Corruption and Economic Growth: The Transmission Channels

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Abstract

The relationship between corruption and economic growth has been the focus of numerous studies. However, no consensus seems to exist on the mechanisms via which corruption should reduce growth. The aim of this paper is to identify the transmission channels through which corruption is likely to affect economic growth. Unlike most previous analysis in this area that used the decomposition method [Mo (2001), Pellegrini and Gerlagh (2004) and, Pellegrini (2011)], we employ a Channel Methodology [developed by Tavares and Wacziarg (2001) and applied by Wacziarg (2001) and, more recently, by Lorentzen, McMillan and Wacziarg (2008)]. This methodology based on a system of simultaneous equations to evaluate the effects of corruption on various determinants of economic growth, will allow us to show how corruption affects growth via each possible channel. Our results suggest that the negative effect of corruption on economic growth is mainly transmitted by its impact on human capital and political instability.

Key words: Corruption, Economic Growth, Simultaneous Equations

JEL Classifications: D73; O40; C30

1. Introduction

The phenomenon of corruption has long been a major concern. Among the various forms of this phenomenon, economists often retain those related to public decisions[1] and, adopt a definition similar to that used by the World Bank for which corruption can be understood as the abuse of public office for private gain[2]. The growing attention paid to this phenomenon since the middle of the nineties has accompanied the need to assess its various economic costs, particularly in terms of economic growth. Empirically, although many researchers have found that there is a significant negative relationship between corruption and growth rates, others contest this result and show that the impact of corruption on growth becomes statistically non significant once some of the usual determinants of economic growth are controlled for. These mixed results seem to favor the idea that the direct effect of corruption on growth is relatively low and that some explanatory variables included in the used empirical models are acting as transmission channels[3]. In other words, this suggests that if corruption is likely to affect economic growth, its effect will be transmitted indirectly via its impacts on the standard determinants of economic growth. This fact was reinforced by a number of authors who explicitly argued that the total effect of corruption on economic growth can be decomposed into a direct impact and a set of indirect effects manifested by a number of transmission variables [Mo (2001), Pellegrini and Gerlagh (2004), Dreher and Herzfeld (2005), and Pellegrini (2011)]. Such findings represented in reality a significant advance toward a better understanding of the various consequences of corruption which may allow, as denoted by Pellegrini and Gerlagh (2004), to limit some of its negative effects on the economy. In this paper, we revisit the relationship between corruption and economic growth. Our main interest is to specify the mechanisms via which corruption should affect growth. The remainder of the paper is organized as follows: Section 2 provides theoretical underpinnings and surveys the related literature on the linkage between corruption and economic growth. Section 3 describes our data and empirical methodology. Section 4 reports the

[1] For details on private corruption, see Argandoña, A. (2003).
[2] World Bank (1997), Helping Countries Combat Corruption: The Role of the World Bank, p. 8. *The World Bank: Washington DC.*
[3] This idea has already been reported since the pioneering study by Mauro (1995) for which the effect of corruption on economic growth tends to disappear once the variable measuring the ratio of investment in GDP is included as an explanatory variable. Mauro (1995) asserts that the impact of corruption on growth is largely due to its effect on investment.

empirical results on the channel effects. Section 5 discusses the robustness of our results, and finally, section 6 concludes.

2. Corruption and economic growth: Theoretical underpinnings and survey of related literature

The phenomenon of corruption has been the subject of observation and study for long time and still receives much attention. Although it is widely accepted that corruption is a detrimental phenomenon, the existing literature often shows mixed evidence about its effect on economic growth. The aim of this section is to present a general review of the theoretical and empirical contributions related to the consequences of corruption. Firstly, we recall the main theoretical arguments often used to apprehend the effects of corruption on the economy. Secondly, we provide a brief survey of the empirical literature on the relationship between corruption and economic growth. Thirdly, we review existing studies dealing with the transmission channels through which corruption is likely to influence growth.

2.1. Theoretical arguments on the economic effects of corruption

The theoretical underpinnings lying behind the relation between corruption and economic performance are diverse. Reflections have always been divided between those who saw that corruption could accelerate economic growth and those who, instead, focus on highlighting the prejudicial effects of this phenomenon. The most obvious argument always used in favour of a possible beneficial effect of corruption is its capacity to avoid administrative rigidities and to grease the wheels of bureaucracy (Leff, 1964). This suggests that corruption can be a source of efficiency for removing rigidities imposed by the state which impede investment and disrupt other economic decisions favorable to growth. In this sense, Lui (1985) proposes a queue model and points out that corruption may be desirable because it minimizes the average value of time costs of the queue, and can drive corrupt officials to be more efficient and to make decisions faster. Other contributions stipulate that in the bidding process, payment of bribes can be a guarantee of efficiency that the contracts will be awarded to the most efficient firms, those who, through their resources, can offer the highest grafts [Beck and Maher (1986), and Lien (1986)].

However, the view of an efficient corruption is not uncontested. Many writers have argued that this view of corruption is based on a problematic assumption that considers regulations and administrative procedures as exogenous and unrelated to corruption. Indeed, it is not unrealistic to suppose that public officials may create delays or administrative rigidities for the sole purpose of collecting bribes. For instance, Myrdal (1968) argues that if corruption is allowed to accelerate procedures, public officials will then have an interest in creating more rigidities and in maintaining slow administrative procedures to obtain more payments. Kaufmann and Wei (2000) indicate that regulatory burden and delays are endogenously chosen by the bureaucrats in order to extract rents and, that firms which pay the highest amounts of bribes are those that spend more, not less, time in negotiating regulations with bureaucrats and therefore they face a higher, not lower, cost of capital. Tanzi (1998) denotes also that firms which can afford to offer the highest bribe are not necessarily the most economically efficient. Moreover, the existence of such payments may divert firms and talented individuals from productive activities to rent-seeking activities resulting in a suboptimal use of human capital, which in turn could damage economic growth (Murphy, Schleifer and Vishny, 1991). Corruption tends also to reduce investment incentives for both local and foreign entrepreneurs. When the latter are often forced to pay bribes before creating their business or when they are often solicited to pay large sums of money to public officials to remain in business, corruption hinders or even blocks the creation and development of enterprises and hence, disadvantages economic growth. In addition, corruption increases transaction costs, impedes the development of a market economy, undermines the system of free markets by increasing the degree of uncertainty and reduces the state revenues while raising its spending [Rose-Ackerman (1997) and Tanzi (1998)]. In particular, it compromises the fundamental role of the state in some areas such as contracts enforcement and protection of property rights, and makes it difficult for government intervention to impose necessary regulatory controls and inspections to correct for market failures. Corruption leads also to a misallocation of resources, particularly when the investment of public funds and approval of private investments are decided, not on the basis of economic or social value of projects, but rather on the potential revenue that public officials expect to receive from their decisions (Jain, 2001). This suggests that the structure of public spending is often altered in favor of certain sectors, particularly those where opportunities for corruption are more obvious [Tanzi and Davoodi (1997), Mauro (1998) and De la Croix and Delavallade (2007, 2009)]. Other arguments for which corruption should be considered harmful to growth are mentioned by Gupta, Davoodi and Alonso-Terme (2002) who argued that corruption can result in more income inequality and higher poverty because it affects the targeting of social programs to the truly need and enables wealthiest individuals to take advantage of government-funded programs at the cost of the rest of the population. Summing up the theoretical literature on the economic effects of corruption, it appears that the predominant view of corruption is that it is a major impediment to economic performance. This view seems to be largely confirmed by the empirical literature related to the consequences of this phenomenon. The next subsection briefly reviews the existing literature on the relationship between corruption and economic growth.

2.1. Corruption and economic growth: review of empirical literature

The empirical literature on the effect of corruption on economic growth has experienced an unprecedented expansion since the middle of the nineties which is mainly due to the availability of new and more reliable data on corruption. The majority of previous studies found that corruption might have negative growth effects. For instance, Mauro (1995) shows that corruption is negatively and significantly related to GDP per capita growth rate for a cross-section of 58 countries for the period 1960-1985. In that paper, the author reports that a one standard deviation improvement in the corruption index is associated with a 0.8 percentage point increase in the annual growth rate of GDP per capita. This result was later confirmed by several empirical studies that found evidence of a significant negative association between corruption and economic growth [Knack and Keefer (1995), Mauro (1997), Leite and Weidmann (1999), Tanzi and Davoodi (2000), Gyimah-Brempong (2002), Méon and Sekkat (2005)]. However, some authors have questioned the robustness of the empirical relationship between corruption and economic growth, with some studies finding that the effect of corruption on economic growth is not always significant, others finding the effect quite sensitive to the inclusion of other important determinants of growth. For instance, Brunetti, Kisunko and Weder (1998) fail to detect any significant association between corruption and economic growth. In several studies the significant relationship tends to disappear when other conditioning variables are included in the regression. This is well illustrated by the study developed by Abed and Davoodi (2000). The objective of that paper is to test the importance of corruption against that of structural reforms in explaining macroeconomic performance for the transition economies. Regression analysis performed by the authors for 25 transition countries over the period 1994-1998 have shown that the coefficient on corruption becomes statistically insignificant when the structural reforms index is added to the regression. A similar finding has already been stressed by the seminal work of Mauro (1995) who found that after controlling for investment, the effect of corruption on economic growth becomes insignificant. Other authors including Mo (2001), Pellegrini and Gerlagh (2004) and Pellegrini (2011) have also provided similar evidence and reported that the relationship between corruption and economic growth becomes statistically insignificant after controlling for other important determinants of growth such as investments, human capital, openness, and political instability.

In a related issue, the more recent empirical literature highlights that the effect of corruption on growth cannot be explained without taking into account the institutional framework of countries. A number of studies argued that the relationship between corruption and economic growth is non linear, suggesting that the impact of corruption on growth might vary across countries according to the quality of their institutional setting. For instance, Mendez and Sepulveda (2005) found evidence of a non-monotonic relationship between corruption and economic growth and reported that corruption has a beneficial impact in countries where there are high degrees of political freedom; elsewhere the effect of corruption on growth is not robust. Aidt, Dutta and Sena (2008) have explored how corruption and economic growth are linked and jointly determined by the quality of political institutions and found that in countries with high quality institutions, corruption has a large negative impact on growth, while in countries with low quality institutions, corruption has, in contrast, no impact on growth. The decisive role of institutions in determining the effects of corruption on economic growth was recently examined by Méon and Weill (2010). Theses authors provide evidence that corruption is substantially less harmful in countries where the institutional framework is less effective. This finding that seems in favor of an efficient corruption that helps overcoming the existing institutional deficiencies is also confirmed by Heckelman and Powell (2010). Precisely, they show that corruption is positively associated to economic growth in countries where economic freedom is limited, but this positive impact tends to decrease as economic freedom increases.

In summary, the main conclusion that can be derived from the above studies is that the relation between corruption and economic growth is empirically very ambiguous. Some studies found a significant negative effect of corruption on growth, others that the effect is statistically insignificant, yet others show the effect to be heterogeneous across countries with different institutional frameworks. A common finding shared by many previous studies is that the significant association between corruption and economic tends to disappear when other conditioning variables are included in the regression [Mauro (1995), Abed and Davoodi (2000), Mo (2001), Pellegrini and Gerlagh (2004) and Pellegrini (2011)]. This finding suggests that large part of the effect of corruption on growth is transmitted indirectly through the main determinants of economic growth. In the next subsection, we propose to review the main results of studies devoted to identify the mechanisms by which corruption could effectively affect economic growth.

2.3. Previous studies on the links between corruption and economic growth

Despite an extensive existing empirical literature on the relationship between corruption and economic growth, very little evidence exists on the transmission channels of the effect of corruption on growth. This issue has been first tackled by Mo (2001). His objective is to estimate the effects of corruption and the channels through which it affects the rate of GDP growth. Using OLS regression analysis for 45 countries for the period 1970- 1985, he initially found a significant negative association between corruption and economic growth, but the magnitude of the effect decreases substantially and becomes statistically insignificant after controlling for other determinants of growth namely investment, human capital and political instability. This finding leads Mo (2001) to conclude that apart from its obvious direct effect, corruption is likely to influence the growth rate indirectly via its impacts on these three variables. In this sens, he suggests that the overall effect of corruption on economic growth can be decomposed into a direct effect and a set of indirect effects following the formula below:

$$\frac{d\mathbf{growth}}{d\mathbf{corruption}} = \frac{\partial\mathbf{growth}}{\partial\mathbf{corruption}} + \sum_{\mathbf{TV}} \left(\frac{\partial\mathbf{growth}}{\partial\mathbf{TV}} \frac{\partial\mathbf{TV}}{\partial\mathbf{corruption}} \right),$$

where TV represents each of the three transmission variables namely investment, human capital and political instability.

In order to estimate the impact of each channel in the transmission process, a second step was performed by the author. It consists on estimating separately the effect of corruption on each transmission variable. Multiplying the effects of corruption on the channel and the effect of the channel on growth allows the author to calculate the effect of corruption on growth via that specific channel. The main result of this decomposition method shows that a one-unit increase in the corruption index reduces the growth rate by 0.545 %. This overall effect is mainly due to the indirect effects of corruption on political instability, investment and human capital, which account for 53%, 21.4%, and 14.8%, respectively, of the overall effect of corruption on the growth rate. Taken together, these three transmission channels describe 88.2 % of corruption's overall effect whereas the direct effect of corruption on growth accounts only for 11.8 % of its overall effect.

The same decomposition method was later applied by Pellegrini and Gerlagh (2004) who retain the same transmission channels studied by Mo (2001) and consider trade openness as an additional transmission variable through which corruption might affect economic growth. For a sample of 48 countries over the period 1975-1996, Pellegrini and Gerlagh (2004) found that one standard deviation decrease in the corruption index is associated with an increase in economic growth by 1.05% per year. Pellegrini and Gerlagh (2004) state that this negative effect is largely transmitted indirectly via the transmission channels which represent 81 % of the overall impact of corruption on growth. More especially, Pellegrini and Gerlagh's (2004) results show that the contribution of each transmission channels to the overall effect of corruption on economic growth equals 32, 28, 16, and 5%, respectively for investment, trade openness, political instability, and human capital. In a more recent version of this paper, Pellegrini (2011) provides evidence that indirect effects of corruption on economic growth account for 61% of its overall effect[4]. He also shows that the most important channel through which corruption hampers economic growth is by lowering investment, which accounts for one-third of corruption's overall negative effects.

In addition to the aforementioned papers, the study developed by Dreher and Herzfeld (2005) has also investigated how corruption affects economic growth through a variety of channels. Using the three-stage least squares method on 71 countries for the period 1975-2001, Dreher and Herzfeld (2005) estimate a system of seven equations which account for the impacts of corruption on economic growth as well as on six possible channels of influence. However, they retain as transmission channels of the effect of corruption on economic growth only variables whose coefficients in the estimated growth equation are statistically significant at least at the ten percent level. Doing so, they found that a one point increase in the corruption index increases GDP per capita growth rate by 0.129%, 0.225% et de 0.451% through the investment, inflation and government expenditure channels, respectively, and reduces growth by 0.106% via the foreign aid channel. Once the direct effect of corruption on economic growth and all transmission channels are taken into account, Dreher and Herzfeld (2005) conclude that the overall effect of corruption on the growth rate of GDP per capita is negative and amounts to 0.13%.

3. Empirical Methodology, Model specification and Data

A shared characteristic to the previous studies focusing on the transmission channels of the effect of corruption on economic growth is that they include a limited number of variables that might explain the linkage between corruption and growth. This could lead to overestimate the relative contribution of each transmission variable to the overall effect of corruption on economic growth. Indeed, this would be particularly more problematic because the existing empirical literature explicitly recognizes that the most known determinants of economic growth are also significantly affected by corruption and, hence, could have a role in explaining the

[4] 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).

observed overall impact of corruption on growth[5]. In this respect, the objective of the present empirical study is to analyze several interdependencies that may influence the relationship between corruption and growth, and therefore, to identify the channels through which corruption is likely to affect growth. To do so, we follow an empirical methodology different to that adopted by the majority of similar previous studies[6]. This methodology is based on the estimation of a system of simultaneous equations for a wide cross section of countries that allow us to assess the incidence of corruption on various determinants of growth and to highlight the relative contribution of each channel to the overall corruption's growth effect. In this section, we first present the proposed empirical methodology and then we describe the model specification, the estimation method and, the data we use.

3.1. Empirical Strategy

In order to explicit the channels through which corruption is likely to affect growth, we proceed in the present empirical study, as do Dreher and Herzfeld (2005), with a system of simultaneous equations. Moving away from the decomposition method applied by most previous studies, the empirical methodology we follow will allow us to take into account the impact of corruption on several determinants of growth and to provide evidence on the relative contribution of each channel to the overall effect of corruption on growth. The starting point to the empirical model is a growth equation to which is added a set of equations describing a variety of indirect effects of corruption on growth and one additional equation that accounts for the determinants of corruption. The corruption equation is introduced into the system to deal with the endogeneity problem related to the simultaneous determination of corruption, economic growth, and the transmission variables. Although it seems impossible to analyze all interdependencies lying behind the relationship between corruption and growth, we attempt to look at the impacts of corruption on five determinants of economic growth at once, namely investment, human capital, government expenditure, inflation and political instability. These variables resume most of the transmission channels explored by previous empirical studies [Mo (2001), Pellegrini

[5] For reviews on the links between corruption and several determinants of economic growth, see for instance Arnone and Iliopulos (2007) and Lambsdorff, J. G. (2006, pp.22-38).
[6] For details on the vigorous criticisms leveled at the decomposition method adopted by Mo (2001), Pellegrini and Gerlagh (2004), and Pellegrini (2011), see Akai, Horiuchi and Sakata (2005, 2006).

and Gerlagh (2004), Dreher and Herzfeld (2005), and Pellegrini (2011)]. The choice of these transmission variables is also consistent with the existing empirical literature that acknowledges their role as major determinants of economic growth while showing that each of which is significantly affected by corruption. Indeed, numerous studies have found that corruption has significant impact on investment [Mauro (1995, 1997), Brunetti and Weder (1998), Campos, Lien and Pradhan (1999) and, Rock and Bonnett (2004)], on human capital [Kaufmann, Kraay and Zoido-Lobaton (1999), Gupta, Davoodi and Tiongson (2001) and, Rajkumar and Swaroop (2008)], on government expenditure [Tanzi and Davoodi (1997) and, Haque and Kneller (2008)], on inflation [Al-Marhubi (2000) and de Honlonkou (2003)], and on political instability [Mo (2001) and, Pellegrini and Gerlagh (2004)].

The empirical methodology we follow to quantify the contribution of each of these five transmission variables to the effect of corruption on economic growth is close to the Channel Methodology developed by Tavares and Wacziarg (2001) to explore links between democracy and economic growth. The same methodology was later applied by Wacziarg (2001) to assess the transmission channels of the effect of trade openness on growth and, more recently, by Lorentzen, McMillan and Wacziarg (2008) to examine the mechanisms through which death rates affect growth. Using a system of simultaneous equations, this methodology consists in excluding corruption from the growth regression and estimating its effects on each of the channel variables. By multiplying the effect of corruption on the channel and the effect of the channel on growth, the effect of corruption on growth through that specific channel can be identified.

Doing so, this methodology will enable us to decompose the total effect of corruption on growth into its various channels and, on the other hand, to assess the relative contribution of each transmission variable to the overall effect of corruption on economic growth, taking into account other competing channels. In addition, it helps us to know whether the five channel variables under consideration fully capture the total effect of corruption on growth. The proposed methodology is also particularly valuable as it allows testing various theoretical arguments on the costs and potential benefits of corruption.

3.2. Model specification and estimation method

The adopted econometric specification is based on a set of seven equations determining growth, corruption and the channel variables. The first equation is a growth regression where GDP per capita growth rate (**GR**) is related to the initial per capita GDP (**IGDP**) and the five transmission variables. For the remaining equations, the chosen specification is based on the existing empirical literature on the determinants of each endogenous variable under consideration. Following Serra (2006) who implemented an Extreme-Bounds Analysis to assess the robustness of various corruption's determinants, we explain corruption (**CRP**) with five variables, namely the level of per capita GDP (**GDP**), the share of Protestants in the population (**PROT**), the degree of political instability (**PI**) and, two dummies accounting for British colonial heritage (**COLUK**) and for maintaining democratic institutions for a long time period (**DLP**), respectively. The human capital (**HC**) equation contains three explanatory variables (**GDP**), (**PSE**), and (**URBAN**) which account for per capita income, public spending on education and urbanization rate, respectively [Gupta, Davoodi and Tiongson (2001), Gupta, Verhoeven and Tiongson (2002), Al-Samarrai (2006), Rajkumar and Swaroop (2008) and, Baldacci, Clements, Gupta and Cui (2008)] and one additional variable accounting for ethnolinguistic fractionalization (**ELF**) [Tavarez and Wacziarg (2001), Rajkumar and Swaroop (2008) and, Dearmon and Grier (2011)]. For the investment channel (**INV**), the specification draws upon Mauro (1995) who controls for initial per capita income (**IGDP**), government expenditure (**GOV**) and human capital (**HC**) and, following Tavares and Wacziarg (2001) and Wacziarg (2001), we add four variables (**POP15**), (**POP65**), (**OPEN**) et (**ELF**) controlling for the share of population aged under 15, the share of population aged over 65, trade openness and ethnolinguistic fractionalization, respectively. Specification of government expenditure (**GOV**) equation includes three variables (**IGDP**), (**POP**) and (**URBAN**) controlling for initial per capita income, country population and urbanization rate, respectively (Alesina and Wacziarg, 1998) and variables measuring the share of population aged under 15 (**POP15**), the share of population aged over 65 (**POP65**) and ethnolinguistic fractionalization (**ELF**) [Tavarez and Wacziarg (2001), and Wacziarg (2001)]. For the inflation equation, the specification is based on Al-Marhubi (2000) who controls for per capita income (**GDP**) and trade openness (**OPEN**) for which we add two additional variables related to government size (**GOV**) and ethnolinguistic fractionalization (**ELF**)

(Tavares and Wacziarg, 2001). The specification of the political instability (**PI**) is close to that estimated by Tavarez and Wacziarg (2001) who specify this variable as a function of initial per capita income (**IGDP**), ethnolinguistic fractionalization (**ELF**), country population (**POP**), government expenditure (**GOV**) and a landlocked country dummy (**LANDLOCK**). In sum, the baseline specification describing the behavior of the endogenous variables can be summarized as follow:

Table 1. Model specification

Dependent Variables	**GR**	**CRP**	**HC**	**INV**	**GOV**	**INFL**	**PI**
Equation n°	**[1]**	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**	**[7]**
Endogenous Variables							
Corruption (**CRP**)			*	*	*	*	*
Human Capital (**HC**)	*			*			
Investment (**INV**)	*						
Government Expenditure (**GOV**)	*			*		*	*
Inflation (**INFL**)	*						
Political Instability (**PI**)	*	*					
Exogenous Variables							
Initial per capita income (**IGDP**)	*			*	*		*
Per capita income (**GDP**)		*	*			*	
Public spending on education (**PSE**)			*				
Urbanization rate (**URBAN**)			*		*		
Ethnolinguistic fractionalization (**ELF**)			*	*	*	*	*
Country population (**POP**)					*		*
Share of population under 15 (**POP15**)				*	*		
Share of population over 65 (**POP65**)				*	*		
Trade openness (**OPEN**)				*		*	
Landlocked dummy (**LANDLOCK**)							*
Share of Protestants in the population (**PROT**)		*					
Uninterrupted democracy dummy (**DLP**)		*					
Former British colony dummy (**COLUK**)		*					

As presented in the table above, all equations are over identified and, therefore, the system of equations will be estimated using the three-stage least squares method (**3SLS**) which treats all equations and all parameters jointly and not equation-by-equation. This method, developed by Zellner and Theil (1962), is considered as a full information method or a system estimation method that takes account of a possible correlation between the disturbances of the different equations. In addition, the three-stage least squares method (**3SLS**) is more efficient than the two-stage least squares method (**2SLS**) if the system of equations is properly specified (Baltagi, 2008, p. 268). The first stage of this method provides instruments for all endogenous variables. These instruments are the predicted values obtained from a regression of each endogenous variable on all exogenous variables included in the system. The second stage estimates each equation in the model separately with the two-stage least squares method (**2SLS**) using instruments from the first stage. This allows retrieving a consistent variance-covariance matrix for the error terms of the model. The third stage performs a generalized-least square estimation using the variance-covariance matrix estimated in the second stage and the instruments of the endogenous variables constructed in the first stage (Greene, 2003, p. 405-406). Furthermore, we use Breusch-Pagan (1980) test of independence to investigate whether cross-equation disturbances are indeed correlated and, by this way, we verify if the model requires a system estimation method. We also use the specification test of Hausman (1978) to ascertain whether the system is properly specified and whether the three-stage least squares method (**3SLS**) is more appropriate than the two-stage least squares method (**2SLS**)[7].

3.3. Data and preliminary analysis

The present analysis is based on cross-country data covering a total of 82 countries, both developed and developing, over the period 1980-2002 (table 1 in appendix lists the countries included in the analysis). Given the large number of explanatory variables used for the specification of the various equations, our data are drawn from a number of sources. Our first dependent variable is the growth rate as measured by the growth rate of real per capita GDP between 1980 and 2002, using the *World Bank World Development Indicators* database (CD-ROM edition, 2004). Almost all variables used in this analysis are averaged over the period under study or over the period for which data were available, except for initial per capita income measured in 1980. The data on corruption come from the Political Risk Services/ International Country Risk Guide database, over the period 1982-2001. 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, we recode the original data so as to obtain a corruption index that ranges from zero (least corrupt) to six (most corrupt). To measure political instability (**PI**), we employ the political stability index drawn from Kaufman, Kraay and Mastruzzi (2008) over the period 1996-2002. This index has been transformed on a scale that ranges between zero and five so that

[7] All estimations and statistical tests are carried out using STATA 10.1 software.

higher levels correspond to more political instability instead of less as on the original scale. For the remaining dependent variables, all data are taken from the World Bank's World Development Indicator where investment (**INV**) is measured by the gross fixed capital formation (% of GDP), human capital (**HC**) is proxied by the secondary gross enrolment rate, inflation (**INFL**) is approximated by the GDP deflator (annual %) and government expenditures (**GOV**) are measured by the share of general government final consumption expenditure in GDP (table 2 in appendix describes all variables used in the analysis with their data sources). In order to offer a preliminary insight on the main variables under study, we present below the correlation coefficients for the major variables of interest, namely the growth rate, corruption and the five transmission variables (table 3 in appendix presents descriptive statistics for all variables used in the analysis).

Correlation Matrix for Main Variables

	GR	**ICRG**	**HC**	**INV**	**GOV**	**INFL**	**PI**
ICRG	-0.367***	1					
HC	0.451***	-0.711***	1				
INV	0.484***	-0.099	0.291***	1			
GOV	-0.007	-0.417***	0.412***	0.125	1		
INFL	-0.264**	0.242**	-0.283**	-0.235**	-0.218**	1	
PI	-0.415***	0.711***	-0.637***	-0.145	-0.378***	0.428*	1

Notes: - Number of observations: 82
*- ***, **,* denote correlation coefficients significant at the 1, 5 and 10% level, respectively.*

Generally, the correlation matrix among the main variables shows coefficients that are in line with previous theoretical and empirical work both on the determinants of economic growth and the consequences of corruption. As shown in the first column, growth is indeed positively correlated with human capital and investment while it is negatively associated with inflation, government expenditures and political instability. The second column of the matrix shows a negative correlation between corruption and human capital, investment and government expenditures whereas the corruption index is found to be positively correlated with inflation and political instability. Expect for investment, all correlations between corruption and the channel variables are relatively high and all significant at conventional levels.

The high correlations between corruption and the transmission variables can be interpreted as a confirmation of the choice we made concerning channels used to explain the effect of corruption on economic growth and for the adoption of a specification based on the estimation of a simultaneous equations system. In sum, the picture that emerges from the correlation matrix suggests that corruption works negatively on growth through its impacts on human capital, investment, inflation and political instability and, positively via the government expenditures channel. Nevertheless, this picture could differ considerably when taking into account interactions between the numerous variables under study and controlling for the determinants of each endogenous variable.

4. Empirical evidence

In this section, we present and discuss the mains results of our econometric analysis. First, we describe results on the effect of the transmission variables on economic growth as well as the impact of corruption on each channel variable. Then, we analyze the relative contribution of each channel variable to the overall effect of corruption on economic growth.

4.1. Estimation results

Tables 4 and 5 in Appendix report the estimates of the baseline model as well as the statistical tests we performed. Theses tables contain the estimates of the baseline specification using respectively the 2SLS and the 3SLS, the Breusch-Pagan test performed to examine whether cross-equations disturbances are correlated and, the Hausman test used to choose the appropriate estimation method. The result of the Breusch-Pagan test shows that cross-equations residuals were not independent (the probability of the test equals 0.07 and, hence, the test rejects the null hypothesis of independence) and indicates, therefore, that the equations need to be estimated simultaneously. We also found that the Hausman test fails to reject the null hypothesis, showing that the specification of the various equations is correct and the 3SLS method is indeed consistent and efficient whereas 2SLS is only consistent. In this respect, we present in the table 2 below the main results we obtained through a three-stage least squares estimation of the baseline model where the second column describes the effect of the transmission variables on growth and, the last column indicates the impact of corruption on each channel variable.

Table 2. Main empirical results

Channel variable	Effect of channel on growth	Effect of corruption on channel
Human Capital	0.000588***	-8.582***
	(4.343)	(-3.115)
Investment	0.00279***	-1.134
	(4.728)	(-1.164)
Government Expenditures	-0.00142***	-3.321***
	(-4.083)	(-2.849)
Inflation	-0.00436**	0.211
	(-1.738)	(0.850)
Political Instability	-0.00855**	0.545***
	(-2.138)	(6.001)

Numbers in parentheses are t-statistics
**** and ** denote coefficients significantly different from zero at the 1 and 10% level, respectively.*

As a first result, we found that the coefficients related to the five transmission channels included in the growth regression are all statistically significant at the conventional levels and, they enter with the expected sings. This finding is in line with previous empirical literature on the determinants of economic growth that have supported a positive effect of investment and human capital on growth and, on the other hand, a negative impact of inflation, government expenditures and political instability. In addition, ours results reveal that corruption is negatively associated with human capital, investment and government expenditures, and it is positively correlated with inflation and political instability. Particularly, we found that the coefficient on corruption is statistically significant at the 1% level in human capital, government expenditures and political instability equations. These results corroborated those obtained by various empirical studies dealing with the consequences of corruption. However, we found that the coefficient on corruption in investment and inflation equations is statistically insignificant, although having the expected sign. Somewhat surprisingly, this finding contrasts with previous empirical results that have shown a clear negative impact of corruption on investment and a positive effect of corruption on inflation. In this regard, it is important to note that most empirical previous studies analyzing the effect of corruption either on investment or on inflation are mainly based on a single equation model and, therefore, were not exploring the impact of corruption on each of these variables following a model that takes into account the various incidences of corruption as described by the theoretical and empirical literature. In this regard, one explanation of this unexpected result may be due to the joint estimation of the effects of corruption on several variables. This explanation is supported by Dreher and Herzfeld's (2005) study which jointly estimates the effects of corruption on various determinants of economic growth and shows that the impact of corruption on investment is statistically insignificant and even positive[8]. In the light of these results, we propose in the following subsection to calculate the indirect impacts of corruption and to quantify the relative contribution of each transmission channel to its overall effect on growth.

4.2. Identifying channels of influence

We present in this subsection our results on the effects of corruption on economic growth through each transmission variable and we discuss the relative importance of each variable in explaining the linkage between corruption and growth. The table below repeats the coefficient of the channel variable in the growth equation (column 2) and the coefficient of corruption in each channel equations (column 3) and, presents in the last column the product of the two coefficients that is the effect of corruption on growth via each channel variable. According to the results presented in Table 3, corruption works negatively for growth through four out of five of the channels under study. Our results show that corruption is likely to lower economic growth through its negative impacts on human capital and investment and, through its positive effects on inflation and political instability. A one point increase in the corruption index decreases growth by 0.5% via the human capital channel, by 0.31% via the investment channel, by 0.09 via the inflation channel and, by 0.46% via the political instability channel. All together, these four transmission variables reduce growth rate by 1.36%. The relative contribution of each of these variables to the negative effect of corruption on growth is about 36.6%, 33.8%, 22.9% and 6.6%, respectively for human capital,

[8] To investigate whether the lack of statistically significant impact of corruption on investment and inflation is driven by the joint estimation of the effects of corruption on several variables, we performed additional econometric regressions on the system of equations initially estimated while dropping one channel equation at a time. Doing so, we found that the coefficient on corruption in the investment equation becomes statistically significant when the human capital equation is not included in the system while the effect of corruption on inflation becomes significant when the political instability equation is excluded from the estimated model. The regression results showing significant effects of corruption on investment (system without human capital equation) and inflation (system without political instability equation) are available from the author on request.

political instability, investment and inflation. The results suggest that only the human capital and political instability channels involve statistically significant effects at the conventional levels. Taken together, human capital and political instability describe almost 70% of the total negative impact of corruption on growth. However, the effects of corruption transmitted through investment and inflation are statistically insignificant. This is mainly due to the fact that these variables are not significantly affected by corruption. In addition to its adverse effects, the estimates suggest that corruption seems to generate a significant improvement in the growth rate of about 0.47% through the government expenditures channel.

Table 3. Summary of the Channel Effects

Channel variable	Effect of channel on growth	Effect of corruption on channel	Effect of corruption on growth
Human Capital	0.000588***	-8.582***	-0.0050494***
	(4.343)	(-3.115)	(-2.64)
Investment	0.00279***	-1.134	-0.0031579
	(4.728)	(-1.164)	(-1.13)
Government Expenditures	-0.00142***	-3.321***	0.0047313**
	(-4.083)	(-2.849)	(2.38)
Inflation	-0.00436*	0.211	-0.0009189
	(-1.738)	(0.850)	(-0.77)
Political Instability	-0.00855*	0.545***	-0.0046597**
	(-2.138)	(6.001)	(-2.09)
Overall Effect			**-0.0090544****
			(-2.49)

Numbers in parentheses are t-statistics
****, ** and * denote coefficients significantly different from zero at the 1, 5 and 10% level, respectively.*

The summation of the partial effects of all channels of influence reveals that the overall effect of corruption on growth is negative and significantly different from zero. A one point increase in the corruption index is associated with a 0.9% decrease in the annual growth rate once all transmission channels are taken into account. Although they are in accordance with past findings that provide evidence of a harmful impact of corruption on growth, the results of our estimates suggest that this negative effect is transmitted mainly through human capital and political instability channels while the relative contribution of investment channel seems to be smaller than that suggested by the studies of Mo (2001), Pellegrini and Gerlagh (2004) and Pellegrini (2011). Moreover, our findings contrast with these studies regarding the relative importance of the human capital channel in explaining the relationship between corruption and economic growth. Indeed, a common result to these three studies is that human capital does not appear to be an important transmission channel as it accounts only for 14.8, 5 and 13% of the total effect of corruption on economic growth, respectively in each of these studies. We also note that our results does not corroborate those obtained by Dreher and Herzfeld (2005) concerning the role of inflation in the transmission processes. While we found that inflation is one of the channels through which corruption adversely affects growth, these authors show that this variable involves a positive effect of corruption on economic growth. Finally, our results are in line with those of Mo (2001), Pellegrini and Gerlagh (2004) and Pellegrini (2011) regarding the negative impact of corruption on economic growth via the political instability channel, and those of Dreher and Herzfeld (2005) who report that corruption might have positive growth effect by lowering government expenditures.

5. Robustness checks

In this section, we extend the analysis by testing the robustness of our results on the linkages between corruption and economic growth. Firstly, we consider another index of corruption and we use a different estimation method. Thus, we will check if our results depend on the corruption measure and the estimation technique we have chosen. Secondly, we examine the exhaustiveness of the estimated model by carrying out a test based on the residuals from the growth equation. Finally, we test the sensitivity of the results to the inclusion of trade openness as an additional channel through which corruption should affect growth.

5. 1. Sensitivity to the measure of corruption and to the estimation method

As a first robustness check, we use the Graft Index by Kaufmann, Kraay and Mastruzzi (2008) as an alternative measure of corruption to see whether the results are validated when we use different corruption data. We then examine the sensitivity of the results to the choice of a different econometric technique. To do so, we run the model using the seemingly unrelated regression estimator (SURE). This estimator, though inconsistent because it proceeds without instrumenting for the endogenous variables, may provide a greater efficiency by taking into account a possible correlation between the disturbances of the different equations. Tables 4 and 5 display the estimation results using the Graft index and the seemingly unrelated regression estimator (these estimates are reported in detail in appendix, table 6 and 7).

Table. 4. Summary of the Channel Effects Using the Graft Index

Channel variable	**Effect of channel on growth**	**Effect of corruption on channel**	**Effect of corruption on growth**
Human Capital	0.000571***	-14.00***	-0.0079853***
	(4.20)	(-3.10)	(-2.60)
Investment	0.00268***	-2.430**	-0.0065136
	(4.59)	(-1.77)	(-1.64)
Government Expenditures	-0.00139***	-5.767***	0.008004***
	(-3.97)	(-3.48)	(2.66)
Inflation	-0.00406	0.309	-0.0012547
	(-1.62)	(0.84)	(-0.75)
Political Instability	-0.00789***	0.832***	-0.0065678**
	(-1.94)	(7.95)	(-1.94)
Overall Effect			**-0.0143175*** (-2.71)**

Numbers in parentheses are t-statistics
**** and ** denote coefficients significantly different from zero at the 1 and 10% level, respectively.*

Table. 5. Summary of the Channel Effects Using SUR estimates

Channel variable	**Effect of channel on growth**	**Effect of corruption on channel**	**Effect of corruption on growth**
Human Capital	0.000489***	-3.451*	-0.0016872*
	(5.82)	(-1.94)	(-1.86)
Investment	0.00147***	-0.193	-0.0002826
	(4.52)	(-0.41)	(-0.41)
Government Expenditures	-0.000913***	-1.631**	0.0014886*
	(-3.99)	(-2.44)	(2.09)
Inflation	-0.00140	0.0969	-0.000136
	(-1.38)	(0.61)	(-0.55)
Political Instability	-0.00743***	0.447***	-0.0033159***
	(-3.52)	(7.31)	(-3.21)
Overall Effect			**-0.003933*** (-2.60)**

Numbers in parentheses are t-statistics
****, ** and * denote coefficients significantly different from zero at the 1, 5 and 10% level, respectively.*

As can be seen from the tables, the results are roughly unchanged in relation to those obtained in the previous section, especially regarding the negative effect of corruption on growth and the relative importance of each channel in explaining the relationship between these two variables. Indeed, we find again that human capital and political instability are the most important channels through which corruption is likely to reduce growth. We also find that government expenditures remain the only channel that involves a positive effect of corruption on economic growth. Table 4 confirms that the results are not sensitive to the use of a different data on corruption. We can notice that all coefficients have the same sign and roughly the same magnitudes compared to the ones estimated using the ICRG corruption index. This is not unexpected given that the two measures of corruption we used are highly correlated (for our sample, the correlation between the two measures of corruption equals 0.847). Table 5 shows that the results on the channels remain essentially unchanged, but the magnitude of the effect of corruption on economic growth decreases substantially when using the seemingly unrelated regression estimator, highlighting the importance of instrumenting for the endogenous variables when exploring the links between corruption and growth.

5. 2. Exhaustiveness of the Model[9]

In order to see whether the five channels we have chosen fully capture the total effect of corruption on growth, we run a test based on the residuals from the growth equation. This test proceeds by regressing the residual vector obtained from the system estimates of the growth equation on the corruption index. A significant effect of corruption on the residuals could indicate that some transmission variables have been omitted from the growth equation, reflecting therefore that the five channels under study have not been able to provide an exhaustive overview on the linkage between corruption and economic growth. Table 6 below displays the results obtained from three-stage least squares and seemingly unrelated regressions estimations, using the two indexes of corruption.

[9] Tests performed in this subsection are suggested by Wacziarg (2001, p. 421-422). However, we note that the test based on the residuals from the growth equation, as highlighted by Wacziarg (2001, p. 421), should not be considered as an absolute proof of exhaustiveness but as an indication that no relevant channel has been omitted.

Table 6. Test based on the residuals from the growth equation

	ICRG		Graft	
	3SLS	**SURE**	**3SLS**	**SURE**
Corruption Index	**-0.00109** **(-0.85)**	**-0.000859** **(-0.85)**	**-0.000582** **(-0.39)**	**-0.000802** **(-0.66)**
Intercept	0.00269 (0.75)	0.00212 (0.75)	0.00125 (0.35)	0.00172 (0.53
N	82	82	82	82
R^2	0.009	0.009	0.002	0.005

The results show that the effect of corruption on the residuals is negative but never statistically significant, regardless of the estimation method and the measure of corruption. This finding seems to confirm that no significant channel variable has been omitted, suggesting that the five channels chosen to explore links between corruption and growth have been able to explain exhaustively the relationship between these two variables.

Additional evidence of the model's exhaustiveness can be provided by comparing the overall effect of corruption on growth computed in the previous section with its unconditional effect obtained by removing all of the channel variables from the growth equation and using only the corruption index. Table 7 summarizes the unconditional effect of corruption on economic growth obtained from three-stage least squares and seemingly unrelated regressions estimates (these estimates are reported in appendix in tables 8 and 9).

Table 7. Unconditional effect of corruption on economic growth

	3SLS	**SURE**
Corruption Index (ICRG)	**-0.00863***** **(-3.31)**	**-0.00598***** **(-3.20)**
N	82	82
R^2	0.085	0.129

Numbers in parentheses are t-statistics
**** denote coefficients significantly different from zero at the 1% level.*

We note that the resulting estimates are consistent with those obtained in the previous section. On the one hand, we find again a negative and significant effect of corruption on economic growth and, on the other hand, the magnitude of the effect is almost the same when compared to the one computed earlier (the magnitude of the overall effect initially computed equals 0.009).

5. 3. Sensitivity to the inclusion of an additional channel

As some previous researchers have noted, there may be additional indirect effects of corruption on growth. To address this issue, we propose to extend the analysis by including trade openness as a possible channel through which corruption should affect growth. According to Pellegrini and Gerlagh (2004) and Pellegrini (2011), this channel seems to explain a considerable part of the effect of corruption on growth. In this respect, we consider an additional equation to take into account the effect of corruption on trade openness. To do so, we adopt a specification close to that estimated by Wacziarg (2001) which contains the usual determinants of trade openness[10]. Table 8 reports the regression results of adding the trade openness equation to the baseline model, using a three-stage least squares estimator (these estimates are displayed in detail in appendix, table 10). The resulting estimates suggest some observations. Firstly, the trade openness channel seems to work positively to economic growth, which contrasts with the findings of Pellegrini and Gerlagh (2004) and Pellegrini (2011). We note however that this is not due to the absence of a negative effect of corruption on trade openness, but rather because this variable seems to exert a negative impact on economic growth[11]. Secondly, some channel effects seems to be quite sensitive to the inclusion of trade openness as an additional channel. In particular, the government expenditures effect is much reduced and becomes statistically insignificant whereas the investment effect becomes positive, which cast considerable doubt on the robustness of this channel. Thirdly, the inclusion of the trade openness channel does not seem to affect the estimates of the most important channels, namely human capital and political instability. These two variables remain the only channels describing a negative and significant effect of

[10] In addition to the corruption index, the specification of trade openness equation includes the initial level of per capita GPD (**IGDP**), two measures for the country size (country population, **POP** and country land area, **AREA**), the government size measured by government consumption as a share of GDP (**GOV**)**,** a landlocked country dummy (**LANDLOCK**), an island dummy (**ISLAND**), an oil exporter dummy (**OIL**) and a post-war independence dummy (**POSTWAR**).

[11] Despite an extensive literature on the benefits of trade openness, some researchers explicitly recognize that the positive association between trade openness and growth seems to be difficult to highlight (see, for instance, Rodrik and Rodriguez, 2000 and Wacziarg, 2001).

corruption on growth, highlighting once again their robustness in explaining the links between corruption and growth.

Table 8. Summary of the Channel Effects Including the Trade Openness channel

Channel variable	Effect of channel on growth	Effect of corruption on channel	Effect of corruption on growth
Human Capital	0.000554***	-10.98***	-0.0060794***
	(4.24)	(-3.94)	(-3.02)
Investment	0.00353***	0.370	0.001308
	(6.49)	(0.46)	(0.46)
Government Expenditures	-0.000673*	-2.792**	0.0018796
	(-1.74)	(-2.43)	(1.42)
Inflation	-0.00602***	0.109	-0.0006539
	(-3.24)	(0.47)	(-0.47)
Political Instability	-0.0100**	0.552***	-0.0055491**
	(-2.53)	(3.33)	(-2.48)
Openness	-0.000130**	-5.455	0.0007116
	(-2.32)	(-0.72)	(0.69)
Overall Effect			**-0.0083831****
			(-2.29)

Numbers in parentheses are t-statistics
****, ** and * denote coefficients significantly different from zero at the 1, 5 and 10% level, respectively.*

6. Concluding remarks

A wide literature has focused on the consequences of corruption. Several writers have argued that corruption has negative effects on economic performance for a variety of reasons. As yet, however, the existing empirical literature seems to be unable to sort out whether corruption is beneficial or harmful to growth in a cross-country setting. To better understand the effect of corruption, it is important to specify the mechanisms via which it should affect growth. In this respect, some researchers have shown that there are important indirect effects of corruption on growth that are manifested through the main sources of income growth. This paper has investigated how corruption affects economic growth through a variety of channels for a cross-section of 82 countries for the period 1980-2002. Unlike most previous studies that adopted the decomposition method developed by Mo (2001), the econometric methodology followed in this paper is close to the one used by Tavares and Wacziarg

(2001). This methodology is based on a system of simultaneous equations which accounts for the impacts of corruption on several determinants of growth: investment, human capital, political instability, inflation and, government expenditures. Our results suggest that human capital and political instability are the most important transmission variables through which corruption is likely to reduce growth. However, there is no evidence that investment constitutes a significant transmission channel via which corruption operates. In addition, we find that the sole beneficial effect of corruption is by lowering government expenditures. Summing up all channel effects, corruption is found to be negatively associated with economic growth. These findings have been shown to be robust to a series of tests (different estimation technique, alternative measure of corruption, model's exhaustiveness). In line with several other studies, the empirical results in this paper confirm the detrimental effect of corruption. Nevertheless, further research remains crucial to improving our understanding of the interaction between corruption and economic growth. It may be interesting to increase the size of the sample and to show how corruption would affect growth across countries with different institutional frameworks or at different stages of economic development. In addition, future extensions should analyze carefully the impact of corruption on the usual determinants of economic growth. Finally, to the extent that we found human capital to be the most important channel through which corruption reduces growth, the conclusions we made need to be followed by detailed country analysis or case studies. In this respect, microeconomic evaluations of the costs of corruption within the education sector appear to be important areas for future empirical research.

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Appendix

Table 1. List of countries

Algeria	El Salvador	Kuwait	Portugal
Argentina	Finland	Luxembourg	Saudi Arabia
Australia	France	Madagascar	South Africa
Austria	Gambia	Malaysia	Spain
Bahrein	Ghana	Mali	Suriname
Bangladesh	Greece	Malta	Sweden
Belgium	Guatemala	Mexico	Switzerland
Bolivia	Guinea-Bissau	Morocco	Syria
Botswana	Guyana	Mozambique	Togo
Brazil	Honduras	Namibia	Trinidad and Tobago
Burkina Faso	Iceland	Netherlands	Tunisia
Cameroon	Indonesia	New Zealand	Turkey
Canada	Iran	Nicaragua	United Arab Emirates
Chile	Ireland	Niger	United Kingdom
Colombia	Israel	Norway	United States
Costa Rica	Italy	Oman	Uruguay
Cyprus	Jamaica	Panama	Venezuela
Denmark	Japan	Papua New Guinea	Zambia
Dominican Republic	Jordan	Paraguay	Zimbabwe
Ecuador	Kenya	Peru	
Egypt	Korea, Republic of	Philippines	

Table 2. Variables Description and Sources of Data

Variable	Description and data source
growth	Growth rate of Real Gross Domestic Product per capita for the period 1980-2002. *Source: WDI (2004).*
ICRG	Corruption index (rescaled: 6-original values), 1982-2001 averages. *Source*: *ICRG, International Country Risk Guide, Political Risk Services, USA*.
Graft	Corruption index (rescaled: 2.5 - original values), 1996- 2002 averages. *Source: Kaufmann et al. (2008).*
INV	Investment: Gross Fixed Capital Formation (% of GDP), 1980-2002 averages. *Source: WDI* (2004).
HC	Human Capital: School Enrollment, Secondary (% Gross), 1980-2002 averages. *Source: WDI (2004).*
GOV	Government Expenditures: General government final consumption expenditure (% of GDP), 1980-2002 averages. *Source: WDI (2004).*
INFL	Inflation: Logarithm of GDP Deflator (Annual %), 1980-2002 averages. *Source: WDI (2004).*
PI	Political Instability Index (rescaled: 2.5 - original values), 1996- 2002 averages. *Source: Kaufmann et al. (2008).*
IGDP	Logarithm of real per capita GDP in 1980. *Source: WDI (2004).*
GDP	Logarithm of real per capita GDP (Constant 1995 US$), 1980-2002 averages. *Source: WDI (2004).*
PSE	Public Spending on Education, Total (% of GDP), 1980-2002 averages. *Source: WDI (2004).*
URBAN	Urban population (% of Total), 1980-2002 averages. *Source: WDI (2004).*
POP	Total population: logarithm of total population, 1980-2002 averages. *Source: WDI (2004).*
POP15	Population ages 0-14 (% of total), 1980-2002 averages. *Source: WDI (2004).*
POP65	Population ages 65 and above (% of total), 1980-2002 averages. *Source: WDI (2004).*
OPEN	Trade Openness: Share of imports plus exports to GDP (Constant price entries), 1980-2002 averages. *Source: Heston et al. (2006).*
ELF	Ethnolinguistic Fractionalization: Probability that two randomly selected persons from a given country will not belong to the same ethnolinguistic group (1985 values). *Source: Roeder, P.G (2001).*
PROT	Protestant religion: The percentage of the population belonging to the Protestant religion in 1980. *Source: La Porta et al. (1999).*
AREA	Land area: Logarithm of area in square kilometers. *Source: WDI (2004).*
COLUK	Dummy variable = 1 if the country is United Kingdom or has been a colony of United Kingdom, 0 otherwise. *Source: Treisman, D. (2000).*
LANDLOCK	Dummy variable = 1 if the country is landlocked, 0 otherwise. *Source : GDNGD (2009)*
DLP	Dummy variable = 1 if the country experienced uninterrupted democracy from 1950 to 1995, 0 otherwise. *Source: Treisman, D. (2000).*
OIL	Dummy variable = 1 if the country is oil producer, 0 otherwise. *Source: Sala-i-Martin, Doppelhoffer and Miller (2004).*
POSTWAR	Dummy variable = 1 if the country gained independence after the Second World War, 0 otherwise. *Source: Central Intelligence Agency (2011), The World Factbook.*
ISLAND	Dummy variable = 1 if the country is an island, 0 otherwise. *Source : Rose A. (2006)*

Table 4. System estimates (2SLS, ICRG Corruption Index)

	growth	Human Capital	Investment	Government Expenditures	Inflation	Political Instability	Corruption
		HC	INV	GOV	INFL	PI	ICRG
HC	**0.000445*** **		0.0563				
	(2.90)		(1.00)				
INV	**0.00243*** **						
	(3.65)						
GOV	**-0.00108*** **		-0.0193		0.0142	0.0295	
	(-2.89)		(-0.10)		(0.35)	(1.61)	
INFL	**-0.00175**						
	(-0.60)						
PI	**-0.0104** **						0.217
	(-2.35)						(0.89)
ICRG		**-6.219** **	**-0.148**	**-3.143** **	**0.102**	**0.437*** **	
		(-2.10)	**(-0.13)**	**(-2.38)**	**(0.39)**	**(4.46)**	
IGDP	-0.00939***		-1.302*	2.111*		-0.120	
	(-3.26)		(-1.79)	(1.87)		(-1.56)	
GDP		9.944***			-0.288		-0.243***
		(3.34)			(-1.55)		(-2.76)
PSE		1.947*					
		(1.72)					
URBAN		0.275**		0.00478			
		(2.06)		(0.10)			
ELF		-8.092	-5.817***	-0.413	-0.0757	0.351	
		(-1.20)	(-3.42)	(-0.17)	(-0.13)	(1.41)	
OPEN			0.0279**		-0.0103***		
			(2.26)		(-2.76)		
POP15			-0.339	0.448**			
			(-1.61)	(2.32)			
POP65			-0.733***	0.0318			
			(-2.68)	(0.08)			
POP				-1.264***		0.172***	
				(-3.41)		(3.57)	
LANDLOCK						-0.196	
						(-1.08)	
DLP							-1.249***
							(-4.40)
PROT							-0.00927***
							(-2.66)
COLUK							0.114
							(0.72)
Intercept	0.0507	-19.35	45.44***	12.53	5.005**	-1.115	4.332***
	(1.63)	(-0.69)	(3.66)	(0.72)	(2.20)	(-0.88)	(3.54)
R^2	**0.394**	**0.824**	**0.413**	**0.382**	**0.237**	**0.613**	**0.748**

*Number of countries: 82. Numbers in parentheses are t-statistics. ***, ** and * denote coefficients significantly different from zero at the 1, 5 and 10% level, respectively.*

Table 5. System estimates (3SLS, ICRG Corruption Index)

	growth	Human Capital	Investment	Government Expenditures	Inflation	Political Instability	Corruption
		HC	INV	GOV	INFL	PI	ICRG
HC	0.000588***		0.0897*				
	(4.34)		(1.77)				
INV	0.00279***						
	(4.73)						
GOV	-0.00142***		-0.212		0.0193	0.0487***	
	(-4.08)		(-1.29)		(0.51)	(3.06)	
INFL	-0.00436*						
	(-1.74)						
PI	-0.00855**						0.238
	(-2.14)						(1.06)
ICRG		-8.582***	-1.134	-3.321***	0.211	0.545***	
		(-3.11)	(-1.16)	(-2.85)	(0.85)	(6.00)	
IGDP	-0.0121***		-1.257*	2.342**		-0.101	
	(-4.64)		(-1.89)	(2.34)		(-1.42)	
GDP		10.22***			-0.235		-0.238***
		(3.72)			(-1.32)		(-2.87)
PSE		0.755					
		(0.74)					
URBAN		0.218*		0.00853			
		(1.81)		(0.20)			
ELF		-5.841	-6.263***	0.0823	-0.142	0.235	
		(-0.96)	(-4.06)	(0.04)	(-0.25)	(1.07)	
OPEN			0.0331***		-0.00884**		
			(3.05)		(-2.58)		
POP15			-0.165	0.506***			
			(-0.90)	(3.08)			
POP65			-0.737***	0.0428			
			(-3.05)	(0.12)			
POP				-1.402***		0.195***	
				(-4.27)		(4.64)	
LANDLOCK						-0.259*	
						(-1.77)	
DLP							-1.212***
							(-4.72)
PROT							-0.00887***
							(-2.88)
COLUK							-0.0414
							(-0.30)
Intercept	0.0626**	-8.146	42.55***	10.86	4.146*	-2.156*	4.275***
	(2.22)	(-0.31)	(3.84)	(0.72)	(1.90)	(-1.89)	(3.77)
R^2	0.182	0.807	0.345	0.367	0.219	0.542	0.746

Breusch-Pagan test of independence: chi2(21) = 30.936, Pr = 0.0747, Hausman Test: (2SLS versus 3SLS) : chi2(38) = 3.57, Prob>chi2 = 1.0000

*Number of countries: 82. Numbers in parentheses are t-statistics. ***, ** and * denote coefficients significantly different from zero at the 1, 5 and 10% level, respectively.*

Table 6. Sensitivity to the measure of corruption: System estimates using the Graft Index (3SLS estimator)

	growth	Human Capital	Investment	Government Expenditures	Inflation	Political Instability	Corruption
		HC	INV	GOV	INFL	PI	Graft
HC	0.000571***		0.0743				
	(4.20)		(1.43)				
INV	0.00268***						
	(4.59)						
GOV	-0.00139***		-0.266		0.0189	0.0303**	
	(-3.97)		(-1.59)		(0.51)	(2.41)	
INFL	-0.00406						
	(-1.62)						
PI	-0.00789*						0.482***
	(-1.94)						(4.30)
ICRG		-14.00***	-2.430*	-5.767***	0.309	0.832***	
		(-3.10)	(-1.77)	(-3.48)	(0.84)	(7.95)	
IGDP	-0.0113***		-1.258*	1.524		0.0894	
	(-4.32)		(-1.78)	(1.39)		(1.30)	
GDP		7.108**			-0.173		-0.288***
		(2.00)			(-0.75)		(-7.02)
PSE		0.627					
		(0.60)					
URBAN		0.233*		0.0116			
		(1.89)		(0.27)			
ELF		-5.242	-5.777***	0.434	-0.0527	0.130	
		(-0.88)	(-3.91)	(0.21)	(-0.10)	(0.77)	
OPEN			0.0295***		-0.00941***		
			(2.96)		(-2.96)		
POP15			-0.0661	0.615***			
			(-0.33)	(3.81)			
POP65			-0.628***	0.0575			
			(-2.74)	(0.19)			
POP				-1.161***		0.117***	
				(-3.45)		(3.52)	
LANDLOCK						-0.127	
						(-1.07)	
DLP							-0.542***
							(-4.28)
PROT							-0.00334**
							(-2.19)
COLUK							-0.140**
							(-2.02)
Intercept	0.0573**	25.33	42.89***	13.65	3.510	-2.540***	3.555***
	(2.01)	(0.71)	(3.78)	(0.98)	(1.25)	(-2.60)	(6.29)
R^2	0.235	0.826	0.276	0.437	0.272	0.764	0.912

Breusch-Pagan test of independence: chi2(21) = 39.587, Pr = 0.0083, Hausman Test: (2SLS versus 3SLS) : chi2(38) = 23.80, Prob>chi2 = 0.9651

*Number of countries: 82. Numbers in parentheses are t-statistics. ***, ** and * denote coefficients significantly different from zero at the 1, 5 and 10% level, respectively.*

Table 7. Sensitivity to the estimation method: SUR estimates (ICRG Corruption Index)

	growth	Human Capital	Investment	Government Expenditures	Inflation	Political Instability	Corruption
	g	**HC**	**INV**	**GOV**	**INFL**	**PI**	**ICRG**
HC	**0.000489***** **(5.82)**		0.0360 (1.34)				
INV	**0.00147***** **(4.52)**						
GOV	**-0.000913***** **(-3.99)**		-0.0270 (-0.34)		0.0197 (0.76)	0.0154 (1.44)	
INFL	**-0.00140** **(-1.38)**						
PI	**-0.00743***** **(-3.52)**						0.619*** (5.23)
ICRG		**-3.451*** **(-1.94)**	**-0.193** **(-0.41)**	**-1.631**** **(-2.44)**	**0.0969** **(0.61)**	**0.447***** **(7.31)**	
IGDP	-0.00883*** (-4.81)		-1.235** (-2.16)	3.294*** (3.64)		-0.100* (-1.75)	
GDP		13.50*** (6.04)			-0.303** (-2.13)		-0.141** (-2.09)
PSE		1.597 (1.63)					
URBAN		0.151 (1.29)		0.00139 (0.03)			
ELF		-6.880 (-1.13)	-6.256*** (-4.28)	0.841 (0.39)	-0.169 (-0.30)	0.292 (1.35)	
OPEN			0.0303*** (3.48)		-0.00933*** (-3.01)		
POP15			-0.393*** (-2.89)	0.598*** (3.55)			
POP65			-0.754*** (-3.46)	0.357 (1.14)			
POP				-1.430*** (-4.40)		0.142*** (3.86)	
LANDLOCK						-0.230 (-1.54)	
DLP							-1.050*** (-4.38)
PROT							-0.00733** (-2.37)
COLUK							0.0751 (0.52)
Intercept	0.0529*** (3.31)	-46.72** (-2.47)	48.51*** (5.28)	-5.667 (-0.42)	5.018*** (3.17)	-0.543 (-0.61)	2.476*** (3.45)
R^2	**0.491**	**0.829**	**0.414**	**0.426**	**0.236**	**0.621**	**0.734**

Breusch-Pagan test of independence: chi2(21) = 30.936, Pr = 0.0747

*Number of countries: 82. Numbers in parentheses are t-statistics. ***, ** and * denote coefficients significantly different from zero at the 1, 5 and 10% level, respectively.*

Table 8. Unconditional effect of corruption on economic growth (3SLS estimates, ICRG Corruption Index)

	growth	Human Capital	Investment	Government Expenditures	Inflation	Political Instability	Corruption
		HC	INV	GOV	INFL	PI	ICRG
ICRG	**-0.00863***** **(-3.31)**	-8.079*** (-2.92)	0.258 (0.26)	-4.246*** (-3.58)	0.146 (0.59)	0.505*** (5.53)	
IGDP	-0.00242 (-1.24)		-0.784 (-1.20)	1.750* (1.74)		-0.115 (-1.61)	
GDP		9.599*** (3.54)			-0.264 (-1.48)		-0.237*** (-2.88)
PSE		1.348 (1.35)					
URBAN		0.249** (2.10)		0.0332 (0.79)			
ELF		-2.411 (-0.39)	-4.844*** (-3.16)	-0.378 (-0.17)	-0.288 (-0.51)	0.123 (0.56)	
GOV			0.0183 (0.11)		0.00912 (0.24)	0.0421*** (2.67)	
HC			0.0337 (0.67)				
OPEN			0.0260** (2.40)		-0.00873** (-2.55)		
POP15			-0.338* (-1.82)	0.552*** (3.31)			
POP65			-0.648*** (-2.68)	-0.0120 (-0.03)			
POP				-1.263*** (-3.81)		0.194*** (4.63)	
LANDLOCK						-0.210 (-1.41)	
PI							0.358 (1.62)
DLP							-1.117*** (-4.41)
PROT							-0.00681** (-2.24)
COLUK							-0.0336 (-0.24)
Intercept	0.0500** (2.35)	-10.34 (-0.40)	40.25*** (3.63)	13.25 (0.87)	4.772** (2.19)	-1.773 (-1.56)	3.921*** (3.49)
R^2	**0.085**	**0.811**	**0.399**	**0.294**	**0.228**	**0.569**	**0.746**

*Number of countries: 82. Numbers in parentheses are t-statistics. ***, ** and * denote coefficients significantly different from zero at the 1, 5 and 10% level, respectively.*

Table 9. Unconditional effect of corruption on economic growth (SUR estimates, ICRG Corruption Index)

	growth	Human Capital	Investment	Government Expenditures	Inflation	Political Instability	Corruption
	g	HC	INV	GOV	INFL	PI	ICRG
ICRG	**-0.00598***** **(-3.20)**	-3.791** (-2.11)	-0.107 (-0.23)	-1.718** (-2.56)	0.0847 (0.53)	0.442*** (7.23)	
IGDP	-0.000740 (-0.46)		-0.860 (-1.54)	3.050*** (3.36)		-0.108* (-1.88)	
GDP		12.50*** (5.64)			-0.314** (-2.21)		-0.152** (-2.25)
PSE		1.978** (2.06)					
URBAN		0.205* (1.78)		0.00836 (0.19)			
ELF		-1.498 (-0.25)	-4.971*** (-3.51)	0.722 (0.34)	-0.333 (-0.59)	0.125 (0.59)	
GOV			-0.0118 (-0.16)		0.0148 (0.57)	0.0127 (1.22)	
HC			0.0366 (1.41)				
OPEN			0.0275*** (3.27)		-0.00895*** (-2.90)		
POP15			-0.320** (-2.45)	0.586*** (3.46)			
POP65			-0.680*** (-3.24)	0.356 (1.13)			
POP				-1.395*** (-4.28)		0.144*** (3.97)	
LANDLOCK						-0.216 (-1.47)	
PI							0.608*** (5.16)
DLP							-1.074*** (-4.49)
PROT							-0.00659** (-2.13)
COLUK							0.0752 (0.52)
Intercept	0.0299* (1.82)	-45.07** (-2.38)	41.67*** (4.68)	-3.998 (-0.29)	5.271*** (3.33)	-0.386 (-0.44)	2.584*** (3.61)
R^2	**0.129**	**0.829**	**0.410**	**0.427**	**0.235**	**0.617**	**0.735**

*Number of countries: 82. Numbers in parentheses are t-statistics. ***, ** and * denote coefficients significantly different from zero at the 1, 5 and 10% level, respectively.*

Table 10. Sensitivity to the inclusion of an additional channel, Trade Openness (3SLS estimates, ICRG Corruption Index)

	growth	Human Capital	Investment	Government Expenditures	Inflation	Political Instability	Openness	Corruption
		HC	INV	GOV	INFL	PI	OPEN	ICRG
HC	**0.000554***** **(4.24)**		0.0311 (0.64)					
INV	**0.00353***** **(6.49)**							
GOV	**-0.000673*** **(-1.74)**		0.105 (0.72)		0.0269 (0.73)	0.0451*** (3.22)	1.398 (0.95)	
INFL	**-0.00602***** **(-3.24)**							
PI	**-0.0100**** **(-2.53)**							0.392* (1.90)
OPEN	**-0.000130**** **(-2.32)**		0.0198 (1.29)		-0.0117*** (-2.64)			
ICRG		**-10.98***** **(-3.94)**	**0.370** **(0.46)**	**-2.792**** **(-2.43)**	**0.109** **(0.47)**	**0.552***** **(6.33)**	**-5.455** **(-0.72)**	
IGDP	-0.0140*** (-5.25)		-1.129* (-1.66)	2.809*** (2.82)		-0.0917 (-1.31)	-4.864 (-0.91)	
GDP		7.553*** (2.78)			-0.330* (-1.89)			-0.213*** (-2.67)
PSE		0.133 (0.13)						
URBAN		0.320*** (2.71)		-0.00496 (-0.12)				
ELF		-7.944 (-1.32)	-5.941*** (-3.99)	0.0452 (0.02)	-0.379 (-0.67)	0.196 (0.95)		
POP15			-0.363* (-1.87)	0.545*** (3.28)				
POP65			-0.616** (-2.31)	0.141 (0.40)				
POP				-1.325*** (-4.07)		0.185*** (4.59)	-9.838** (-2.37)	
LANDLOCK						-0.224 (-1.57)	0.206 (0.02)	
AREA							-8.691*** (-3.27)	
ISLAND							-9.764 (-0.78)	
POSTWAR							9.038 (0.77)	
OIL							21.61 (1.59)	

	growth	Human Capital	Investment	Government Expenditures	Inflation	Political Instability	Openness	Corruption
DLP								-1.097***
								(-4.49)
PROT								-0.00730**
								(-2.48)
COLUK								-0.0515
								(-0.39)
Intercept	0.0692**	17.10	43.03***	3.423	5.354***	-2.019*	359.8***	3.657***
	(2.47)	(0.65)	(3.32)	(0.23)	(2.60)	(-1.88)	(4.32)	(3.43)
R^2	**0.085**	**0.786**	**0.390**	**0.396**	**0.231**	**0.547**	**0.485**	**0.745**

Breusch-Pagan test of independence: chi2(21) = 41.012, Pr = 0.0536, Hausman Test : (2SLS versus 3SLS) : chi2(46) = 22.99, Prob>chi2 = 0.9982

*Number of countries: 82. Numbers in parentheses are t-statistics. ***, ** and * denote coefficients significantly different from zero at the 1, 5 and 10% level, respectively.*