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Corruption and Economic Growth[1]

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This study introduces a new perspective on the role of corruption in economic growth and provides quantitative estimates of the impact of corruption on the growth and importance of the transmission channels. In our ordinary least squares estimations, we find that a 1% increase in the corruption level reduces the growth rate by about 0.72% or, expressed differently, a one-unit increase in the corruption index reduces the growth rate by 0.545 percentage points. The most important channel through which corruption affects economic growth is political instability, which accounts for about 53% of the total effect. We also find that corruption reduces the level of human capital and the share of private investment. *J. Comp. Econ.*, March 2001, **29**(1), pp. 66–79. School of Business, Hong Kong Baptist University, Kowloon Tong, Hong Kong. © 2001 Academic Press

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1. INTRODUCTION

Theoretically, the literature reaches no agreement about the effect of corruption on economic growth. Some researchers suggest that corruption might be desirable (Leff, 1964; Huntington, 1968; Acemoglu and Verdier, 1998). Corruption works like piece-rate pay for bureaucrats, which induces a more efficient provision of government services, and it provides a leeway for entrepreneurs to bypass inefficient regulations. From this perspective, corruption acts as a lubricant that smoothes operations and, hence, raises the efficiency of an economy.

On the other hand, corruption tends to hurt innovative activities because innovators need government-supplied goods, such as permits and import quotas, more than established producers do. Demand for these goods is high and inelastic; hence, they become primary targets of corruption. Moreover, innovators have no established lobbies and connections so that they are subject to particularly heavy bribes and expropriations. Furthermore, unlike established producers, innovators are

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often credit-constrained and cannot find the cash to pay bribes (Murphy et al., 1993). This will reduce private investment and, hence, the stock of producible inputs in the long run. People's talent and effort will be allocated to rent-seeking activities instead of productive investments, e.g., accumulating capital, knowledge, and skills. Moreover, corruption favors a particular class of people and creates inequality in opportunities. In addition to the shrinking of opportunities due to productivity retardation, inequality in opportunities, which is similar to income and wealth inequality, will lead to frustration and sociopolitical instability. Recent studies suggest that the existing corruption levels are unfavorable to development, e.g., Gould and Amaro-Reyes (1983), United Nations (1990), and Mauro (1995). However, the actual effect of corruption on economic growth and its transmission process can be settled only empirically.

Mauro (1995) engaged in an empirical analysis of corruption by investigating the relationship between investment and corruption for 58 countries. His corruption variable is defined as the degree to which business transactions involve corruption and questionable payment. The average ratio of total and private investment to GDP for the period between 1970 and 1985 is drawn from Barro (1991), while the corruption indicator is the simple average for the country in question for the period from 1980 to 1983 from Business International (1984). Mauro finds that corruption has a significant negative effect on the ratio of investment to GDP. These results are consistent with the view that corruption is deleterious for economic growth. However, the exact channels through which corruption affects economic growth are not resolved empirically. Based on the ideas of previous researchers and employing data similar to Mauro (1995), we develop a new analytical framework to estimate the effects of corruption and the channels through which it affects the rate of GDP growth. The channels under consideration include investment, human capital, and political instability.

The following section introduces the analytical framework and the transmission. Section 3 introduces the data and presents the initial empirical estimations. In Section 4, we estimate the role of the share of investment, human capital, and political instability in the corruption–growth linkage. For comparison purposes, we investigate each channel independently and then study the impacts of the channels when all transmission variables are included in the regressions. The last section contains concluding remarks.

2. ANALYTICAL FRAMEWORK

In our framework for investigating the growth mechanism, the input–output relationship is characterized by a general production function, $Y = Tf(K, L)$, where Y is the total output level, T is total factor productivity, and K and L are the capital stock and labor, respectively. Total differentiation of Y gives

$$dY = f dT + T(f_K dK + f_L dL). \tag{1}$$

Dividing (1) by Y yields a decomposition similar to that of Solow (1957)[2]:

$$\frac{dY}{Y} = \frac{dT}{T} + T f_K \frac{dK}{Y} + \frac{f_L L}{f}\frac{dL}{L}. \tag{2}$$

However, Eq. (2) can be interpreted according to Schumpeter's theory of economic development (Schumpeter, 1912, 1939),[3] in which two classes of influence on the evolution of an economy are distinguished. One is the effect of changes in factor availability, the growth component, which is related to the growth rates of capital and labor in the production function. The other is the effect of social and technological changes, the development component, which is related to the forces driving total factor productivity growth in the production function (Schumpeter, 1912). We characterize these components as

$$\mathrm{GR} = F[\gamma, \mathrm{IY}, \mathrm{dLL}], \tag{3}$$

where GR and γ are the growth rates of real GDP and total factor productivity, IY is the investment output ratio, and dLL is the growth rate of labor. In this expression, F_γ equals 1, F_{IY} is the marginal production of capital, and F_{dLL} is the elasticity of output to labor.

Levine and Renelt (1992) identify four variables that are robust in determining growth; these are the share of investment in GDP, the rate of population growth, the initial level of real GDP per capita, and a proxy for human capital. The first two variables belong to the growth component and the last two belong to the development component. Based on this work and the discussions in the Introduction, the rate of productivity growth is determined by

$$\gamma = \gamma(\mathrm{CORRUPT},\ y0,\ \mathrm{HUMAN}), \tag{4}$$

where CORRUPT is an index for the level of corruption, $y0$ is the initial GDP per capita, and HUMAN is an index for human capital stock. The expected sign of the initial per capita output is negative because of the convergence tendency due to the knowledge gap between countries in the literature of endogenous growth. The larger the knowledge gap, the easier it is for a country to raise its productivity by learning, imitating, and adapting technology from the leading economies (Barro and Sala-I-Martin, 1995). The initial per capita output is commonly used to capture this effect. According to Benhabib and Spiegel (1994), the human capital stock has a positive effect on the growth rate of total factor productivity because

[2] However, we use the equation to investigate the divergence of cross-country growth performance rather than for a traditional growth accounting study.

[3] The interpretation of Schumpeter's theory is based on the discussion in Adelman (1961, chap. 6) of Schumpeter's theory of economic growth and development.

an educated labor force is better at learning, creating, and implementing new technologies, which generates a higher rate of productivity growth. As discussed in the Introduction, we do not have any a priori expectation about the sign on the coefficient of corruption.

3. DATA, DESCRIPTIVE STATISTICS, AND INITIAL ESTIMATIONS

Except for the corruption index, all data are obtained from the panel data set assembled by Robert Barro and Jong-Wha Lee.[4] The data begin in 1960, go through 1985, and are divided into five 5-year subperiods. In the periods before 1970, some essential variables have a large number of missing observations. Hence, meaningful estimations can start only from 1970. Recent financial crises in the world reveal that the short-term GDP growth rate of a country may fluctuate wildly according to its country-specific conditions. To study the determinants of the growth rates of total factor productivity and the capital stock, we need a relatively long observation period. Hence, the period from 1970 to 1985 is chosen for this study. As similar data sets have been used for empirical studies, our results can be easily reproduced and compared with other studies employing a similar framework.

The measure of the corruption level is obtained from the Transparency International Corruption Perception Index for the period 1980 to 1985. Transparency International and the University Goettingen trace the evolution of a country's integrity performance and form a comparative assessment on the change of corruption perception starting from 1980. The index ranges from 0 to 10, with 10 indicating a highly clean country and 0 indicating a highly corrupt country. The index is a poll of polls, as it has been prepared from various sources. For example, the countries included in the 1996 index have at least four sources in order to present a balanced view and avoid malperformance of any single survey. Based on this stringent selection criterion, there are 54 countries available in the 1996 ranking. The corruption index used in this study is obtained from their Historical Comparisons table. The table presents two figures for each historical period. The first is the average score and the second is the number of surveys available. The data from the original sources have been normalized so as to be comparable with the much more reliable data of 1996.

The normalized data are based on two sources, the surveys conducted by Business International and Political Risk Service. In general, fewer sources have been available in the past, so that the historical data are usually not as reliable as the more recent data. Moreover, as institutions tend to evolve slowly, these selected normalized 54 observations will be more reliable, precise, and comparable than any single source. Therefore, we choose this data set as a proxy

[4] The data set is obtained from the NBER web page.

for the corruption level in the period.[5] Among the 54 countries, 2 of them are not in the Barro–Lee data set and the growth rates of GDP for China, Hungary, and Poland are missing in that data set. Therefore, we have a maximum of 49 observations. Additionally, most of the key regressions in the two data sets have only 46 common observations. Therefore, we use a maximum of 46 observations in our regressions to avoid the possible problem of different sample sizes in this relatively small sample. Our estimations use the ordinary least squares method (OLS) and the White Heteroskedasticity-adjusted *t* statistics are reported.[6]

All variables in the following empirical study match closely with those in the analytical framework except for the growth rate of labor. The growth rate of the population is used as a proxy for the growth rate of labor. Although the two variables may not have identical effects on the growth of GDP, population growth is commonly used as proxy for labor growth in other studies because the quality of the data on population is usually better. Furthermore, the estimated coefficient of the population growth rate can reveal its effect on the change of per capita GDP. The average schooling years in the total population over age 25 is used as the proxy for the level of the human capital stock. The measure of political instability is the average of the number of assassinations per million population per year and the number of revolutions per year over the period. The annual growth rate of a variable is approximated by fitting the compound interest rate formula.[7] Corruption is most prevalent where other forms of institutional inefficiency exist;

[5] The data set is available on their web page: www.gwdg.de/~uwvw/. The correlation coefficient between the corruption index used in this study and that used in Mauro (1995) equals 0.95.

[6] For comparison, the two-stages least squares estimations are reported in Appendix II. Corruption is commonly considered an institutional problem that lasts for a long period. Therefore, in our cross-sectional studies, economic growth and the share of investment are less likely to have direct effects on the corruption level. However, some transmission variables, in particular political instability, may have simultaneity problems with the corruption index. These two variables tend to reinforce each other. Hence, we use the two-stages least squares method (2SLS) to observe the robustness of our ordinary least squares (OLS) results. The instruments used include the following regional dummy variables in the Barro–Lee data set: ASIAE = dummy for East Asian countries; LAAM = dummy for Latin-American countries; OECD = dummy for OECD countries; SAFRI = dummy for Sub-Saharan African countries. The variable ethnolinguistic fractionalization in Mauro (1995) is also used. The corruption index is regressed on the instruments and the other right-hand-side variables. The predicted value of corruption is then used as the instrumental variable in the estimations. In the process, the number of observations is reduced to about 43. The 2SLS results reveal that there is no serious simultaneity problem in the OLS estimations. Our major OLS results and conclusions remain intact in the 2SLS estimations. However, the results of the 2SLS estimation method are generally less stable and statistically less significant than the OLS results. The results suffer from an obvious multicollinearity problem when the transmission variables are included in the regressions, as exemplified by the estimation AP2 in Table 8. This may be due to the quality of the instrumental variable, as most of the instruments are dummy variables. For these reasons, we use the results of the OLS estimations in our analysis.

[7] For example, the annual growth rate in GDP is estimated by finding r in the formula $\mathrm{GDP70}^*(1 + r)^{15} = \mathrm{GDP85}$, where GDP70(85) is the real gross domestic product in 1970 (1985).

TABLE 1
Correlation Coefficients and Descriptive Statistics

	GR	CORRUPT	IY	$y70$	PRIGHT	HUMAN	INSTAB	POPG
GR	1							
CORRUPT	−0.18	1						
IY	0.21	0.51	1					
$y70$	−0.54	0.79	0.35	1				
PRIGHT	0.45	−0.62	−0.40	−0.80	1			
HUMAN	−0.34	0.77	0.40	0.85	−0.69	1		
INSTAB	−0.12	−0.56	−0.37	−0.46	0.48	−0.34	1	
POPG	0.31	−0.72	−0.45	−0.73	0.72	−0.70	0.32	1
Mean	4.21	5.54	0.17	3909	2.79	5.80	0.26	1.64
(SD)	(2.31)	(2.69)	(0.05)	(2682)	(1.69)	(2.74)	(0.37)	(1.04)

Note. GR, growth rate of real GDP in percentage; CORRUPT, the corruption index; IY, ratio of private investment to GDP; $y70$, the initial per capita income; PRIGHT, the Gastil index of political rights; HUMAN, average schooling years in the total population over age 25 in 1970 to 1985. INSTAB, measure of political instability; POPG, rate of population growth.

therefore, we include the Gastil political rights index in all regressions to capture other institutional characteristics of countries.[8]

The correlation coefficients and descriptive statistics for the major variables are summarized in Table 1. The variables are defined in the note to the table and the original acronyms and sources of data are summarized in Appendix I.

The OLS regressions reported in Table 2 reveal the sensivity of the estimated effect of corruption on the growth rate. B1 indicates that corruption has a significant negative effect on the growth rate when all the plausible transmission channels are not included in the regression. B2 introduces the share of investment, one of the possible channels, into the model. As expected, the magnitude and the significance level of the corruption coefficient decrease. However, the coefficient is still significant at the conventional confidence interval. B3 to B6 include other plausible transmission variables into the model, which introduce significant multicollinearity problems. The magnitude and the level of significance of the corruption coefficient decrease substantially. This suggests that human capital and political instability are important channels through which corruption reduces economic growth. In B6, when all plausible channels are included in the regression, the magnitude and the significance level of the coefficient are the lowest. This pattern of regression coefficients provides only indirect support concerning the role of the transmission

[8] The inclusion of the political rights index has no substantial effect on our empirical results. In the literature about democracy, the merits and demerits of higher political rights are well-documented but there is no conclusion about their effect on economic growth empirically. Therefore, we introduce the political rights variable in a quadratic way in our regressions. The empirical results in regressions B4, B5, and B6 support this treatment.

TABLE 2
The Effect of Corruption on the Growth Rate

Estimations:	B1	B2	B3	B4	B5	B6
	Dependent variables					
Independent variables	GR	GR	GR	GR	GR	GR
CORRUPT	0.54542	0.391395	0.361571	0.16416	0.145855	0.06459
	(2.47)**	(1.70)*	(1.49)	(0.80)	(0.71)	(0.33)
$y70$	−7.16N4	−6.44N4	−7.45N4	−5.47N4	−7.93N4	−7.45N4
	(2.96)***	(2.42)**	(2.69)**	(2.26)**	(3.96)***	(3.05)***
PRIGHT	1.945	1.467	1.421	2.247	2.714	2.275
	(1.46)	(1.13)	(1.07)	(2.26)**	(2.60)**	(2.28)**
$(\text{PRIGHT})^2$	−0.271	−0.185	−0.179	−0.269	−0.332	−0.260
	(1.57)	(1.08)	(1.03)	(2.03)**	(2.37)**	(2.02)*
HUMAN	—	—	0.150	—	0.3423	0.3168
			(0.89)		(2.15)**	(1.99)**
INSTAB	—	—	—	−2.5611	−3.2186	−2.9736
				(3.70)***	(4.14)***	(4.24)***
IY	—	13.553	13.21	11.287	—	10.197
		(2.15)**	(2.0)*	(2.08)**		(1.81)*
POPG	−0.087	0.045	0.079	−0.351	−0.477	−0.342
	(0.21)	(0.10)	(0.19)	(0.75)	(1.35)	(0.86)
Constant	1.571	0.022	−0.222	1.226	2.067	0.907
	(0.55)	(0.01)	(0.09)	(0.54)	(0.90)	(0.41)
R^2	0.51	0.56	0.57	0.66	0.67	0.69
No. of obs.	46	45	45	45	46	45

Note. White heteroskedasticity-adjusted t statistics are reported. Absolute values of the t statistics are in parentheses. The superscrites $*$, $**$, and $***$ following the t statistics represent a 10, 5, and less than 1% significant level, respectively.

variables. In the next section, we will estimate the impact of each channel in the transmission process.

4. THE TRANSMISSION CHANNELS

4.1. The Investment Channel

A recent study finds that corruption is strongly negatively associated with the share of private investment and, hence, it lowers the rate of economic growth (Mauro, 1995). If the rate of GDP growth depends on the share of investment, which in turn depends on the level of corruption, the effect of corruption on the growth rate can be decomposed as:

$$\frac{d\text{GR}}{d\text{CORRUPT}} = \frac{\partial\text{GR}}{\partial\text{CORRUPT}} + \left(\frac{\partial\text{GR}}{\partial\text{IY}}\frac{\partial\text{IY}}{\partial\text{CORRUPT}}\right). \tag{5}$$

Similar relationships apply to the other plausible transmission channels. For

TABLE 3
The Investment Channel

Direct effect	Investment channel (a)	Total effect (b)	$(a)/(b)$
0.391395	$13.553*0.01143 = 0.155$	0.54542 [$0.391395 + (a) = 0.5463$]	0.284

Note. The summation inside the brackets [...] is the calculated total effect based on Eqs. (6) and B2, while the estimated total effect is drawn from the result in B1.

comparison purposes, we estimate the role of each channel individually and then analyze their effects when all are included in the regression. We begin with the share of investment:

$$\begin{aligned} \text{IY} = {} & 0.01143\ \text{CORRUPT} - 5.52\text{N}6\ y70 + 0.035\ \text{PRIGHT} \\ & \quad (2.20)^{**} \qquad\qquad (0.88) \qquad\qquad (1.17) \\ & - 0.0064\ (\text{PRIGHT})^2 - 0.968\ \text{POP} + 0.115. \\ & \quad (1.68) \qquad\qquad (0.82) \qquad (1.85)^{*} \\ R^2 = {} & 0.37,\ \text{no. of obs.} = 45. \end{aligned} \tag{6}$$

Equation (6) indicates that corruption has a negative effect on the share of investment. The direct effect of corruption on the growth rate is indicated in the coefficient of corruption in estimation B2, while that in B1 incorporates the direct effect plus its effect through the share of investment. Therefore, the magnitude of the coefficient in B1 is expected to be larger than that in B2. Moreover, based on Eq. (6) and regressions B1 and B2, we can quantify the role of the share of investment using Eq. (5). The result, reported in the second row of Table 3, indicates that about 28% of the growth rate reduction in the corruption–growth linkage is due to the investment channel.

4.2. The Human Capital Channel

Obviously, corruption reduces the returns of productive activities. If the returns to production fall faster than the returns to corruption and rent-seeking activities, resources will flow from productive activities to corruption activities over time (Murphy et al., 1993). This will result in a lower stock of producible inputs like human capital in corrupted countries. We estimate the effect of corruption on human capital:

$$\begin{aligned} \text{HUMAN} = {} & 0.25408\ \text{CORRUPT} + 5.81\text{N}4\ y70 + 0.250\ \text{PRIGHT} \\ & \quad (1.79)^{*} \qquad\qquad (3.31)^{***} \qquad\qquad (0.31) \\ & - 0.042\ (\text{PRIGHT})^2 - 0.214\ \text{POP} + 2.180. \\ & \quad (0.04) \qquad\qquad (0.526) \qquad (1.39) \\ R^2 = {} & 0.75,\ \text{no. of obs.} = 46. \end{aligned} \tag{7}$$

TABLE 4
The Human Capital Channel

Direct effect	Human capital channel (a)	Total effect (b)	(a)/(b)
0.361571	$0.150*0.25408 = 0.038112$	0.391395 [$0.361571 + (a) = 0.3997$]	0.097

Note. The summation inside the brackets [...] is the calculated total effect based on estimations B3 and (7), while the estimated total effect drawn from the result in B1.

Equation (7) indicates that corruption has a negative effect on the level of human capital.[9] The direct effect of corruption on the rate of productivity growth is indicated in the coefficient of corruption in estimation B3, while that in B2 incorporates the direct effect plus its effect through the human capital channel. The magnitude of the coefficient in B2 is therefore expected to be larger than that in B3. Moreover, based on the estimates in (7), B2 and B3, we can separate the impact of human capital on the rate of productivity growth according to a decomposition similar to that in Eq. (5). The result, reported in the second row of Table 4, indicates that about 9.7% of the rate of productivity reduction is due to the human capital channel.[10]

4.3. *The Political Stability Channel*

Recent empirical investigations have found a positive relationship between income inequality and sociopolitical instability. Higher income inequality results in stronger incentives for the groups at the bottom of the distribution to engage in illegal or violent actions for material benefits or as a reaction to inequality. This instability creates uncertainty over the protection of property rights and, hence, reduces investment and productivity. Consequently, income inequality has a negative effect on economic growth (Perotti, 1994; Alesina and Perotti, 1996; Mo, 2000).

As noted by many researchers, corruption creates the opportunity for increased inequality, reduces the return of productive activities, and, hence, makes rent-seeking and corruption activities more attractive. This opportunity for increased inequality not only generates psychological frustration to the underprivileged but also reduces productivity growth, investment, and job opportunities (Murphy et al., 1993). These factors combine to create sociopolitical instability. We estimate the

[9] A 2SLS estimation method generates similar results, as can be seen in the tables in Appendix II.

[10] We use the estimate of the effect of human capital on the growth rate in regression B3 for the calculation in Table 4, although the coefficient is statistically insignificant. Statistical insignificance may be due to the absence of a functional relationship between the variables or to multicollinearity among the independent variables or because the relationship is relatively small. Since the estimated result is consistent with the calculated results shown in Table 4, we adopt the last interpretation.

TABLE 5
The Political Instability Channel

Direct effect	Stability channel (a)	Total effect (b)	$(a)/(b)$
0.16416	$(-2.5611)*(-0.097116) = 0.2487$	0.391395 [$0.16416 + (a) = 0.4129$]	0.636

Note. The summation inside the brackets [...] is the calculated total effect.

impact of political instability in the corruption–growth process[11]:

$$\begin{aligned}\text{INSTAB} = {} & -0.097116\ \text{CORRUPT} + 3.80\text{N5}\,y70 + 0.266\ \text{PRIGHT} \\ & \qquad (2.22)^{**} \qquad\qquad (0.90) \qquad\qquad (1.19) \\ & -0.023\ (\text{PRIGHT})^2 - 0.144\ \text{POP} + 0.386. \\ & \qquad (0.79) \qquad\qquad (2.32)^{**} \qquad (0.99) \\ R^2 = {} & 0.42,\ \text{no. of obs.} = 46. \end{aligned} \tag{8}$$

Estimation (8) indicates that corruption has a significant positive effect on political instability. Based on the estimates in (8), B2 and B4, we calculate the contribution of political instability to the productivity growth rate in the corruption–growth linkage. According to the calculations reported in Table 5, political instability accounts for about 64% of the effect of corruption on the rate of productivity growth.

4.4. A Decomposition of the Transmission Channels

If the human capital level, political instability, and the share of investment are not independent, analyzing their contributions in the above manner will give biased results. The appropriate way would then be to analyze all plausible channels simultaneously. Based on the estimations B6, (6), (7), and (8), the role of the stock of human capital, political instability, and the investment ratio can be calculated from the following decomposition of the total effect:

$$\frac{d\text{GR}}{d\text{CORRUPT}} = \frac{\partial \text{GR}}{\partial \text{CORRUPT}} + \sum_{\text{TV}} \left(\frac{\partial \text{GR}}{\partial \text{TV}} \frac{\partial \text{TV}}{\partial \text{CORRUPT}} \right), \tag{9}$$

where TV equals HUMAN, INSTAB, and IY (Table 6).

According to regression B1, the overall effect of the corruption coefficient on the growth rate equals 0.545, or 0.72 in elasticity terms. This overall effect can be decomposed into the direct impact and the human capital, political stability, and

[11] A 2SLS estimation method generates similar conclusions, as can be seen in regression AP4 in Table 8 of Appendix II.

TABLE 6
Decomposition of the Transmission Channels

Model	Direct impact (a)	Human capital channel (b)	Stability channel (c)	Investment channel (d)	Overall effect
B6	0.06459 {0.118}	$0.3168 * 0.2541 = 0.081$ {0.148}	$-2.9736 * (-0.09712) = 0.28878$ {0.530}	$10.197 * 0.0114 = 0.1166$ {0.214}	0.54542 [0.5505]

Note. The number inside the brackets [...] is the calculated total effect that is equal to the summation of (a), (b), (c), and (d), while that inside the braces {...} is the ratio of the respective channel to the overall effect.

investment channels, which account for 11.8, 14.8, 53, and 21.4%, respectively, of the overall effect of corruption on the growth rate.[12] Although the political instability channel is seldom discussed in the corruption–growth literature, our empirical work indicates that it is the most important channel.

5. CONCLUDING REMARKS

Given the complexity of the growth process, our framework is necessarily incomplete. However, our new perspective generates the estimations of the impact of corruption on growth and the relative importance of the channels of transmission. We find that a 1% increase in the corruption level reduces the growth rate by about 0.72% or, expressed differently, a one-unit increase in the corruption index reduces the growth rate by 0.545 percentage points. The most important channel through which corruption affects economic growth is political instability, which accounts for about 53% of the overall effect.[13] The other channels include the level of human capital and the share of private investment.

However, our results are more general. Corruption is most prevalent where other forms of institutional inefficiency, such as bureaucratic red tape and weak legislative and judicial systems, are present. Although these problems may be alleviated by including variables like the Gastil political rights index and initial per capita income to capture the institutional characteristics of countries, we find it more compelling to interpret the corruption index as a set of institutional problems associated with corruption. As corruption, government regulations, bureaucratic red tape, and even the strength of legislative and judicial systems tend to reinforce

[12] Although the 2SLS estimations generate qualitatively similar results, the total effect of corruption and the effects of the transmission channels are larger in absolute terms. These results are summarized in Table 9 of Appendix II.

[13] In our sample, the maximum corruption index equals 8.41 and the minimum one equals 0.2. Countries having such different levels of corruption may have long-term growth rate differences of about 4.5 percentage points. In the 2SLS estimations, a 1% increase in the corruption level reduces the growth rate by 1.3% or, expressed differently, a one-unit increase in the corruption index reduces the growth rate by 0.989 percentage points. The political instability channel accounts for about 57% of the overall effect.

each other, multicollinearity prevents us from disentangling their individual effects empirically. However, they may be just the manifestation of a single phenomenon so that their separation is impossible.

APPENDIX I

TABLE 7
Data Source

Variables involved	Original source
Real GDP per capita	Summers and Heston (1988), GDPSH4
Total population	Same, POP
Corruption index	University Goettingen and Transparency, 1999
Index of political rights (from 1 to 7; 1 = most freedom)	GASTIL (various years)
Average schooling years in the total population over age 25 in 1970, 1985 (proxy for human capital stock)	Barro and Lee, HUMAM
Measure of political instability	Same, PINSTAB
Ratio of nominal domestic investment to nominal GDP	World Bank, INVWB
Ratio of nominal public domestic investment to nominal GDP	Same, INVPUB

APPENDIX II

TABLE 8
The Two-Stages Least Squares Estimations

Estimations:	AP1	AP2	AP3	AP4	AP5	AP6[a]
	Dependent variables					
Independent variables	GR	GR	IY	INSTAB	HUMAN	GR
CORRUPT	0.989	0.0237	0.030	−0.1775	0.281	0.000569
	(1.83)*	(0.04)	(2.45)**	(1.79)*	(0.82)	(0.002)
$y70$	−1.009N3	−3.97N4	−1.86N5	8.78N5	5.34N4	−7.14N4
	(2.35)**	(0.88)	(1.70)*	(1.16)	(2.00)*	(2.75)***
PRIGHT	1.60	1.597	0.016	0.339	0.336	2.39
	(1.20)	(1.22)	(0.54)	(1.28)	(0.42)	(2.07)**
PRIGHT^2	−0.239	−0.181	−0.005	−0.030	−0.053	−0.27
	(1.41)	(1.03)	(1.16)	(0.87)	(0.51)	(1.70)*
HUMAN	—	—	—	—	—	0.33
						(1.96)
INSTAB	—	—	—	—	—	−3.17
						(2.99)***
IY	—	19.42	—	—	—	11.42
		(2.23)**				(1.84)*

TABLE 8—*Contiued*

Estimations:	AP1	AP2	AP3	AP4	AP5	AP6[a]
			Dependent variables			
Independent variables	GR	GR	IY	INSTAB	HUMAN	GR
POPG	0.317	−0.238	0.944	−0.228	−0.261	−0.43
	(0.44)	(0.37)	(0.47)	(2.00)*	(0.53)	(0.95)
Constant	0.187	0.087	0.067	0.650	2.15	0.774
	(0.05)	(0.03)	(0.96)	(1.27)	(1.07)	(0.30)
R^2	0.42	0.50	0.02	0.34	0.72	0.67
Prob(*F* stat)	0.0005	0.0002	0.024	0.006	0.00	0.00
No. of obs.	43	42	42	43	43	40

Note. Please refer to the footnotes to Tables 1 and 2. The instruments used are the following regional dummy variables in the Barro–Lee data set: ASIAE = dummy for East Asian countries; LAAM = dummy for Latin-American countries; OECD = dummy for OECD countries; SAFRI = dummy for Sub-Saharan African countries; and the ethnolinguistic fractionalization in Mauro (1995).

[a] In this regression, we find that corruption and $y70$ have a multicollinearity problem when we use the original instrumental variable. Therefore, we introduce the indicators on efficiency of the judiciary system and red tape in Mauro (1995) as additional instruments to obtain a new instrumental variable of corruption. This solves the multicollinearity problem but further reduces the number of observations to 40.

TABLE 9
Decomposition of the Transmission Channels for the 2SLS

Model	Direct impact (a)	Human capital channel (b)	Stability channel (c)	Investment channel (d)	Overall effect
AP6	0.000569	0.33∗0.281	−3.17∗(−0.1775)	11.42∗0.03	0.989
	{0.006}	= 0.093{0.094}	= 0.56{0.57}	= 0.343{0.346}	[0.997]

Note. The number inside the brackets [...] is the calculated total effect that is equal to the summation of (a), (b), (c), and (d), while that inside the braces {...} is the ratio of the respective channel to the overall total effect. The calculation are based on the estimations in AP1 and AP3 to AP6.

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