

Corruption and Education: Empirical Evidence

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ABSTRACT: Corruption is widely believed to be detrimental to economic performance. However, little empirical evidence has been presented to assess its consequences on education. Using various education indicators, this paper aims to examine the effects of corruption on education both from a quantitative and qualitative point of view. The cross-country regression analysis shows a strong link between corruption and secondary school enrollment rates, but the relationship between corruption and education quality as measured by repeater rates is weaker. The results suggest that high and rising corruption decreases significantly access to schooling. A unit increase in corruption reduces enrollment rates by almost 10 percentage points. These findings are robust to the use of alternative measure of corruption and other sensitivity analysis.

Keywords: Corruption; education

JEL Classifications: D73; I20

1. Introduction

The question of the macroeconomic impact of corruption has received a great deal of attention during the last few decades. In their definitions of corruption, economists often place emphasis on practices related to public decisions and retain a description close to that adopted by the World Bank for which corruption can be understood as the abuse of public office for private gain¹. Increased availability of new and more reliable data on corruption since the middle of the nineties has contributed to a growing body of empirical work on the links between corruption and economic performance. This led naturally to a better understanding of the costs of corruption and to a broad consensus on its adverse consequences. However, nearly two decades since the first empirical studies in this area, it is clear that there is very little work related to the effects of corruption on education and human capital formation. Indeed, large part of previous literature paid much attention to the incidence of this phenomenon on economic growth and investment. Conversely, little theoretical or empirical research has been offered on the impact of corruption on education. Nevertheless, it is not unrealistic to consider that corruption can also constitute, for several reasons, a real obstacle to education development and human capital formation and accumulation.

In this paper, we revisit the relationship between corruption and education. Our main interest is to examine the effects of corruption on quantitative and qualitative aspects of education through a cross-section regression analysis with a wide sample of countries and different education indicators. Section 2 of the paper provides a summary of previous literature on the links between corruption and education. Section 3 describes the empirical methodology used in the study, presents our cross-country regression results and discusses their robustness. We finally conclude in section 4.

2. Background and Previous Literature

A considerable number of economists believe that corruption is likely to hamper education expansion and to reduce the ability of a country to form a high-quality human capital. This idea seems to be supported by some theoretical and empirical developments. In this section, we first recall the

¹ World Bank (1997), *Helping Countries Combat Corruption: The Role of the World Bank*, p. 8. *The World Bank: Washington DC*.

arguments lying behind the adverse effect of corruption on education. Then, we provide a summary of previous empirical studies that have investigated the relationship between these two variables.

2.1. Arguments on the effect of corruption on education

The existing economic literature seems to provide sufficient insight and a variety of arguments on the perverse effect of corruption on education. The most obvious argument is that corruption is inimical for the development of an economic and institutional environment that enhances education expansion and high-quality human capital formation. In this respect, Ehrlich and Lui (1999) state that the will to benefit from rents caused by government intervention in the economy is likely to alter individual decisions to invest in human capital and can lead people to spend less time in education and, hence, to focus more on accumulating political capital that allow them to assure bureaucratic power and to engage in rent-seeking activities. The influence of such activities could also affect the formation of high-quality human capital by stimulating the diversion of students from some types of studies (engineering, for example) to alternative disciplines (law, for example), though the former are more likely to engender growth². This idea has been well illustrated by Tanzi and Davoodi (2001) who found that countries with high corruption tend to have a higher ratio of lawyers to engineers. In this sense, corruption could lead to the formation and the accumulation of unproductive human capital. Besides its effect on individuals' decisions to invest in education, there is a broad consensus that corruption reduces GDP per head and facilitates the misappropriation of public funds. One consequence of this fact is that corruption is likely to entail more difficulties for governments to provide basic services, namely public education services. This effect seems to be more damageable for poor people who depend more than others on publically provided services, including education services. In this respect, corruption can be seen as a heavy burden that poor are usually less able to support and, therefore, could result in decreased ability to invest in education and limited access to educational services, leading to a lower human capital accumulation.

Increased poverty and income inequalities constitute a further mechanism through which corruption could affect education. Several empirical studies show that higher corruption exacerbates income inequalities [Li et al. (2000), Gupta et al. (2002), Gymiah-Brempong (2002), Gymiah-Brempong and de Camacho (2006) and, Tebaldi and Mohan (2010)] and increases poverty [Gupta et al. (2002) and, Tebaldi and Mohan (2010)]. In a similar vein, Gupta et al. (2002) state that corruption is likely to produce education inequalities. This may happen when wealthy population groups tend to lobby the government to bias social expenditures toward the provision of particular kinds of educational services that better favour their own interests. The writers argued that corruption diminishes the positive impact of social programs and stimulates the misappropriation of public funds allocated to poor people, resulting in limited poverty reduction efforts and reduced resources available for expanding access and improving education quality. Regarding education, higher income inequalities can lead to a lower political and popular support for redistributive policies, namely state funding of public education, which may weaken the efficiency of such policies (Benabou, 2000)³. Empirically, many studies found higher income inequality to be associated with lower school enrollment and performance [Perotti (1996), Flug et al. (1998), Easterly (2007), Mo (2000), Checchi (2003) and, Papagapitos and Riley (2009)].

Corruption could also adversely affect education through its impact on public spending, more specifically public education expenditures. On the one hand, corruption may engender a substantial decrease in the resources allocated to education by affecting tax revenue and hence the volume of funds available to the government for allocation. Indeed, a considerable number of empirical studies provide evidence that revenues from tax collection are significantly lower in countries where corruption is widespread [Tanzi and Davoodi (1997, 2001), Ghura (1998), Johnson et al. (1999), Friedman et al. (2000), and Hwang (2002)]. On the other hand, corrupt practices accompanying the processes of affectation, distribution and allocation of education expenditures are likely to reduce the amount of funds allocated to education. Several empirical analyses found that government spending on

² Murphy et al. (1991) show that engineers (representing the share of talented people who are allocated to production activities) are more growth-enhancing than lawyers (representing the fraction of qualified individuals who engage in rent-seeking activities).

³ Conversely, some studies found that government expenditure on education increases significantly with income inequalities [see, for instance Easterly and Rebelo (1993) and, Sylwester (2000)].

education is negatively and significantly associated with higher levels of corruption [Mauro (1998), Delavallade (2006), De la Croix and Delavallade (2007, 2009)]⁴. The misappropriation and the misallocation of education funds could also reduce the volume of resources really perceived by education sector. When education resources did not reach those who are ultimately supposed to receive them, corruption would certainly compromise the ability of education systems to expand access to educational services as well as their ability to improve quality and equity in education.

Another avenue through which corruption could affect education is through its perverse impact on the volume and the effectiveness of international aid for education. In many developing countries, international aid for education has played a central role in supporting national policies aimed at improving access to education and enhancing equity and quality of educational services. But in countries where corruption is widespread it would be more difficult to make an efficient use of aid flows since a large part of international aid targeted at education is usually shifted away from its intended purposes. The lack of aid effectiveness would certainly lead to the donor community's reluctance to offer any further aid, resulting in limited external assistance and hence reduced resources available for education. During the last few years, aid ineffectiveness due to corrupt practices seems to imply that "it makes little sense, for instance, to channel resources through national budgets in countries where egregious corruption is known to exist" (UNESCO, 2009, p. 220).

2.2. Previous Empirical Results

Although few in number, the existing empirical studies on the consequences of corruption on education have been developed by the end of the nineties following various objectives. Among these studies, we cite the one by Kaufmann, Kraay and Zoido-Lobaton (1999) aimed at investigating the relationship between a variety of governance indicators, including control of corruption, and development outcomes, including educational outcomes. For a wide cross-section of countries, they provide evidence that improved control of corruption leads to better adult literacy rates. Another study by Gupta et al. (2001) has explored how corruption affects the provision of social services, including health care and education services. In that paper, various education indicators were regressed on a constant and a corruption index using cross-section data for the period 1985-1997. As a result, corruption is found to have a negative and significant effect on school enrollment rates and persistence to grade 5 in primary education on the one hand, and a positive and significant effect on illiteracy rates, repeater rates and student dropout rates in primary schools on the other. However, when real per capita GDP is included in the regression, the coefficient of corruption becomes statistically insignificant, except for repeater rates and dropout rates. More especially, the results on corruption and dropout rates are particularly robust to the use of alternative measures of corruption, the inclusion of other independent variables and the use of estimation technique that accounts for potential endogeneity bias. Evidence presented by Gupta et al. (2001) suggests that student dropout rates in countries with high corruption are five times as high as in countries with low corruption.

The estimates of the effect of corruption on education were also discussed by another strand of empirical literature aimed at exploring the linkage between corruption and economic growth. For instance, Mo (2001) focus on the mechanisms through which corruption is likely to reduce growth rates for a cross-section of 46 countries between 1970 and 1985 and points to a negative and significant link between corruption and the level of human capital as measured by the average schooling years in the total population over age 25. Mo's (2001) result shows that a one unit increase in the corruption index is associated with a decrease in average schooling years by 0.25 years. This result is not consistent with those by Pellegrini and Gerlagh (2004) and Pellegrini (2011) that emphasize that corruption has no significant impact on average schooling years⁵. In a related issue, Dreher and Herzfeld (2005) have investigated how corruption affects economic growth through a variety of channels, including human capital, for a cross-section of 71 countries for the period 1975-

⁴ However, the effect of corruption on education through reduced public education expenditures should be interpreted with caution since the positive association between public education spending and educational outcomes remains a controversial issue.

⁵ The study developed by Pellegrini (2011) differs from Pellegrini and Gerlagh's (2004) paper only regarding the period used to calculate the growth rate (1980-2004 instead of 1975-1996) and the instruments used to control for the endogeneity of corruption (the share of fuels and minerals on merchandise exports and the share of Protestants in the population instead of the legal origins).

2001. The estimation of a set of equations describing the incidence of corruption on several determinants of growth demonstrated that the relationship between corruption and human capital, as measured by school enrollment rates, is not always significant and seems to be quite sensitive to the estimation technique. Indeed, when equations are estimated separately using the ordinary least squares method, corruption is found to be negatively and significantly associated with school enrollment rates. The OLS results suggest that an increase in the index of corruption by one point leads to a decrease in school enrollment by almost 5 percentage points. However, the magnitude of the effect decreases substantially and becomes statistically insignificant when equations are estimated jointly as a system using the three-stage least squares technique.

Besides the aforementioned studies that focus on the direct effect of corruption on various education indicators, there is a large empirical literature on the impact of corruption on the composition of public investment. As part of this literature, several studies show that corruption is likely to reduce public education expenditures. For instance, Mauro (1997) found that government spending on education as a ratio to GDP is negatively and significantly associated with higher levels of corruption. Cross-country regression results suggest that a country that improves its standing on the corruption index from 6 to 8 (on a scale ranging from 0 to 10, where 0 being most corrupt) will experience a 0.5 percentage point increase in its spending on education (Mauro, 1997, p. 94). A similar finding is reported by the same author who emphasizes that a one standard-deviation improvement in the corruption index leads education expenditure to increase by over six percentage points of total government consumption expenditure (Mauro, 1998, p. 276). In line with these findings, Delavallade (2006) and De la Croix and Delavallade (2007, 2009) provide evidence that countries with high levels of corruption invest less in education. In a related issue, a number of researchers have questioned the relationship between corruption and the effectiveness of public spending on education and provided evidence of an adverse impact. In this respect, Gupta et al. (2001) demonstrated that increased public spending on education is significant in reducing student dropout rates only in countries with low levels of corruption. Rajkumar and Swaroop (2008) have also provided similar evidence and reported that an increase in the share of public education spending in GDP lowers the primary education failure rate in countries with good governance, and has no impact in countries with weak governance. This is consistent with the findings of Baldacci, Clements, Gupta and Cui (2008) who emphasize that the positive effect of government spending on education is much less pronounced in countries with poor governance. In sum, the general picture that emerges from the existing economic literature is that, wherever it exists, corruption seems to work against education expansion and school performance. These adverse effects are broadly supported by past empirical work that points to a negative effect of corruption on education either directly as demonstrated by most previous studies or, indirectly, through its perverse impact on the amount and the effectiveness of public spending on education.

3. Empirical Evidence

The aim of this section is to test the impact of corruption on quantitative and qualitative aspects of education for a wide cross-section of countries for the period 1980-2002. We first present the empirical model, the estimation method and, the data we use. Then, we describe our cross-country regression results. Finally, we present the proposed robustness checks.

3.1. Model and data

Previous studies dealing with effect of corruption on education have typically addressed the relationship between these two variables using an empirical model where an education indicator is regressed on a corruption index and a set of conditioning variables, including some of the habitual determinants of education. The education equation to estimate in this paper is in the spirit of Gupta et al. (2001) and, therefore can be written as follow:

$$Y_i = \alpha + \beta C_i + \gamma Z_i + \varepsilon_i \quad (1)$$

where Y_i is an education indicator; C_i is the corruption index in country i ; Z_i is a vector of control variables that may affect education; and ε_i an error term. Empirically, different education indicators have been used by past studies, including adult literacy rates [Kaufmann et al. (1999) and Gupta et al. (2001)], average schooling years in the total population aged 25 and over [Mo (2001), Pellegrini and Gerlagh (2004) and Pellegrini (2011)], enrollment rates either in primary education (Gupta et al., 2001) or in secondary education (Dreher and Herzfeld, 2005), persistence to grade five in primary

schools and student dropout and repetition rates (Gupta et al., 2001). These indicators don't have the same signification, which made it possible to investigate the effect of corruption on different aspects of education. Some of these indicators provide a measure of human capital stocks (adult literacy rates and average years of schooling in the working-age population,). Others, namely those based on enrollment rates, are often used to measure access to education within each country and to assess a government's progress in providing education for all school-going age population. The remaining indicators used by past studies (persistence to grade five in primary schools and dropout and repeaters rates) can be seen as proxies for the quality of education and the internal efficiency of the education systems. In this paper, with the aim to assess the effect of corruption on various aspects of education, we use more than one education indicator. The first indicator is the secondary gross enrollment rate (**SSER**) which allows us to address the impact of corruption on the efforts made by a government to ensure and to expand access to education for all school-age population. However, it needs to be recognized that such indicator does not provide any information neither about schooling results nor about the performance of the educational systems, and therefore could not reflect quality education differences across countries. In this respect, the adoption of some policies that are successful in promoting access to education may help one country to achieve high enrollment rates but, due to little attention paid to education quality, high dropouts and repetition rates could also persist. For this reason, we use the secondary school repetition rate (**REP**) as an approximation for the quality and the internal efficiency of education systems. A lower repetition rate generally corresponds to a higher quality of education and an improved ability of education systems to ensure high educational achievement for the enrolled children, which enable them to meet basic skills and competencies⁶. Taken together, the two selected indicators will allow us to capture the effect of corruption on education both from a quantitative and a qualitative point of view.

Regarding the explanatory variables to include in the education equation, we note that the set of right-hand side variables used by past empirical work varies greatly from one study to another. Indeed, cross-country literature on the determinants of education suggests a variety of factors that may affect education indicators. In this paper, we retain, in addition to the corruption index, the same control variables used by Gupta et al. (2001) which, themselves, resume the main factors that have been identified previously as potential determinants of education. Doing so, the education regressions will include the following control variables:

- The level of per capita income as measured by real GDP per capita (**GDP**). This variable will allow us to control for the difference in the level of development across countries and to take into account the potential impact of some family factors, namely parents' income, on schooling access and performance.
- The share in GDP of public spending on education (**PES**). This variable accounts for the effect of government spending on the provision of education services as well as the impact of school resources on educational outcomes.
- The share of female population aged 15 and over with no formal education (**FEM**), reflecting the educational level of the parents' generation. The use of this variable allows controlling for the effect of family background of students, namely maternal education, on school enrollment, attendance and advancement.
- The age dependency ratio (**AGE**) measured as the ratio of dependents (people younger than 15 or older than 64) to the working-age population (those ages 15-64). This indicator provides the age structure of the population and is meant to capture the constraints on public resources such as the negative impact on the share of public spending available for school-age children that may result from an increase in the share of dependents in the total population.

⁶ We note that the use of repetition rates as measures of quality and internal efficiency of education systems should have to be interpreted cautiously given that many countries adopt policies that favour automatic promotion. Furthermore, a high repetition rate may reflect high quality standards in terms of learning achievement rather than a high level of inefficiency in a school system (UNESCO, 2000, p. 35). The use of this indicator is mainly explained by the fact that quality education indicators, namely those based on direct measures of the cognitive skills of individuals obtained from tests of cognitive achievement, are not available for a broad number of countries.

- Urbanization rate (**URBAN**) measured by the share of urban population in total population. The inclusion of this variable is explained by the fact that implementation of educational infrastructure and access to schooling are generally expected to be easier in urban areas.

Given the difficulty in obtaining reliable and comparable annual data on most of the key variables we use, this study, as do most previous empirical work, relies on cross-sectional regressions with data averaged over the period 1980-2002, or the nearest period for which data were available. We perform the analysis on a maximum of 103 observations but, due to data availability, some regressions cover only 85 countries (table 1 in appendix lists the countries included in the analysis). In our empirical analysis, we use data on corruption drawn from the International Country Risk Guide database (**ICRG**)⁷. Data on secondary school repetition rates are taken from the UNESCO statistics and those on female education are from Barro and Lee (2010) database. For the remaining variables, data were collected from the World Bank's Development Indicators (see table 2 in appendix for data sources and variables definitions and, table 3 for descriptive statistics for all variables used in the analysis).

Before regression analysis, there is a need to determine which functional form to apply for the model as given in equation (1). Some earlier studies that used a similar empirical specification retained a linear model (Gupta et al., 2002), yet others suggested a non linear relationship between social indicators, namely education and health indicators, and their standard determinants and, opted therefore for a semi-logarithmic form (Gupta et al., 2001) or a log-linear form [Baldacci et al. (2003), Al-Samarrai (2006), Rajkumar and Swaroop (2008)]. In this study, the choice of the appropriate functional form is based on the REST Ramsey test and, the McKinnon, White and Davidson (MWD) test which allows us to decide between a linear regression model and a log-linear one⁸. We begin by running regressions of the model under study using the OLS method. In this respect, we employ the White test to verify the homoskedasticity assumption. When detected, heteroskedasticity of residuals will be corrected using the white method. In using the OLS method, it should be borne in mind that such method assumes that corruption is exogenously determined. However, as pointed out by most previous empirical work, corruption could be an endogenous variable for a variety of reasons. First, this is may be to due to measurement errors of our corruption variable since the corruption index we use, like other available corruption indices, is by construction based on perceptions of the observed phenomenon. Second, endogeneity may arise from a possible simultaneity bias as the relationship between corruption and education may suffer from reverse causality. Indeed, as argued by Gupta, et al. (2001, p. 126), poor levels of education could create an environment conducive to corruption. Conversely, a better educated population seems to entail better chances to combat and control corruption. Furthermore, more educated individuals are expected to be less tolerant of corruption [Swamy et al. (2001, p. 40), Mocan, (2004, p. 8)]. Several empirical studies have provided evidence that corruption tends to go along with lower levels of education [Ades and Di Tella (1999), Ali and Isse (2003), Persson et al. (2003), Cheung and Chan (2008) and, Evrensel (2010)]. Third, it is possible that corruption and education respond simultaneously to some omitted factors. One may think, for example, about the presence of non-democratic regimes that may contribute to the creation of more incentives for corruption, while fostering the adoption of public policies which are less favorable to the provision of good quality education services. In either case, the estimates resulting from OLS regressions would be biased. To address the potential issues of endogeneity, we perform two-stage least squares (2SLS) regressions by using the absolute value of latitude of each country (**LAT**) and the share of Muslims in the population (**MUSL**) as instruments for corruption. In this context, the assumption of endogeneity and the validity of instruments are tested using the Durbin-Wu-Hausman test proposed by Davidson and McKinnon (1993) and, the Sargan test, respectively (When correcting for heteroskedasticity, Wu-Hausman test and Hansen J-Statistic are used for these purposes).

3.2. Empirical results

The MWD test of functional forms and the REST Ramsey test suggest that the linear form is appropriate to estimate the model given in equation (1), for the two education indicators under study:

⁷ The International Country Risk Guide corruption index (**ICRG**) ranges from zero to six, with higher scores indicate lower corruption levels. For the sake of simplicity, this index has been rescaled so that greater values correspond to more, rather than less, corruption.

⁸ McKinnon, J., White, H. and Davidson, R. (1983), Tests for Model Specification in the Presence of Alternative Hypothesis: Some Further Results. *Journal of Econometrics*, vol. 21, 1983, pp. 53-70.

secondary school enrollment rate (**SSER**) and repetition rate at secondary education (**REP**). The regression results for the linear specification are presented in table 1 and 2, respectively for each education indicator. For both tables, columns (1)-(6) report results obtained in OLS estimation of various specifications of the education equation; whereas columns (7)-(12) show the 2SLS results. The endogeneity test and the over identification test reported at the bottom of each table indicate, on the one hand, that corruption is indeed an endogenous variable, and that the instruments we used are correctly specified for all 2SLS regressions, on the other. For most of 2SLS regressions, the F-statistic obtained from the first-stage regressions is higher than 10, highlighting, as suggested by Staiger and Stock (1997), that the chosen instruments are not weak.

As a first result, we found that corruption works negatively for the first education indicator. Column 1 (table) shows that the coefficient on corruption is statistically significant at the 1% level. This finding suggests that a one point increase in the corruption index is associated with a decrease in the secondary school enrollment rate by 17 percent. The coefficient on corruption remains statistically significant at the conventional levels even when controlling for the most important determinants of enrollment rates, including per capita income, public spending on education and urbanization (column 2, 3 and 4). However, we found that the effect of corruption on education tends to decrease and becomes statistically insignificant after including other explanatory variables which are likely to affect enrollment rates. In addition, results of OLS regressions show that all explanatory variables included in the education equation have the expected signs. As reported in table 1, coefficients on all control variables are significant at the conventional statistical levels; except for GDP per capita, with the coefficient insignificant in some regressions (column 5 and 6)⁹. Results on control variables indicate that per capita income, public spending on education and urbanization produce a positive effect on secondary school enrollment rate whereas higher age-dependency ratio and higher uneducated female population are found to be associated with lower enrollment rates. This suggests that our findings are broadly consistent with previous results in the literature dealing with the determinants of education indicators.

The overall results continue to hold when instrumental variable estimation is used to account for endogeneity bias. The results of 2SLS regressions given in column (7) to (12) of table 1 are broadly similar to those obtained from OLS regressions. The majority of control variables (public spending on education, urbanization rate and age-dependency ratio) are correctly signed and statistically significant at the conventional levels. In addition, the 2SLS regression analysis confirms the negative effect that corruption produces on education. In all 2SLS regressions, there is a negative and significant relationship between corruption and enrollment rates, even when all control variables are included in the model. The magnitude of the effect indicates that an increase in the index of corruption by one point leads to a decrease in secondary school enrollment by almost 9 percentage points (column 12). This effect is similar to what is found by Dreher and Herzfeld (2005) who demonstrate that a one point increase in the corruption index is associated with a 5% decrease in enrollment rates. In sum, regressions for the first education indicator point out that corruption reduces significantly enrollment rates and constrains efforts aimed at expanding access to schooling.

⁹ The suggested relative insignificance of GDP per capita may be due to multicollinearity among explanatory variables, namely GDP per capita and the corruption index (in our sample, the simple correlation coefficient between these two variables equals 0.75).

Table 1. Corruption and secondary school enrollment rates, 1980-2002: cross-sectional analysis

Dependent variable : secondary school enrollment rates (SSER)												
	Ordinary least squares						Two-stage least squares					
	[1]	[2] ^a	[3] ^a	[4]	[5]	[6] ^a	[7]	[8]	[9]	[10]	[11]	[12]
Corruption (ICRG)	-16.71***	-7.715***	-6.07**	-4.59*	-2.01	-0.634	-24.71***	-26.45***	-25.59***	-22.54***	-11.55***	-8.92*
	(-8.64)	(-2.75)	(-2.01)	(-1.97)	(-1.22)	(-0.40)	(-8.79)	(-4.05)	(-3.71)	(-3.75)	(-2.85)	(-1.86)
Per capita income (GDP)		0.00***	0.001***	0.00**	0.00	0.00		-0.00	-0.00	-0.00	-0.00	-0.00
		(3.98)	(4.27)	(2.09)	(1.19)	(1.39)		(-0.44)	(-0.38)	(-1.41)	(-1.25)	(-0.69)
Public educ. spending (PES)			3.32**	2.38*	4.09***	3.98***			0.51	-0.08	2.66**	2.90**
			(2.02)	(1.89)	(4.57)	(5.07)			(0.25)	(-0.05)	(2.28)	(2.57)
Urbanization (URBAN)				0.70***	0.27***	0.21**				0.62***	0.27***	0.24**
				(6.83)	(3.28)	(2.14)				(4.75)	(2.82)	(2.59)
Dependency ratio (AGE)					-106.53***	-94.64***					-97.13***	-93.24***
					(-10.13)	(-7.98)					(-7.65)	(-7.56)
Female education (FEM)						-0.20***						-0.10
						(-2.80)						(-1.02)
constant	107.46***	73.31***	55.15***	22.06*	108.46***	105.6***	128.26***	134.97***	130.17***	93.97***	138.14***	130.65***
	(19.23)	(7.09)	(3.55)	(1.94)	(9.30)	(8.77)	(16.50)	(6.20)	(4.72)	(3.69)	(7.89)	(7.10)
N	103	103	103	103	103	103	103	103	103	103	103	103
R²	0.425	0.515	0.538	0.687	0.848	0.860						
White's test (P-value)	0.4683	0.0764	0.0161	0.1714	0.1847	0.0794						
Ramsey RESET test	0.7392	0.0134	0.0009	0.1056	0.9896	0.8699						
Durbin-Wu-Hausman test (P-value)							0.00000	0.00004	0.00005	0.00001	0.00142	0.02915
Pagan-Hall test (P-value)							0.3316	0.5056	0.2422	0.4490	0.1553	0.2511
Sargan P-value							0.2142	0.1828	0.1844	0.2350	0.6795	0.1979
First-stage F statistic							61.95	17.30	15.94	15.36	13.73	8.48

(***), (**), and (*) denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

a) Regular t-statistics are reported in parentheses, except for columns (2), (3) and (6) where White heteroskedasticity-corrected t-statistics are shown.

The instruments used are the absolute value of the latitude of each country (LAT) and the percentage of the population belonging to the Muslim religion (MUSL).

Table 2. Corruption and repeater rates at secondary education, 1980-2002: cross-sectional analysis

Dependent variable : Repeater rates, secondary (REP)												
	Ordinary least squares						Two-stage least squares					
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12] ^a
Corruption (ICRG)	0.928	0.623	0.667	0.623	0.121	-0.784	3.519***	6.932***	7.744***	7.675***	5.815**	2.241
	(1.26)	(0.60)	(0.62)	(0.58)	(0.12)	(-0.76)	(3.03)	(2.70)	(2.70)	(2.66)	(2.07)	(0.95)
Per capita income (GDP)		-0.000	-0.000	-0.000	0.000	-0.000		0.001*	0.001*	0.001**	0.000*	0.000
		(-0.42)	(-0.43)	(-0.09)	(0.34)	(-0.08)		(1.98)	(1.95)	(2.00)	(1.86)	(1.14)
Public educ. spending (PES)			0.096	0.184	-0.045	-0.091			1.039	1.084	0.738	0.307
			(0.16)	(0.31)	(-0.08)	(-0.17)			(1.30)	(1.34)	(0.97)	(0.45)
Urbanization (URBAN)				-0.038	0.047	0.092*				-0.022	0.031	0.074
				(-0.79)	(0.84)	(1.70)				(-0.36)	(0.47)	(1.46)
Dependency ratio (AGE)					18.942***	9.273					12.568	8.288
					(2.76)	(1.32)					(1.48)	(1.02)
Female education (FEM)						0.148***						0.115*
						(3.40)						(1.91)
constant	6.130***	7.297**	6.792	8.353	-7.717	-4.820	-1.015	-13.378	-19.953*	-18.889	-23.653**	-13.369
	(2.78)	(2.05)	(1.44)	(1.63)	(-1.01)	(-0.67)	(-0.30)	(-1.57)	(-1.78)	(-1.61)	(-2.08)	(-1.39)
N	85	85	85	85	85	85	85	85	85	85	85	85
R²	0.019	0.021	0.021	0.029	0.114	0.228						
White's test P-value	0.1385	0.3256	0.6408	0.8383	0.3959	0.2741						
Ramsey RESET test	0.2951	0.5752	0.6391	0.5461	0.8030	0.4318						
Durbin-Wu-Hausman test (P-value)^b							0.00095	0.00058	0.00040	0.00043	0.00627	0.1053
Pagan-Hall test P-value							0.1011	0.1605	0.4398	0.2424	0.1405	0.0249
Sargan P-value^c							0.1470	0.3380	0.5190	0.5075	0.2726	0.8952
First-stage F statistic							35.62	12.55	11.09	10.85	9.31	3.75

(***), (**), and (*) denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.
a) Regular t-statistics are reported in parentheses, except for column (12) where White heteroskedasticity-corrected t-statistics are shown.
b) For column (12), Wu-Hausman test P-value is reported instead of Durbin-Wu-Hausman test P-value.
c) For column (12), Hansen J-Statistic is reported instead of Sargan P-value.
The instruments used are the absolute value of the latitude of each country (LAT) and the percentage of the population belonging to the Muslim religion (MUSL).

Exploring the links between corruption and education quality, as measured by repetition rate at secondary education, yields weaker results most notably when using the OLS technique. As shown in column (1) to (6) of table 2, most of explanatory variables are statistically insignificant and, in some specifications, not correctly signed. Except for column (6), the OLS results point to a positive relationship between corruption and secondary school repetition rates, but this effect is never significantly different from zero. A similar result has been reported by Gupta et al. (2001) who used repeaters rate at primary education and, found no statistically significant association between corruption and this education indicator. The 2SLS regressions presented in column (7) to (12) of table 2 provide better results, at least with respect to our key variable. Except for column (12), all results of 2SLS estimation point to a positive and significant association between corruption and education quality. This suggests that countries with higher corruption tend to have higher repeaters rates at secondary education. However, the magnitude of the effect is not the same from one specification to another: a one point increase in the corruption index is associated with an increase in repeaters rates that ranges from 2.24% (column 12) to 7.74% (column 9).

In summary, the cross-country analysis presented in this paper provides some evidence on the detrimental effects of corruption on both quantity and quality of education. Indeed, as reported by all 2SLS regressions for secondary school enrollment rates, access to schooling is found to be significantly lower in countries with higher corruption levels. However, regressions for repeaters rates show that the effect of corruption on education quality is not as clear as its impact on the quantitative indicator. We notice that the suggested relative insignificance of corruption should not be considered as an absolute proof to cast doubt on its adverse consequences on education quality and performance. As mentioned earlier, the lack of statistically significant results for corruption may be due to the fact that repeaters rate is not always a good proxy for education quality. One should also indicate that the currently available indices of corruption, like the one used in this study, are by construction made to capture cross-country differences on the overall level of corruption as such. Unfortunately, it is also possible that such indices are not sufficiently refined to account accurately for certain kinds of corruption that might have more significance for the internal efficiency of education systems and, hence for education quality.

3.3. Robustness checks

The empirical results presented in the previous section show a strong relationship between corruption and education, at least when using a quantitative education indicator based on enrollment rates. To check the robustness of these results, we perform a series of sensitivity test. As a first test for robustness, we use another index of corruption. To this end, we use the **GRAFT** index by Kaufmann, Kraay and Mastruzzi (2008)¹⁰. Thus, we will check if our results depend on the corruption measure we have chosen. Second, we examine the sensitivity of our results by controlling for some other factors that might impact enrollment rates. To do so, three additional explanatory variables are included in the education equation to control for other potential determinants of enrollment rates: ethnolinguistic diversity measured by the ethnolinguistic fractionalization index (**ELF**), the stock of health capital approximated by the infant mortality rate (**CHILD**) and, income inequality measured by the Gini coefficient (**GINI**). The choice of these variables is consistent with the recent empirical literature that acknowledges their role as major determinants of education indicators, namely enrollment rates. Finally, we investigate whether our results indicating a negative and significant effect of corruption on education are validated when we use an alternative education indicator. To do this, we use the average schooling years in the total population over age 25 (**ASY**) as a dependant variable instead of secondary school enrollment rates. The aim here is twofold. First, this will allow us to bypass some criticisms often leveled at the use of an education indicator based on enrollment rates. Second, the use of average schooling years in the total population aged 25 and over as a dependant variable will allow us to compare our findings to those who employed such indicator when exploring the links between corruption and education, for instance, Mo (2001), Pellegrini and Gerlagh (2004) and Pellegrini (2011).

¹⁰ The Graft index has been rescaled on a scale that ranges between zero and five so that higher values of the index correspond to higher level of corruption.

Data on additional variables used for robustness check are drawn from various sources: the ethnolinguistic fractionalization index is taken from Roeder (2001), data on the average schooling years are drawn from Barro and Lee (2010) and, data on the GINI coefficient and child mortality rates are collected from the World Bank Development Indicators. As discussed in the previous section, all regressions are run using a two-stage least squares estimator. Estimates results and statistical tests are reported in tables 3 and 4 below. For all specifications, the number of observations equals 103, except for those including the Gini coefficient for which data were available only for 89 countries.

The estimates presented in Table 3 and 4 reveal that our results remain essentially unchanged. As reported in column (1) to (6) of table 3, the use of an alternative measure of corruption did not change our original results substantially, in particular concerning the effect of corruption on education. Similar to the regressions with the ICRG corruption index, the coefficient on the Graft index is consistently negative and significant at the conventional statistical levels in all specifications, except for column (12) with a coefficient significant only at the 12% level. This suggests that the negative and significant relationship between corruption and enrollment rates is confirmed regardless of the index used to measure corruption. Columns (7) to (9) of table 3 show that our results are almost unchanged even when controlling for additional variables that may be expected to influence education indicators. The resulting estimates reveal that the absolute magnitude and significance of the corruption coefficient are not affected by the inclusion of other control variables. Indeed, the effect of corruption on education is roughly of the same magnitude as found earlier, indicating that a one point increase in the ICRG corruption index is associated with a decrease in the secondary school enrollment rate by 10% (column 9). Besides, the results concerning the impact of the additional control variables are broadly consistent with what is found in the previous empirical literature. The results presented in Table 3 show that the additional control variables included in the education equation, though with insignificant coefficients in some regressions, have the expected relationship with education. The estimated coefficient for ethnolinguistic fractionalization is negative suggesting that countries with higher levels of ethnolinguistic diversity have lower levels of enrollment rates. This finding is in line with those of many previous studies, for instance Easterly and Levine (1997), Alesina et al. (1999), Alesina et al. (2003), Alesina and La Ferrara (2005), Rajkumar and Swaroop (2008) and, Dearmon and Grier (2011)]. For child mortality rates, our results are consistent with the findings of past studies indicating that a healthier population is more likely to invest in human capital [Gupta et al. (2002), Baldacci et al. (2003) and, Baldacci et al. (2008)]. The coefficient associated with the GINI index confirms the negative impact of income inequality on education previously demonstrated by Flug et al. (1998), Gupta et al. (2002), Bjornskov (2009) and, Papagapitos and Riley (2009). In sum, these results confirm again the negative and significant influence of corruption on education as measured by secondary school enrollment rates. That said, corruption is inimical to expanding education and attaining access to educational services for all school-age population. This finding is robust to the use of an alternative measure of corruption and to the inclusion of other potential determinants of education in various specifications correcting for the possible endogeneity of corruption.

According to the results presented in Table 4, corruption is found to work negatively for education even when using an alternative education indicator. Indeed, regressions for the average schooling years in the total population over age 25 yield similar results to what is obtained previously with school enrollment rates. Under all specifications, the coefficient associated with the corruption index is consistently negative and significant at the standard levels of significance. These results are broadly consistent with those of Mo (2001) but contrast with the findings of Pellegrini and Gerlagh (2004) and Pellegrini (2004) who found no statistical significant relationship between corruption and the average schooling years in the working-age population. The magnitude of the effect indicate that a one point increase in the corruption index decreases the average schooling years in the total population over age 25 by 0.8 years (column 9). Our interpretation of this finding is twofold. First, it provides robust evidence that corruption has negative consequences on education, regardless of the education indicator we use. Second, our results suggest that beyond decreased access to schooling within a country, corruption is likely to have a significant adverse effect on the level of educational attainment of the working-age population, leading therefore to a lower human capital accumulation.

Table 3. 2SLS estimates using an alternative measure of corruption and additional control variables

Dependent variable : secondary school enrollment rates (SSER)									
	Graft index (GRAFT)						ICRG corruption index (ICRG)		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Corruption	-30.85*** (-10.02)	-55.00*** (-3.79)	-57.65*** (-3.34)	-54.06*** (-3.02)	-36.10* (-1.86)	-29.61 (-1.60)	-7.860* (-1.86)	-11.28** (-2.44)	-10.13* (-1.80)
Per capita income (GDP)		-0.00270** (-2.06)	-0.00283* (-1.96)	-0.00291** (-2.18)	-0.00195 (-1.51)	-0.00154 (-1.27)	-0.000187 (-0.54)	-0.000367 (-0.98)	-0.000347 (-0.83)
Public education spending (PES)			-1.561 (-0.58)	-1.692 (-0.67)	0.648 (0.26)	1.175 (0.53)	2.960*** (2.76)	2.215* (1.88)	2.025 (1.43)
Urbanization (URBAN)				0.295 (1.37)	0.185 (1.26)	0.174 (1.35)	0.243*** (2.65)	0.187* (1.85)	0.242** (2.06)
Dependency ratio (AGE)					-61.08* (-1.97)	-63.50** (-2.46)	-88.97*** (-6.95)	-67.63*** (-4.11)	-53.35*** (-2.86)
Female education (FEM)						-0.0932 (-0.73)	-0.102 (-1.10)	0.0408 (0.36)	-0.131 (-1.10)
Ethnolinguistic fractionalization (ELF)							-5.887 (-1.03)	-3.320 (-0.53)	-4.190 (-0.60)
Child mortality (MORT)								-0.194** (-2.31)	-0.128 (-1.30)
Income inequality (GINI)									-0.321 (-1.62)
constant	136.0*** (18.01)	212.6*** (4.88)	226.5*** (3.85)	202.8*** (3.04)	192.1*** (3.73)	176.6*** (3.67)	126.8*** (7.51)	132.2*** (7.33)	131.3*** (5.80)
N	103	103	103	103	103	103	103	103	89
R²	0.474	0.121	0.062	0.173	0.568	0.667	0.834	0.813	0.833
Test de Durbin-Wu-Hausman (P-value)	0.00002	0.00005	0.00007	0.00001	0.00201	0.01235	0.03227	0.00243	0.01377
Pagan-Hall test P-value	0.9149	0.9231	0.9137	0.8273	0.6849	0.8125	0.1800	0.2446	0.5713
Sargan P-value	0.736	0.589	0.648	0.602	0.477	0.738	0.293	0.557	0.387
First-stage F statistic	48.78	7.73	6.12	5.29	2.45	2.10	10.67	10.03	7.13

(***), (**), and (*) denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.
Regular t-statistics are reported in parentheses.
The instruments used are the absolute value of the latitude of each country (**LAT**) and the percentage of the population belonging to the Muslim religion (**MUSL**).

Table 4. 2SLS estimates using an alternative measure of education: the average schooling years in the total population over age 25 (ASY)

Dependent variable : the average schooling years in the total population over age 25 (ASY)									
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Corruption (ICRG)	-2.2885***	-3.0990***	-3.2258***	-3.0218***	-2.5925***	-0.9911**	-1.0099***	-0.9270**	-0.8090*
	(-9.75)	(-5.05)	(-4.80)	(-4.83)	(-4.43)	(-2.43)	(-2.70)	(-2.47)	(-1.88)
Per capita income (GDP)		-0.0001*	-0.0001*	-0.0001**	-0.0001**	-0.0000	-0.0000	-0.0000	-0.0000
		(-1.76)	(-1.76)	(-2.56)	(-2.61)	(-0.81)	(-0.91)	(-0.77)	(-1.17)
Public education spending (PES)			-0.1644	-0.2071	-0.1008	0.0502	0.0469	0.0645	0.0419
			(-0.83)	(-1.14)	(-0.60)	(0.52)	(0.49)	(0.68)	(0.39)
Urbanization (URBAN)				0.0434***	0.0299**	0.0137*	0.0138*	0.0151*	0.0211**
				(3.17)	(2.15)	(1.71)	(1.71)	(1.84)	(2.36)
Dependency ratio (AGE)					-3.7176**	-1.5751	-1.5208	-2.0053	-0.6016
					(-2.03)	(-1.50)	(-1.35)	(-1.50)	(-0.42)
Female education (FEM)						-0.0568***	-0.0564***	-0.0597***	-0.0747***
						(-6.88)	(-6.93)	(-6.48)	(-8.21)
Ethnolinguistic fractionalization (ELF)							-0.0676	-0.1253	0.2320
							(-0.13)	(-0.25)	(0.44)
Child mortality (MORT)								0.0044	0.0080
								(0.64)	(1.06)
Income inequality (GINI)									-0.0567***
									(-3.76)
constant	11.9547***	14.8750***	15.9227***	13.4371***	15.0929***	10.5071***	10.5568***	10.4197***	11.3847***
	(18.43)	(7.28)	(5.93)	(5.08)	(5.97)	(6.70)	(7.08)	(7.13)	(6.60)
N	103	103	103	103	103	103	103	103	89
R²	0.379	0.168	0.131	0.277	0.435	0.830	0.828	0.837	0.871
Durbin-Wu-Hausman test (P-value)	0.00000	0.00000	0.00000	0.00000	0.00000	0.02869	0.01138	0.02431	0.11547
Pagan-Hall test P-value	0.4570	0.5136	0.4190	0.7239	0.7914	0.3269	0.3510	0.4263	0.3368
Sargan P-value	0.0835	0.2518	0.3290	0.1867	0.0558	0.4553	0.4624	0.3776	0.5015
First-stage F statistic	61.95	17.30	15.94	15.36	13.73	8.48	10.67	10.03	7.13

(***), (**), and (*) denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.
 Regular t-statistics are reported in parentheses.
 The instruments used are the absolute value of the latitude of each country (LAT) and the percentage of the population belonging to the Muslim religion (MUSL).

4. Conclusion

There is now a large literature documenting how increased corruption can impede growth and economic performance. However, there has been little empirical and theoretical work dealing with the consequences of corruption on education. In this respect, the motivation in this paper was to analyze some conceptual as well as empirical direct links between corruption and education and, in particular, to investigate the impact of corruption on quantitative and qualitative aspects of education. Apart from discussing the channels through which corruption should affect education, this paper has also reviewed past empirical studies on the effect of corruption on education. The existing empirical literature suggests that corruption leads to lower schooling access and performances while decreasing the amount and the effectiveness of public spending on education. Using regressions analysis for a wide cross section of countries and both quantitative and qualitative education indicators, the paper provides some evidence that corruption has major implications for expanding access to schooling and improving education quality. Regressions for the quantitative education indicator demonstrated that access to schooling is significantly and negatively affected by increased corruption. The magnitude of the effect is considerable indicating that a one point increase in the corruption index is associated with a decrease in the secondary school enrollment rates of about 10 percentage points. Regressions for education quality, as measured by the repeater rates at secondary education, yields weaker results but seem to suggest that the performance and the internal efficiency of education systems are also adversely affected by corruption. Finally, we note that the negative and significant relationship between corruption and school enrollment rates is robust to the use of an alternative measure of corruption in various specifications correcting for the possible endogeneity of corruption and including several variables expected to influence the dependent variable.

In conclusion, although the findings are robust, much more research on the linkages between corruption and education needs to be conducted beyond analyses based on cross-sectional data. To the extent that certain kinds of corruption are not well captured by the currently available data on corruption, which by construction reflect a country's level of corruption as such, detailed country analysis or case studies focusing on the prevalence of corrupt practices within education sectors remains therefore an important topic for further research.

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Appendix

Table 1. List of countries

Albania	El Salvador	Luxembourg	Senegal
Algeria	Finland	Malawi	Sierra Leone
Argentina ^a	France	Malaysia ^a	Singapore
Australia ^a	Gabon ^b	Mali	South Africa
Austria	Gambia	Malta ^b	Spain
Bahrain ^b	Ghana	Mexico	Sri Lanka
Bangladesh	Greece	Mongolia	Sudan ^{a, b}
Belgium	Guatemala	Morocco	Sweden ^a
Bolivia	Guyana	Mozambique	Switzerland
Botswana	Haiti ^b	Namibia	Syria ^b
Brazil	Honduras	Netherlands	Tanzania
Bulgaria	Hungary	New Zealand	Thailand ^a
Cameroon	Iceland ^{a, b}	Nicaragua	Togo ^b
Canada ^a	India	Niger	Trinidad and Tobago
Chile	Indonesia	Norway ^a	Tunisia
China	Iran	Pakistan ^a	Turkey
Colombia	Ireland	Panama	Uganda
Congo, Rep. ^b	Israel	Papua New Guinea	United Arab Emirates ^b
Costa Rica	Italy	Paraguay	United Kingdom ^a
Cote d'Ivoire	Jamaica	Peru	United States ^a
Cyprus ^b	Japan ^a	Philippines	Uruguay
Czech Republic	Jordan	Poland	Venezuela
Denmark ^a	Kenya ^a	Portugal	Vietnam
Dominican Republic	Korea, Rep. ^a	Romania	Zambia
Ecuador	Kuwait ^b	Russian Federation	Zimbabwe ^a
Egypt	Liberia ^b	Saudi Arabia ^{a, b}	
^a : countries with missing data on repeater rates			
^b : countries with missing data on Gini coefficients			

Table 2. Variable description and data sources

Variable	Source and definition
ICRG	Corruption index (rescaled: 6-original values), 1982-2001 averages. <i>Source: ICRG, International Country Risk Guide, Political Risk Services, USA.</i>
GRAFT	Corruption index (rescaled: 2.5 - original values), 1996- 2002 averages. <i>Source: Kaufmann, Kraay and Mastruzzi (2008).</i>
SSER	School Enrollment, Secondary (% Gross), 1980-2002 averages. <i>Source: WDI (2004).</i>
REP	Repeater rate, secondary (percent), 1980-2002 averages. <i>Source: UNESCO statistics.</i>
GDP	Per capita income: real per capita GDP (Constant 1995 US\$), 1980-2002 averages. <i>Source: WDI (2004).</i>
PES	Public Spending on Education, Total (% of GDP), 1980-2002 averages. <i>Source: WDI (2004).</i>
FEM	Female education: Percentage of no schooling attained in the female population aged 15 and over, 1980-2000 averages. <i>Source: Barro and Lee (2010).</i>
AGE	Age dependency ratio (dependents to working-age population), 1980-2002 averages. <i>Source: WDI (2004).</i>
URBAN	Urban population (% of total), 1980-2002 averages. <i>Source: WDI (2004).</i>
LAT	Absolute value of the latitude of each country. <i>Source: La Porta et al. (1999).</i>
MUSL	Muslim religion: The percentage of the population of each country belonging to the Muslim religion in 1980. <i>Source: La Porta et al. (1999).</i>
ELF	Ethnolinguistic fractionalization index that measures the probability that two randomly selected individuals in a country belong to different ethnolinguistic groups (1985 values). <i>Source: Roeder, P.G (2001).</i>
CHILD	Mortality Rate, Infant (Per 1,000 Live Births), 1980-2002 averages. <i>Source: WDI (2004).</i>
GINI	Income inequality: GINI coefficient, 1980-2002 averages. <i>Source: WDI (2004).</i>
ASY	Average schooling years in the total population over age 25, 1980-2000 averages. <i>Source: Barro and Lee (2010).</i>

Table 3. Descriptive Statistics

Variable	Mean	Standard deviation	Minimum	Maximum
ICRG	2.600926	1.262714	0	4.98
GRAFT	2.33279	1.080318	0.16628	4.217583
SSER	64.00241	32.37398	5.16346	130.5776
REP	8.690895	7.80544	0.59622	34.60703
GDP	7493.411	10411.27	151.064	43441.54
PES	4.330152	1.670327	0.7514285	8.511
FEM	28.4744	26.25874	0.3193113	91.64963
AGE	0.6947097	0.1781488	0.4096848	1.0294
URBAN	55.87371	23.08173	11.56876	100
LAT	0.2958576	0.1948043	0.0111	0.722
MUSL	21.39515	35.00581	0	99.4
ELF	0.449301	0.2864778	0.003	0.984
MORT	45.37864	41.20085	4.6	174.4
GINI	41.35649	10.44899	24.44	70.66066
ASY	6.002426	2.812426	0.7044779	12.43541

For all variables, the number of observations is 103, except for Repeater rate (REP) and Gini coefficient (GINI) for which data were available only for 85 and 89 countries, respectively.