 4.1) shows the Chi-squared (and the p-value in parentheses) of the Hansen test whose null hypothesis is that the over-identification restrictions are valid; we do not reject the null and the model is correctly specified. (We also compute, but we do not show, the difference-in-Hansen test in order to test the joint validity of the full instrument set; we do not reject the null.) The last raw of Table 2 displays the p-value of the Arellano-Bond test for second-order autocorrelation in the first differenced residuals; the null hypothesis is the absence of autocorrelation of residuals that we always accept.In order to control for common shocks in a given year, calendar year dummies are included. (In Table 2 of estimation results we do not display such dummies.) Every specification in Table 2 is estimated by the two-step options with the Windmeijer (2005) correction. Windmeijer (2005) finds that the two-step efficient GMM performs somewhat better than one-step in estimating coefficients, with lower bias and standard errors, and that the two-step estimation with corrected errors is superior to robust one-step.

We start estimating equation (1) including the two typical controls in cross-country analysis, the (log of) per capita GDP and the population size; in order to test the robustness of results, in the following specifications we add, step by step, all the control variables described above. All the regressors in equation (1) are introduced contemporaneously: given that our dependent variable is an index of perceived corruption, we have no reason to believe that this perception by citizens is affected

[1] We used the Stata command xtabond2 provided by David Roodman (2009)

by past values of the variables. This is the reason why we do not introduce lag structure in the estimated model. An important issue here is to deal with the possibility of endogeneity of the Gallagher index. First of all, the theoretical literature analyzing the link between electoral rules and corruption considers the first as a *determinant* of corruption and not the reverse. Second, it seems unlike to think that the perception of corruption (as a menace for foreign investments) may affect the way in which electoral system is designed by politicians; third, it seems also unlike to believe that a more or less corrupt system may affect the way in which votes are translated in seats, as the electoral system does. However, an endogeneity problem may arise when dealing with political institutions, that is, there may be some omitted factors that influence electoral systems and simultaneously influence corruption.In order to verify the exogeneity of *GDI* we perform the *C* test on the *GDI* variable. Under the null, the Hansen statistic tests the validity of a subset of orthogonality conditions. To perform the *C* test we have to estimate two models, one where *GI* is exogenous and another where the *GI* is endogenous. The estimation of the first model gives us a Hansen statistic (called H1) and the estimation of the second model gives us another Hansen statistic (called H2). We need to use the same set of exogenous instruments for both estimations that is we have to assume that all the other orthogonality conditions hold, i.e. all the other included and excluded instruments remain exogenous. H1 and H2 are both distributed as a Chi-squared with the dof of H2 smaller than the dof of H1. The *C* test on *GI* is simply a test of H1-H2. The test statistic H1-H2 is distributed as Chi-squared with dof equal to the number of regressors being tested for endogeneity (in our case 1, *GDI*). If it is endogenous, then H1-H2 will be high because H1 is high while H2 is not. In order to deal with the general endogeneity issue, system GMM treats the model as a system of equations—one for each time period—where the predetermined and endogenous variables in first differences are instrumented with suitable lags of their own levels (see Table A4, Appendix). Columns (a) and (a') display the estimates of equation (1) where *GDI* is treated respectively as exogenous and endogenous (only with lngdp and pop as control variables). This allows us to calculate the statistic (H1-H2). It is distributed as a Chi-squared with dof=1 and it is equal to 0.03. Looking at the critical value of the Chi-squared distribution with 1dof, the test says that at 1 percent we do not reject the null: *GDI* is exogenous. Moreover, the coefficients of *GDI*, *HI* and *GDI*HI* are significant when *GDI* is endogenous.

As mentioned above, the per capita GDP is treated as endogenous and it is instrumented with its own lags. We treat the low and order variable as exogenous and endogenous; where endogenous, it is instrumented with its own lags.

Results

Table 2. Estimation results. Dependent variable: Corruption Index

	(a)	*(b)*	*(c)*	*(c')*	*(d)*	*(d')*	*(e)*	*(f)*	*(f')*	(g)
corr (-1)	1.08*** (20.8)	1.03*** (16)	1.01*** (14.4)	1.08*** (12.5)	1.04*** (15.7)	1.04*** (14.6)	0.99*** (12)	1.05*** (15)	1.04*** (15)	0.98*** (8.03)
corr (-2)	-0.23*** (-5.7)	-0.21*** (-5.3)	-0.21*** (-4)	-0.23*** (-3.3)	-0.21*** (-4.4)	-0.22*** (-5)	-0.21*** (-4.2)	-0.21*** (-4.3)	-0.21*** (-4.5)	-0.17** (-2.2)
GDI	-0.01** (-2.23)	-0.01** (-2.28)	-0.01* (-3)	-0.01* (-1.77)	-0.01*** (-3.18)	-0.01*** (-2.7)	-0.01** (-2.5)	-0.01*** (-2.88)	-0.01*** (-3.04)	-0.01** (-2.1)
HI	-0.48** (-1.92)	-0.6** (-2.03)	-0.8* (-2.6)	-0.36* (-1.72)	-0.6** (-2.10)	-0.67* (-1.86)	-0.41* (-1.62)	-0.54* (-1.8)	-0.59** (-2.01)	-0.43* (-1.8)
GDI *HI	0.02*** (2.6)	0.02** (2.49)	0.03* (3.2)	0.02** (2.23)	0.03*** (2.8)	0.03*** (3.02)	0.02** (1.92)	0.03** (2.5)	0.03*** (2.63)	0.02* (1.8)
lngdp	0.02 (0.7)	0.02 (0.5)	-0.05 (-0.7)	0.03 (1)	-0.09 (-1.1)	-0.06 (0.9)	-0.02 (-0.26)	-0.08 (-1.09)	-0.09 (-1.1)	0.03 (0.4)
pop	-5.77e-11 (-0.5)	-8.90e-11 (-0.7)	-2.05e-10 (-1)	5.63e-11 (0.8)	-1.08e-10 (-0.7)	-1.45e-10 (-0.8)	3.30e-11 (0.27)	-1.14e-10 (-0.7)	-7.88e-11 (-0.4)	1.84e-11 (0.1)
gov_stab		0.05*** (3.1)	0.05* (2.95)	0.03** (1.96)	0.03** (2.4)	0.04 (1.54)	0.03*** (2.7)	0.03** (2.17)	0.03** (2.2)	0.03 (1.48)
dem			0.05** (1.96)	0.003 (0.2)	0.003 (2.39)	0.02 (0.5)		0.004 (0.35)	0.006 (0.5)	-0.01* (-0.7)
press				-0.004 (-1.1)						
law_order					0.15*** (2.73)	0.06 (0.5)	0.12*** (2.11)	0.13*** (2.6)	0.14*** (2.7)	0.10 (1.3)
women							0.006** (2.14)			
G/GDP								0.003 (0.8)		
G/POP									0.08* (0.8)	
lnschool										0.6 (0.8)
N. obs. (n. groups)	1303 (70)	1298 (70)	1191 (69)	1151 (70)	1191 (69)	1191 (69)	1155 (69)	1182 (69)	1182 (69)	697 (65)
N. instrum.	36	37	47	41	47	48	47	48	48	49
Chi2 (p-value) Hansen test	1.1 (0.89)	1.9 (0.7)	12.4 (0.5)	6.6 (0.35)	10.4 (0.58)	11.9 (0.53)	9.36 (0.7)	11.6 (0.47)	10.2 (0.6)	17.3 (0.18)
p-value 2nd order autocor	0.17	0.13	0.12	0.12	0.18	0.14	0.25	0.17	0.2	0.9

Notes. All specifications contain calendar year dummies (results not reported); the time span is 1984-2010. The dependent variable is Corr. Standardized normal z-test values are in parentheses; cluster-robust standard errors. lngdp is endogenous everywhere and it is instrumented with its own lags; law_order is endogenous in (d') and it is instrumented with its own lags. Significant coefficients are indicated by * (10% level), ** (5% level) and *** (1% level).Two-step estimations with Windmeijer (2005) correction.

Specification (a) contains only the per capita GDP (in natural log) and population; the specifications which follow contain all the control variables we described above. The signs and significance of the political indices of interest do not change in every specification. At the cross-country level, our findings exactly confirm those in ABC. The coefficient of the *GDI* is negative everywhere; recalling that it is a disproportionality index, the more the degree of proportionality of the electoral system, the less the level of corruption (remember also that the higher the value of the Corruption index, the lower the level of corruption). This result states that the *direct* effect of the proportionality of the electoral system on corruption is positive also at the cross-country level and contradicts the previous empirical findings of Persson et al. (2003). This may be due to the fact that we distinguish electoral

systems according to their degree of proportionality instead of dummy variables; in our opinion, as stated above, the measure of proportionality is the correct way to identify electoral rules in an empirical setting. The magnitude of β_1 is 0.01 meaning that if the proportionality increases, for example, by 0.1, the level of corruption decreases by 0.001. The HI shows a negative and significant coefficient equal, on average, to 0.55: a decrease in this index means an increase in political competition which is beneficial for corruption. Finally, the novelty of the present work (as that of ABC) is the interpretation of the interaction term *GDI*HI*, capturing the *indirect* effect of the degree of proportionality of the electoral system on corruption. Looking at the specification (a), we can write

$$\frac{\partial corr}{\partial HI} = -0.48 + 0.02 * GDI \tag{2}$$

that is, the effect of political concentration on corruption depends positively on the degree of disproportionality of the electoral system. In equation (2), there is a threshold value of the *GDI* (*GDI*=24) such that if *GDI*> 24, $\frac{\partial corr}{\partial HI} > 0$, if *GDI*<24, $\frac{\partial corr}{\partial HI} < 0$. (The threshold value of *GDI* is the value such that $\frac{\partial corr}{\partial HI} = 0$ in equation (2). This is equal to 24.)

Therefore, an increase in political competition may have a positive or negative impact on corruption depending on whether the variable *GDI* is above or below that threshold value. The threshold values slightly change according to the estimated coefficients of specifications in Table 2. We can now deal with the *total* effect of the degree of proportionality of the electoral system on corruption. It depends on how political competition reacts to changes in the degree of proportionality of the electoral system. Where electoral systems are characterized by high degrees of proportionality, an increase (decrease) in their degrees of proportionality followed by an increase (decrease) in political competition, is beneficial (is not beneficial) for corruption because the *direct* and the *indirect* effects go in the same direction. Otherwise, under less proportional electoral systems (*GDI* above 24), an increase (decrease) in political competition which follows an increase (decrease) in proportionality, leads to the *direct* and the *indirect* effects in opposite directions. In this situation, in order to reduce corruption, an increase in the degree of proportionality should be followed by a reduction in political competitiveness. Therefore, if the change in political competition has the same sign as the change in the degree of proportionality of the electoral formula, the *indirect* effect strengthens the *direct* effect under more proportional rules and it mitigates the *direct* effect on corruption under less proportional regimes.

In terms of the data, only few countries in few years of elections experienced a degree of proportionality greater than 24. (Those countries are Albania, Bahamas, France, Jamaica, Mongolia, Papua New Guinea, Philippines, Sri Lanka, Trinidad & Tobago and Turkey.)

This means that, according to our estimation, the relevant case to be considered is $\frac{\partial corr}{\partial HI} < 0$.

Now look at the other variables. Past values of *Corr* are always highly significant and the long-run effect is positive, as expected. The introduction of all the control variables does not change the results.The *lngdp* and pop are never significant. The government stability (*gov_stab*) is positive and significant, as expected, almost everywhere with magnitude, on average, of 0.03: an increase of 0.1 in government stability index leads to an increase in the Corruption index (that is, a decrease in corruption) of 0.003. In columns (c) and (c') we introduce *demand press*: they are

both variables related to the democratization of countries. *[D]emis* positive, as expected, and significant in (c); when we introduce *press* in (c'), *dem* loses significance and press is not significant. We drop this latter from the following estimations. *[L]ow_order* is positive everywhere and significant only where it is exogenous (in (d') it is treated as endogenous): a stronger rule of law is confirmed to deter corrupt behaviour. A positive sign is confirmed also for the presence of women in the country's parliament. As a proxy for the government size, we control for both public consumption spending/GDP and public consumption spending/population. Only the second one is significant with positive sign. Finally, the rate of schooling seems to have no relevance in the explanation of corruption.

Robustness analysis

We perform a further robustness check of the analysis, concerning the dependent variable. We test the same model with the two other most widely used indicators of corruption worldwide: the Corruption Perceived Index (hereafter *CPI*) and the Control of Corruption Index (hereafter *C_C*). The CPI measures the perceived levels of public sector corruption (CPI, 2012). Based on expert opinion, countries are scored from 0 (highly corrupt) to 10 (very clean). *C_C* Index reflects perceptions of the extent to which public power is exercized for private gain capturing all the forms of corruption by which elites and private interests take advantage from public sector. It ranges from approximately -2.5 (high corruption) to 2.5 (low corruption). (See Tables A1 and A2 for the description and statistics of those variables.) The estimation results are in Table 3 where we introduce, as controls, only *lngdp* and *pop*.[2]

Table 3. Estimations. Dependent variables: *CPI* and *C_C*

	(h) *Dep. Var.: CPI*	*(i)* *Dep. Var.: C_C*
CPI (-1)	0.05 (0.9)	
CPI (-2)	0.46** (2.1)	
C_C (-1)		-0.08 (0.5)
GDI	-0.08* (-1.9)	-0.05** (-2)
HI	-1.81* (-1.9)	-1.78* (-1.82)
GDI *HI	0.25** (2)	0.11* (1.65)
lngdp	0.4 (1.2)	0.33* (1.66)
pop	-2.15e-10 (-0.5)	-6.63e-10* (-1.21)
N. obs. (n. groups)	734 (67)	540 (69)
N. instrum.	39	35
Chi2 (p-value)	21.4	25.3
Hansen test	(0.2)	(0.2)
p-value 2nd order autocorrelation	0.2	0.7

Notes. CPI is the Corruption Perception Index; C_C is the Control of Corruption Index. All specifications contain calendar year dummies (results not reported); in (h) the time span is 1995-2011; in (i) the time span is 2002-2011. Standardized normal z-test values are in parentheses; cluster-robust standard errors. lngdp is endogenous everywhere. Significant coefficients are indicated by * (10% level), ** (5% level) and *** (1% level).Two-step estimations with Windmeijer (2005) correction.

As we can notice, both *direct* and *indirect* effects of the degree of proportionality of the electoral system on corruption remain robust to different measures of corruption. The number of observations drastically decreases because the time span is 1995-

[2] In the estimation with C_C as dependent variable, in column (i) Table 3, we introduce only one lag of the dependent variable because it is enough to remove the autocorrelation of residuals.

2011 for the *CPI* and 2002-2011 for the *C_C*. The estimated coefficients for *GDI*, HI and the interaction *GDI*HI* show that the threshold values of the *GDI* fall into the allowable range: it is equal to 7.24 when the dependent variable is the *CPI*, and it is equal to 16.2 when the dependent variable is the *C_C*. This robustness check seems very important; it indicates that the threshold value of the disproportionality index is not easily determined. The threshold value would allow to identify the direction of the *indirect* effect of the degree of proportionality on corruption, and therefore, to deal with the *total* effect. In our estimations, it depends on the corruption index we use, but, probably, it may widely vary among countries depending on their specific characteristics.

Concluding remarks

This work extends the ABC paper to an international context. The very interesting results they found, within the Italian scenario, on the role played by political competition in the link between the electoral system and corruption required further investigations in order to be generalized. Therefore, we test the same hypothesis as in ABC on a cross-country panel data, from 1984 to 2010. Our findings, firstly, contradicts previous empirical literature on cross-country data that makes plurality systems those most virtuous in terms of corruption. The interpretation of this reversed result can be due to the use of a more suitable measure of electoral rules, as a degree of proportionality index, instead of a dummy variable, that allowed us to properly consider all electoral systems in an empirical setting. Secondly, they confirm that one cannot draw conclusions about the way the electoral system could be designed as a tool in fighting corruption without considering political competition. Again we stress the fact that how political competition reacts to changes in the degree of proportionality of the electoral system, both theoretically and empirically, remains, until now, still unexplored.

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Appendix

Table A1: Variables description

Corr	*Corruption Index. It summarizes the valuation of corruption within the political system; in particular, the presence of corruption is a threat to foreign investment because it 'distorts the economic and financial environment; reduces the efficiency of government and business by enabling people to assume positions of power through patronage rather than ability, and introduces an inherent instability into the political process' (http://www.prsgroup.com/ICRG_methodology.aspx). The result is that corruption makes it difficult to conduct business and, in some cases, it may force the withdrawal of investments. Source: ICRG, 1984-2010.*
CPI	Corruption Perceptions Index. The Corruption Perceptions Index (CPI) ranks countries and territories based on how corrupt their public sector is perceived to be. It is a composite index – a combination of polls – drawing on corruption-related data collected by a variety of reputable institutions. The CPI reflects the views of observers from around the world, including experts living and working in the countries and territories evaluated - See more at: http://cpi.transparency.org/cpi2012/in_detail/#sthash.BQB3zGZV.dpuf Source: Transparency International, 1995 – 2012.
C_C	Control of Corruption Index. It reflects perceptions of the extent to which public power is exercized for private gain capturing all the forms of corruption by which elites and private interests take advantage from public sector. It is based on 30 underlying data sources reporting the perceptions of governance of a large number of survey respondents and expert assessments worldwide. The used data are selected from the Worldwide Governance Indicators (WGI) research dataset which estimate the quality of governance. The estimated data of governance ranges from approximately -2.5 (weak) to 2.5 (strong) governance performance. Source: Worldwide Governance Indicators by World Bank, 1996 -2011 (with missing in 1997, 1999, 2001).
GDI	Gallagher Disproportionality index. Source: Gallagher Electoral Disproportionality Data,1945-2011 http://www.tcd.ie/Political_Science/staff/michael_gallagher/ElSystems/Docts/ElectionIndices.pdf.
HI	Herfindahl index. Source: Gallagher Electoral Disproportionality Data,1945-2011 http://www.tcd.ie/Political_Science/staff/michael_gallagher/ElSystems/Docts/ElectionIndices.pdf.
lngdp	Natural logarithm of gross domestic product at constant price 2000 US. Source: World Bank, 1980-2011.
pop	Urban population refers to people living in urban areas as defined by national statistical offices. Source: World Bank population estimates and urban ratios from the United Nations World Urbanization Prospects, 1980-2011.
gov_stab	Government stability. It is an assessment both of the government's ability to carry out its declared program(s), and its ability to stay in office. The risk rating assigned is the sum of three subcomponents (Government Unity, Legislative Strength, Popular Support), each with a maximum score of four points and a minimum score of 0 points. A score of 4 points equates to Very Low Risk and a score of 0 points to Very High Risk. This index ranges into the interval (0, 12). Source: ICRG, 1984-2010.
dem	Democratic accountability. Measure of how responsive government is to its people, on the basis that the less responsive it is, the more likely it is that the government will fall, peacefully in a democratic society, but possibly violently in a non-democratic one. The points in this component are awarded on the basis of the type of governance enjoyed by the country in question. This index ranges into the interval (0, 6). Source: ICRG, 1984-2010.
press	Freedom of press. Freedom House has been at the forefront in monitoring threats to media independence which plays a key role in sustaining and monitoring a healthy democracy, as well as in contributing to greater accountability, good government, and economic development. The annual index contains the most comprehensive data set available on global media freedom; it provides numerical rankings and rates each country's media as "Free," "Partly Free," or "Not Free". Index Score ranges from 0 to 100 cover the period 1993-2011; 0 states that press freedom is maximum and 100 means press is absolutely not free. During the period 1980-1992 the statistics published by Freedom House are expressed using the status Free, Partly Free, Not Free. The Freedom House specifies that these status could be scored in different intervals, in particular the status free press range in the interval [0-30]; the status partly free press range in the interval [31-60] and the status not free press range in the interval [61-100]. Taking these instructions, we assign the mean score of each interval of status only in the case the mean value of interval was very close to index score. Source: Freedom House's annual Press Freedom, 1980-2014. https://www.freedomhouse.org/report-types/freedom-press#.VK_REU0U_IU
law_order	Law and Order is composed by sub-component comprising zero to three points. The Law sub-component is an assessment of the strength and impartiality of the legal system, while the Order sub-component is an assessment of popular observance of the law. Thus, a country can enjoy a high rating – 3 – in terms of its judicial system, but a low rating – 1 – if it suffers from a very high crime rate of if the law is routinely ignored without effective sanction (for example, widespread illegal strikes). This index ranges into the interval (0, 6). Source: ICRG, 1984-2010.
wom	Proportion of seats held by women in national parliaments (%). The data referred to Unicameral assembly or lower chamber of bicameral assembly. These data are comparable with United Nations Women's Indicators and Statistics Database – Wistat published by World Bank. Source: PARLIA database, 1980-2011. http://www.ipu.org/wmn-e/classif-arc.htm, http://www.ipu.org/parline-e/parlinesearch.asp, http://databank.worldbank.org/data/views/reports/tableview.aspx
G	General government final consumption expenditure (% of GDP). It includes all government current expenditures for purchases of goods and services, most expenditures on national defense and security, but excludes government military expenditures that are part of government capital formation. Source: World Development Indicators, 1980- 2011 http://data.worldbank.org/indicator/NE.CON.GOVT.ZS.
lnschool	Natural log of the net enrolment primary rate. It is the ratio between who are enrolled in primary school and the total population of the official primary school age. Source: World Development Indicators http://data.worldbank.org/indicator/SE.PRM.NENR, 1980-2011.
Polity IV	The Polity IV index is a combined polity score ranging from -10 (strongly autocratic) to +10 (strongly democratic), reached by subtracting the autocracy score from the democracy score. The democracy and autocracy indices were originally constructed additively based on the following indicators: competitiveness of executive recruitment, openness of executive recruitment, constraints on chief executive, regulation of participation, and competitiveness of participation. Scholars have reduced the index to a dichotomous measure of democracy and autocracy. A perfect +10 democracy, like Australia, Greece, and Sweden, has institutionalized procedures for open and competitive political participation; chooses and replaces chief executives in open, competitive elections; and imposes substantial checks and balances on the powers of the chief executive. In a perfect -10 autocracy, by contrast, citizens' participation is sharply restricted or suppressed; chief executives are selected according to clearly defined (usually hereditary) rules of succession from within the established political elite; and, once in office, chief executives exercise power with few or no checks from legislative, judicial, or civil society institutions. A polity score of -88 indicates economies in transition. Source: Polity IV Individual Country Regime Trends, 1946-2013: http://www.systemicpeace.org/polity/polity4.htm

Table A2: Descriptive statistics of variables

Variable	*Mean*		*Std. Dev.*	*Min*	*Max*	*Observations*
Corr	3.39	overall	1.41	0	6	N = 2160
		between	1.18			n=85
		within	0.76			T=25
CPI	5.02	overall	2.4	0.4	10	N = 1223
		between	2.32			n=85
		within	0.5			T=14
C_C	0.34	overall	1.08	-1.7	2.56	N = 1105
		between	1.07			n=85
		within	0.18			T=13
GDI	7.64	overall	6.54	0.26	33.25	N = 1975
		between	5.46			n=85
		within	3.67			T=23
HI	0.3	overall	0.13	0.06	0.89	N = 1772
		between	0.12			n=79
		within	0.06			T=22
lngdp	8.25	overall	1.46	4.9	10.9	N = 2566
		between	1.44			n=83
		within	0.22			T=31
pop	3.97e+07	overall	1.14e+08	210600	1.24e+09	N = 2688
		between	1.13e+08			n=84
		within	1.89e+07			T=32
gov_stab	7.63	overall	2.01	1	11.5	N = 2153
		between	0.88			n=85
		within	1.82			T=25
dem	4.92	overall	1.79	0	11.5	N = 2153
		between	1.43			n=85
		within	1.05			T=25
press	33.4	overall	19.2	5	100	N = 1762
		between	18.2			n=85
		within	6.2			T=21
law_order	3.93	overall	1.53	0	6	N = 2153
		between	1.32			n=85
		within	0.75			T=25
wom	14.4	overall	10.1	0	47.3	N = 2347
		between	7.5			n=84
		within	6.8			T=28
G/GDP	16.5	overall	5.98	2.9	43.4	N = 2526
		between	5.16			n=83
		within	3.04			T=30
G/POP	0.08	overall	0.32	3.33e-06	2.99	N = 2510
		between	0.31			n=83
		within	0.06			T=30
lnschool	4.48	overall	0.2	2.9	4.6	N = 1494
		between	0.17			n=81
		within	0.08			T=18
Polity IV	8.4	overall	1.79	4	10	N=1995
		between	1.73			n=79
		within	0.73			T=25

Table A3. Correlations

	corr	*GDI*	*HI*	*lngdp*	*pop*	*gov_stab*	*dem*	*press*	*law_order*	*wom*	*G/GDP*	*G/POP*	*lnschool*
corr	1												
GDI	-0.2	1											
HI	-0.24	0.17	1										
lngdp	0.63	-0.23	-0.34	1									
pop	-0.09	-0.02	-0.08	-0.05	1								
gov_stab	0.08	0.08	0.11	0.11	-0.04	1							
dem	0.35	-0.28	-0.26	0.38	0.02	0.08	1						
press	0.6	0.19	0.15	-0.8	0.09	-0.12	-0.3	1					
law_order	0.7	-0.18	-0.28	0.66	-0.06	0.12	0.39	-0.6	1				
wom	0.39	-0.38	-0.16	0.33	-0.13	0.06	0.21	-0.5	0.28	1			
G/GDP	0.43	-0.18	-0.18	0.45	-0.16	-0.01	0.14	-0.44	0.51	0.37	1		
G/POP	0.27	-0.14	-0.01	0.28	-0.1	0.17	0.04	-0.26	0.25	0.14	0.14	1	
lnschool	0.22	-0.18	-0.3	0.6	0.04	-0.01	0.37	-0.38	0.33	0.15	0.32	0.1	1

Table A4: C test. Dependent variable: Corruption Index

	(a)	**(a')**
corr (-1)	1.83***	1.08***
	(20.8)	(20.8)
corr (-2)	-0.23***	-0.23***
	(-5.7)	(-5.7)
GDI	-0.01**	-0.007
	(-2.23)	(-0.17)
HI	-0.48**	-0.42
	(-1.92)	(-0.7)
GDI *HI	0.02***	0.13
	(2.6)	(0.17)
lngdp	0.02	0.02
	(0.7)	(0.4)
pop	-5.77e-11	-6.23e-11
	(-0.5)	(-0.5)
N. obs. (n. groups)	1303 (70)	1303 (70)
N. instrum.	36	35
Chi2Hansen test	1.1	1.07
(dof)	(4)	(3)
p-value 2nd order autocorrelation	0.17	0.7

Notes. All specifications contain calendar year dummies (results not reported); the time span is 1984-2010. The dependent variable is Corr. Standardized normal z-test values are in parentheses; cluster-robust standard errors. lngdp is treated as endogenous everywhere. In (a) GDI is treated as exogenous while in (a') it is treated as endogenous and it is instrumented with its own lags. Significant coefficients are indicated by * (10% level), ** (5% level) and *** (1% level). Two-step estimations with Windmeijer (2005) correction.