## Corruption

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# Corruption's Effect on Growth and its Transmission Channels

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## I. INTRODUCTION

It is a common finding in the literature that corruption hinders economic growth (Jain 2001, Boycko, Shleifer and Vishny 1995, 1996, Gupta, de Mello and Sharan 2001, Kaufmann 1997, Mauro 1995, 1997, 1998, Murphy, Shleifer and Vishny 1991, Porta and Vannucci 1997, Tanzi and Davoodi 1997). In this paper, we study empirically the direct and indirect transmission channels through which corruption affects growth levels. Specifically, we focus on the effect of corruption on investment, schooling, trade policy, and political stability, and estimate the contribution of the various channels to the overall negative effect of corruption on growth.

There is a growing interest in the relation between economic growth and the institutional environment. The new interest is partly driven by new data that have become available over the past decades. The Freedom House Indexes of Political Freedoms and Civil Liberties, sometimes referred to by the name of their creator Raymond Gastil, and the indicators from Business Environment Risk Intelligence are among the indexes that appeared in the early 70s. Nowadays, we have a rich data set from sources that are also used by companies to evaluate investment opportunities in foreign countries. These data cover many aspects of the economic environment that are considered important by economic agents: risk of expropriation, definition of property rights, contract enforceability, infrastructure quality, working of markets, bureaucratic efficiency, political and institutional stability, repudiation of contracts by government, and

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so forth. Also, data on institutional features have become available for statistical use by international institutions and by policy advisors. The data employed in this paper fall in the latter category. We use data on corruption, available since 1995, gathered by Transparency International, a non-governmental organisation providing free access to its information.

Though, nowadays, it is common to assume that corruption negatively affects growth, the conclusion is not trivial. According to some earlier authors, corruption is like grease for the economy. Leff (1964) and Huntington (1968) underline two mechanisms through which corruption can foster economic growth. Bribes can help firms to avoid burdensome bureaucratic regulations and they can serve as an incentive to civil servants to accomplish their duties. Lui (1985) argues that agenda-setting and labour efforts of government officials can be made more efficient through bribes.

These arguments, in support for the hypothesis that corruption is beneficial for economic output, rely however on static efficiency arguments, and Kaufmann (1997) offers a comprehensive list of practical and theoretical shortcomings. Also, the recent empirical literature based on time series suggests less optimistic growth scenarios are plausible for countries affected by pervasive corruption. North (1990) emphasises the need of reliable institutions (incompatible with corruption) to defend property rights and reduce transaction costs; institutions are identified as 'the underlying determinant of the long-run performance of economies' (p. 107). Murphy, Shleifer, and Vishny (1991) assert that corrupted societies create incentives that stimulate the most talented people to earn their income through bribing rather than in more productive activities. Boycko, Shleifer, and Vishny (1995, 1996) argue that agreements produced by corrupted practices are inherently unenforceable and this produces an uncertainty that is disadvantageous to the economic process. Mauro (1995) finds, through empirical research, evidence of a negative relationship between corruption and investment, and through this channel, eventually, corruption lowers economic growth. As the basic mechanism behind this finding, Mauro (1998) claims that corruption, when understood as an institution that raises revenues for the administration, has more distortionary effects than taxation because of its illegal character. Economic agents spent substantial efforts to avoid detection and punishment.

In addition to the distortionary effect of corruption on the private sector, different authors have argued that corruption also affects the ways policy makers take decisions. Krueger (1993a, 1993b) argues that incompetent policies are not always the result of lack of knowledge, but rather the outcome of decision-makers' efforts to capture personal rents. With high level of corruption, the allocation of government resources is influenced by bribe opportunities, and re-

sources are located to activities with a high potential for bribes to be collected, as opposed to welfare enhancing activities (Porta and Vannucci 1997). Bardhan (1997), along the same lines, argues that 'because different activities have different chances of detection for bribes, there will be some substitution effect following from corruption by which corrupt officials will try to induce investment and transactions in the direction of lower-detection activities' (p. 1326)[1]. Tanzi and Davoodi (1997) provide evidence that corrupted government officials direct public investment towards large projects, possibly at the expense of basis expenditures such as for education and health. They put forward both theoretical arguments and empirical evidence supporting the idea that corruption negatively affects the quality of infrastructures. Gupta, de Mello and Sharan (2001) claim that the defence sector is very sensitive to bribes, while it does not contribute much to economic growth, and indeed, in their empirical analysis they find a positive correlation between the level of corruption and defence expenses.

In sum, recent studies on the impact of corruption on the economy indicate that the effects of corruption are negative and pervasive throughout the economy (Jain 2001, p. 72). Yet, we can only estimate empirically the effect of corruption on economic growth when corruption is not endogenous to the growth process, that is, we need to make sure that the causality does not run the other way around, from low income levels to corruption. It could be that low income would result in poor institutional settings which, in turn, create incentives for civil servants to collect bribes. But empirical work suggests that the level of corruption is better explained by the quality of economic institutions, rather than by income. Corruption practices among civil servants often reflect cumbersome bureaucratic procedures for which the help of state employees is necessary, and these state employees are in a position to expect payments for fulfilling their duties. Indeed, Mauro (1995) finds high correlation levels between corruption and other institutional quality indexes. Furthermore, Acemoglu, Johnson and Robinson (2001) and Easterly and Levine (2002) have shown that institutions are very persistent over time and are fundamental determinants of economic growth. This, in turn, implies a high degree of persistence over time of corruption levels, so that we can consider corruption as an exogenous variable when used in regressions explaining recent growth rates. Still, to be sure, when carrying out regression analysis, we will explicitly check for the causality

1. In Italy, court cases (in the 'clean hands' trials) have shown that governments were devoting an unusual amount of resources to assist developing countries because of favourable bribe collection opportunities. Bribe collection was easier in this part of public expenditures because of the difficulties of Italian judges to undertake enquiries abroad, especially in developing countries (Bollini and Reich 1994).

among corruption, investments, schooling, openness, political instability, and economic growth, using legal origins as an instrumental variable for corruption.

In the present paper, we use a method similar to one developed by Mo (2000, 2001) and elaborated on in Papyrakis and Gerlagh (2004), to analyse empirically the contribution of various direct and indirect channels through which corruption affects economic growth. Our findings suggest that corruption slows down economic growth, mainly through its effect on investments and trade policies. The latter transmission channel has not been taken into account in previous empirical work, while trade openness has been shown to be of major importance for economic growth. Sachs and Warner (1995), in their extensive analysis, find strong evidence of convergence among open economies and higher growth rates in economies after trade liberalisation programmes.

The paper proceeds as follows. In the next section, basis cross-country regressions are presented with estimates of the direct effect of investments, schooling, trade openness, political instability, and corruption, on growth. In Section III, the transmission channels through which corruption affects growth are studied and their relative importance and long-term effect on growth are calculated. The last section concludes. Furthermore, *Appendix 1* provides the derivation of long-term income effect, *Appendix 2* provides estimates with instrumental variables for corruption and robustness checks of our main results and *Appendix 3* provides a description of the variables and of the sources.

## II. CROSS COUNTRY GROWTH REGRESSIONS

In this Section, we estimate basic growth regressions to quantify the effect of corruption on economic growth, both in a context with and without other independent variables. At this stage we will not produce an explicit estimate of the transmission channels. We start with the common regression equation in which the dependent variable $G$ denotes the GDP growth rate per year in the period from $t_0 = 1975$ to $t_T = 1996$: $G^i = (1/T)\ln(Y_T^i/Y_0^i)$. We include (the natural logarithm of) the level of initial income, $\ln(Y_0^i)$, as independent variable and expect, according to the conditional convergence hypothesis, that this variable will have a negative coefficient, $\alpha_1 < 0$. That is, we expect the growth rate of income to be negatively associated with the level of income at the beginning of the period. As second independent variable, we take corruption, $C^i$, the coefficient of which, $\alpha_2$, is subject of the analysis, and as the other independent variables, denoted by the vector $Z^i$, we take the common regression variables in the growth literature (e.g. Levine and Renelt 1992, Sachs and Warner 1995) that

are possibly linked with corruption as discussed in the next section: investments, schooling, trade openness, and political instability.

$$G^i = \alpha_0 + \alpha_1 \, ln(Y_0^i) + \alpha_2 C^i + \alpha_3 Z^i + \varepsilon^i \qquad (1)$$

where the superscript *i* denotes each country in the sample. The *corruption* variable measures the extent to which bribes and bribe asking were common in a country, over the period 1980–1985. It covers 48 countries in our sample. More recent indexes cover a larger sample of countries and are highly correlated with the old data, but to make sure that the corruption variable is not endogenous, we preferred to use the earliest data on corruption levels. We checked the robustness of our analysis to this decision and found that the use of data on corruption for the period 1988–1992 does not change substantially the results of our analysis[2]. We consider the corruption data for the period 1980–1985 exogenously, on the basis of the inertia in formal and informal institutions (North 1990), and indeed, the corruption perception indexes are highly correlated over time[3]. Data are from the Corruption Perceptions Index by Transparency International.

The *investment* variable presents the percentage of gross investment (public and private) on GDP in the period 1975–1996. The proper time frame for the investment variable is subject to discussion. We preferred to have an average for the whole period as the most reliable measure of the size of investment in the economy, keeping in mind that there could be an endogeneity problem between the growth rate and investment. For a comprehensive treatment thereof, we refer to Temple (1999). Data on income, investments, and growth levels come from the Penn World table 6.0. The *schooling* variable measures the average years of schooling in the population over 25 in the year 1975; this variable is considered an approximation for the investments in human capital. Data are from the International Data on Educational Attainment by Barro and Lee.

The variable *trade openness* measures the number of years in which the country has been open for trade according to Sachs and Warner (1995) criteria over the period 1965–1990. The variable *political instability* measures the averaged sum of revolutions and the number of assassinations per million people per year in the period 1970–1985. Data on trade openness are taken from the Natural Resource Abundance and Economic Growth data set (Sachs and Warner) and the ones on political instability are from the Barro and Lee dataset. A comprehensive description of sources and variables is presented in the appendix.

2. The overall effect of corruption on growth is similar (the new coefficient in equation (3) is –0.39 versus –0.38) and investment and openness remain the most important transmission channels.
3. The Corruption Perception Index for 1980–1985 and for 2001 have a correlation of 89%.

*Table 1*

Growth regressions as in equation (1)

| Independent variable: $G_{75-96}$ | (1) | (2) | (3) |
|---|---|---|---|
| Constant | 14.22 | 14.48 | 15.54 |
| $\ln Y_{1975}$ | –1.19*** | –1.89*** | –1.96*** |
| (0.96) | (0.36) | (0.32) | (0.33) |
| Investment | | 0.14*** | 0.14*** |
| (7.51) | | (0.03) | (0.03) |
| Schooling | | 0.13 | 0.11 |
| (2.72) | | (0.10) | (0.10) |
| Openness | | 1.65*** | 1.54*** |
| (0.46) | | (0.43) | (0.46) |
| Political instability | | –3.00** | –2.58* |
| (0.12) | | (1.39) | (1.51) |
| Corruption | –0.38*** | | –0.07 |
| (2.76) | (0.13) | | (0.10) |
| N | 48 | 48 | 48 |
| Adjusted $R^2$ | 0.17 | 0.62 | 0.62 |

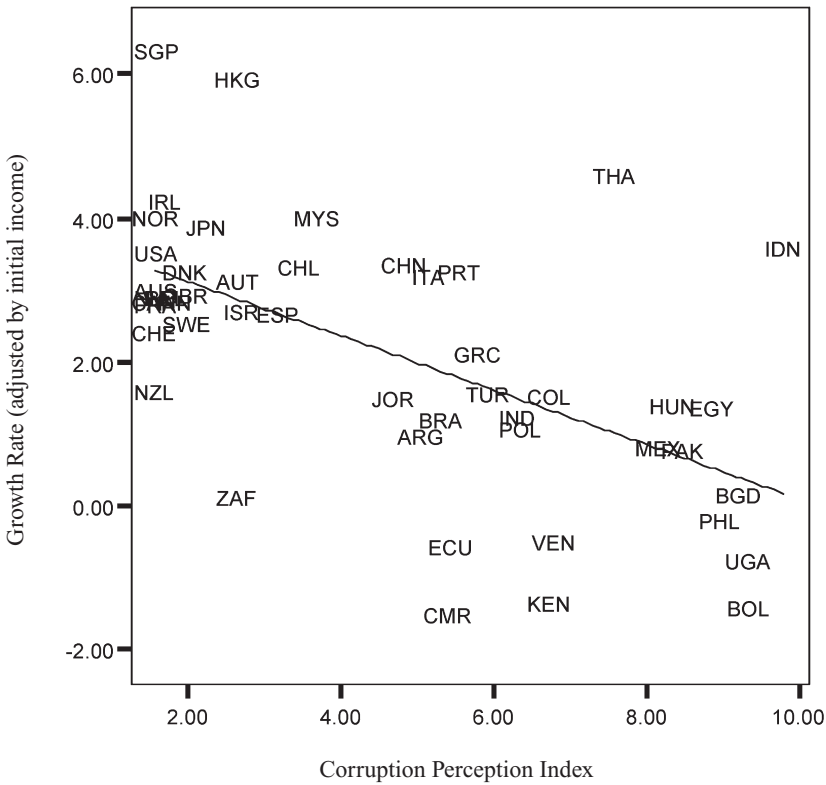
Notes: OLS estimation with average annual GDP per capita growth rate as dependent variable. Superscripts *, **, *** correspond to a 10, 5, 1% of significance, respectively. Standard deviations are in parenthesis under the independent variables, standard errors are in parenthesis under the coefficients.

Regression (1) in *Table 1* presents the results of estimating equation (1) including only the initial income level and corruption as independent variables. The coefficients have the predicted signs and are statistically significant at 1%: the coefficient on initial income is negative and equal to 1.19 and the one on corruption is negative and equal to 0.38. Corruption has substantial impact on economic growth and income. A decrease in the corruption level of one standard deviation – e.g., from the position of the Philippines to the one of India, or from the position of Turkey to the one of Spain – increases economic growth by approximately 1 per cent per year[4], and increases the long-term income level by about 140 per cent[5]. However, the $R^2$ of the first regression is only 0.17. The relation between corruption and the growth rate can be seen in *Figure 1*.

4. From *Table 1*, we multiply the standard deviation for corruption (2.76) with its coefficient (0.38), and find $2.76 \times 0.38 = 1.05$.
5. From *Table 1*, we multiply the standard deviation for corruption (2.76) with its coefficient (0.38), and divide this by the coefficient for initial income (1.19) to calculate the effect on the log of long-term income. The change in income is now calculated as $\exp(2.76 \times 0.38 / 1.19) - 1 = 1.41$. See *Appendix 1* for a derivation and justification of this procedure.

*Figure 1*

Growth rate of per capita income, in the period 1975–96, versus corruption, in the period 1980–85. Growth rates are corrected for initial income effect




Note: Growth rates are corrected for initial income effects as follows:
$G^i - \alpha_1 \ln(Y_0^i) + \alpha_1$ average $(\ln(Y_0))$, $\alpha_1$ based on regression (1).

Regression (2) in *Table 1* presents the results of regressing growth on all the variables included in the $Z^i$ vector, investments, schooling, openness, and political stability, but excluding corruption. The results are consistent with Solow's growth model and with common findings of the empirical literature. The adjusted $R^2$ is equal to 0.62 and all coefficients except for schooling are significant. The coefficient of $\ln Y_{1975}$ is negative; its value of –1.89 is consistent with

a convergence rate of almost 2 per cent per year, confirming the conditional convergence hypothesis. The coefficient of *investment* is positive and equal to 0.14. An increase in investments of 7.5 per cent point, the standard deviation, increases growth rates by 1.05 per cent, and increases the long-term income level by 70 per cent. *Schooling* has also a positive coefficient, 0.131, but it is not significant. The coefficient for *openness* is positive, 1.65. After investments, the openness variable explains most of the growth differences; an increase of the variable of one standard deviation implies an increase in growth of 0.76 per cent per year, and an increase in long-term income of 49 per cent, confirming the hypothesis that free trade spurs economic growth. *Political instability* has a negative coefficient, –3.00, and has an explanatory variation of 0.36 per cent growth per year, and an implied long-term income effect of 21 per cent.

The third regression (3) in *Table 1* includes both corruption and the other independent variables. The adjusted $R^2$ remains unchanged, relative to the previous regression, while all coefficients, except for initial income, show a slight decrease in absolute value and in statistical significance. The increase in (the absolute value of ) the coefficient of $\ln Y_{1975}$ can be interpreted as an improvement of the identification of the steady state path of the economy. Relative to the first regression, the coefficient for corruption has dropped almost to zero, and has become insignificant. A change of one standard deviation in the corruption variable increases growth by a modest 0.20 per cent. The direct effect on the growth rate of a reduction in the corruption index seems insubstantial, when compared to the contribution of any of the other independent variables. But this result is misleading. The suggested relative insignificance of corruption is due to the fact that large part of the effect of corruption on growth is transmitted through the other variables, investments, schooling, openness, and political stability, and their coefficients partly reflect the indirect effects of corruption on growth. In the next Section, we isolate the indirect effects for each transmission channel.

## III. TRANSMISSION CHANNELS FOR CORRUPTION

Regression (3) only accounted for the direct effects of corruption on growth[6]. We suggest, in line with the literature, that corruption is a pervasive phenomenon that negatively affects the working of the economy in several ways. In this section we explore the transmission channels through which corruption can affect growth as captured by the other variables: investment, schooling, open-

6. It must be noted that the 'direct' effect of corruption on growth can be interpreted as that part of the total effect whose transmission channels have not yet been identified.

ness, and political instability. We estimate the dependence of the variables in $Z^i$ on corruption, according to the following equation:

$$Z^i = \beta_0 + \beta_1 \ln(Y_0{}^i) + \beta_2 C^i + \mu^i \quad (2)$$

where $\beta_0$, $\beta_1$ and $\beta_2$, are four-dimensional vectors of coefficients; $\beta_1$ describes the effect of income at the beginning of the period, the latter describes the effect of corruption on the vector of dependent variables $Z^i$, and $\mu^i$ is the vector of residuals.

Before presenting the results, we notice that we have to pay due attention to the problem of causality among the various variables. It is not obvious from the outset that causality runs from corruption to the transmission variables. The problem of causality is pressing, since one can easily imagine variables such as openness and political stability to affect corruption, as well as the other way around. We controlled for endogeneity of the corruption variable by use of legal origins as an instrument variable for corruption. As in Mo (2001), we also used continental dummies and ethnolinguistic fractionalization as instrumental variables, but the Hausman test rejected these as valid instruments for corruption in most of our regressions[7]. Furthermore, we checked the robustness of our results including in the regression analyses various other independent variables such as a democracy index and regional dummies. In *Appendix 2*, we present a detailed report on our calculations with instrumental variables and other independent variables.

*Table 2*

Indirect Transmission Channels as in equation (2)

| | (4) | (5) | (6) | (7) |
|---|---|---|---|---|
| Dependent Variable: | Investment | Schooling | Openness | Political instability |
| Constant | −0.32 | −10.68 | −0.14 | −0.06 |
| $\ln Y_{1975}$ | 2.72* | 1.94*** | 0.12 | 0.003 |
| | (0.96) | (1.42) | (0.36) | (0.09) | (0.26) |
| Corruption | −0.89* | −0.18 | −0.07** | 0.02** |
| | (2.76) | (0.49) | (0.13) | (0.03) | (0.01) |
| N | 48 | 48 | 48 | 48 |
| Adjusted $R^2$ | 0.38 | 0.69 | 0.36 | 0.21 |

Notes: Standard errors for coefficients in parentheses, standard deviation in parenthesis under the independent variable. Superscripts *** correspond to a 1% level of significance.

7. Mo does not report tests for the validity of these instruments.

### *1. The Investment Transmission Channel*

As a first transmission channel we consider investments, which are affected by corruption because it adds uncertainty to the returns on investment activities, in two ways. First, bribes bring costs with them, when detected, and second, agreements based on bribes are unenforceable (Boycko, Shleifer, and Vishny 1995, 1996). Another effect on investment appears when one considers bribes as an additional tax on investment (Southgate, Salazar-Canelos, Camacho-Saa and Stewart 2000). The fourth regression, presented in *Table 2*, shows that, indeed, corruption has a substantial negative effect on the investment level. A one standard deviation decrease in corruption levels increases investments by 2.46 per cent point, which in turn increases economic growth by 0.34 per cent per year[8]. The effect of the investment transmission channel exceeds substantially the direct corruption effect of 0.20 per cent growth per year (calculated above).

We tested the direction of causality between corruption and investments and used a 2-stage least square (2SLS) estimation with legal origins as instrumental variable for corruption, reported in *Table 8*, regression (16), *Appendix 2*. Using 2SLS, we find a substantial increase in the coefficient that measures the effect of corruption on investments. At the same time, however, for this transmission channel, the instrumental variable is rejected in the Hausman test, which can be interpreted as evidence that legal origins have an extra effect on investments that does not go through corruption. The problem we are confronted with is that legal origins is a weak instrument for corruption. But the alternative instrument, common in the literature, is ethnolinguistic fractionalization, which does not pass the Hausman test neither on this transmission channel nor on others. We thus cannot use the 2SLS coefficients for our quantitative assessment of the transmission channels, but the evidence is sufficient to support the hypothesis that causality runs from corruption to investments. We furthermore tested the robustness of the coefficient in regression (4) by adding various other independent variables to the regression, such as a democracy index, an OECD dummy, and regional dummies. As shown in *Table 12*, regression (24), *Appendix 2*, again the coefficient for corruption slightly increases. Together, the 2SLS and the robustness tests provide sufficient substance to suggest that the coefficient for the effect of corruption on investments as reported in regression (4) will not be overestimated.

8. From *Table 1* regression (3), we multiply the investment coefficient (0.14) with 2.46.

### *2. The Schooling Transmission Channel*

Second, the literature emphasises the effects of corruption on education. Tanzi and Davoodi's (1997) empirical analysis suggests that corruption lowers the ability of the government to raise revenues, while it increases the amount of public investment in large infrastructure projects. Thus, corruption decreases the availability of public funds for education. Mauro (1998) confirms this relationship by direct estimation, as he finds that government expenditure on education is negatively and significantly associated with corruption. From the coefficients of regression (5), we find that a one standard deviation decrease in corruption is associated with an increase of half a year of schooling of the people above 25 years. This in turn results in an increase of growth of 0.06 per cent per year. The schooling transmission channel, being highly influenced by the income variable, proves to be the one with the smallest effect in our estimations.

Similar to the analysis for investments, we tested the direction of causality by use of an instrument. For this transmission channel, and for the two other transmission variables as well, the 2SLS regressions passed the Hausman test. We also tested the size of the coefficient by inclusion of other independent variables. Quantitatively, the implications of the 2SLS and robustness tests are comparable with those for investments. As reported in *Table 8*, regression (17), the use of the instrument substantially increases the size of the coefficient. Adding various other independent variables leaves the coefficient almost unchanged, as shown in *Table 12*, regression (25). That is, the auxiliary analyses suggest that causality runs from corruption to schooling, and that the coefficient for the effect of corruption on schooling as reported in regression (4) will not be overestimated.

### *3. The Trade Openness Transmission Channel*

The third transmissions channel deals with the effects on trade policies of corrupted practices in governments. The literature in support of the general argument that corruption distorts policy making has been summarised in the introduction. The influential paper by Krueger (1974) shows the mechanisms through which import restriction become a substantial government-induced source of rents, leading to rent seeking activities. Also, Southgate, Salazar-Canelos, Camacho-Saa and Stewart (2000) describe the relation between corruption and the allocation of trade licenses, import quotas and the implementation of other trade limitations. The openness variable we employ in our analysis is defined as the share of years the country has been open, according to Sachs

and Warner's (1995) definition, in the period 1970–89. Indeed, to define countries as open or closed economies, Sachs and Warner used criteria that more or less measure the possibility to capture trade rents and include: the size of black market exchange premiums, import quotas, and tariffs[9]. Our estimation for the openness transmission channel thus, more or less, describes the tendency in corrupted societies to raise trade barriers by regulation, thus creating a potential source of influence and income for policy makers, and by custom bureaucracy, a potential source of bribe income for custom officials.

Regression (6), shows that, indeed, a one-standard deviation decrease in corruption is associated with an increase in the openness of a country of 0.19, in turn associated with an increase in growth of 0.30 per cent per year. This transmission channel has a smaller effect when compared to the investment transmission channel, but it still exceeds the direct effect of corruption as measured in regression (3). Following the same procedure as for the above transmission channels, we carried out a 2SLS regression and found that this leaves the coefficient almost unchanged (*Table 8*, regression (18)), while the use of other independent variables slightly decreases the coefficient (*Table 12*, regression (26)). Thus, we conclude that causality runs from corruption to openness, and that the coefficient reported in *Table 2* is a reasonable estimate.

### *4. The Political Instability Transmission Channel*

The last transmission channel we analyse runs through political instability. It is argued that corruption 'challenges the popular legitimacy of democratic institutions, and it feeds political instability and the violence that can flow from it' (Mulloy 1999). Bardhan (1997) mentions the fact that in opinion pools made in developing countries, corruption is usually the most important problem referred to by respondents. Political discontent is fuelled by the perception that corrupted practises are widespread among governments and civil servants, and this discontent creates room for political instability. Mo (2001) argues that corruption bolsters political instability, through its effects on income polarisation. Regression (7) shows that corruption has a positive and significant effect on political instability. A one-standard deviation decrease in corruption is associated with a decrease in the political instability index of 0.06, which in turn increases growth by 0.14 per cent per year. Causality from corruption to political instability is confirmed by the use of the instrumental variable for corruption, re-

9. For a full description of the variables and of the method used see Sachs and Warner 1995, pp. 64–67.

ported in *Table 8*, regression (19). The size of the coefficient is robust both against the use of an instrument and against the use of other independent variables, reported in *Table 12*, regression (27).

### *5. Direct and Indirect Effects of Corruption*

Now that we have estimated the effect of corruption on the four variables in $Z$ in equation (1), we can single out the direct and indirect effects of corruption on economic growth, and the effect of the independent variables in $Z$ that are not explained by corruption. Formally, after substitution of equation (2) into (1), we obtain:

$$G^i = (\alpha_0 + \alpha_3\beta_0) + (\alpha_1 + \alpha_3\beta_1)\ln(Y_0^i) + (\alpha_2 + \alpha_3\beta_2)\,C^i + \alpha_3\mu^i + \varepsilon^i \qquad (3)$$

where $\alpha_2$ is the direct effect of corruption on growth and $\alpha_3\beta_2$ captures the summed indirect effects of corruption on economic growth, and $\mu^i$ are the residuals of equation (2). The coefficient estimates of this regression are reported in *Table 3*.

Comparing the results of regression (8) with (3), there are two aspects that stand out. First, the coefficient for corruption has become highly significant, and secondly, it has increased by more than a factor 5. When taking into account the transmission channels, corruption is the single most important variable explaining growth. A one standard deviation decrease in corruption leads to an increase in growth of 1 per cent per year, for a given initial income level. The long-term income level increases by 140 per cent. These results are consistent with regression (1), as reported in *Table 1*, and certainly provide evidence of an outstanding effect of corruption on growth. For any other independent variable, apart from initial income, a one-standard deviation change has less effect. We notice that we have omitted other institutional variables to avoid multi-collinearity, and since corruption is positively correlated with those variables, the corruption coefficient also captures the effect of other institutional implicit variables.

Comparing our results with earlier estimates on corruption and growth, we mention Mauro (1995) who finds that a one-standard-deviation decrease of the corruption index increases the annual growth rate of GDP per capita by 0.8% percentage point[10], but after controlling for investment the coefficient of corruption is halved and becomes statistically insignificant. Mauro (1995) does

10. The analysis takes into consideration the time frame 1960–85 and GDP per capita growth rate is regressed on corruption, GDP in 1960, secondary education in 1960 and population growth.

not study explicitly the transmission channels. Our results are qualitatively similar to Mo's (2001) results, who also found the transmission channels to account for more than 80% of the total effect of corruption on growth. But our results are different in various aspects. Mo studied another set of transmission channels and specifically did not include the trade policy transmission channel. Also, Mo studied a shorter time span, based on data from earlier sources, and he seems to have used initial income, instead of the commonly used logarithm of initial income, as independent variable to account for conditional convergence. For these reasons, and because of the above-mentioned causality tests, we consider our quantitative results more reliable.

*Table 3*

Growth regressions as in equation (3)

| Independent variable: $G_{75-96}$ | (8) |
|---|---|
| Constant | 14.22 |
| $\ln Y_{1975}$ | –1.19*** |
| (0.960) | (0.08) |
| 1 (Investment) | 0.14*** |
| (5.783) | (0.03) |
| $\mu_2$ (Schooling) | 0.11 |
| (1.483) | (0.10) |
| $\mu_3$ (Openness) | 1.54*** |
| (0.361) | (0.46) |
| $\mu_4$ (Political instability) | –2.58* |
| (0.105) | (1.51) |
| Corruption | –0.38*** |
| (2.761) | (0.08) |
| N | 48 |
| Adjusted $R^2$ | 0.62 |

Notes: Superscripts *, **, *** correspond to a 10, 5, 1% of significance respectively. Standard deviations are in parenthesis under the independent variables, standard errors are in parenthesis under the coefficients.

We summarise the contributions of the transmission channels in *Table 4*. The direct effect or corruption on growth is captured through the coefficient $\alpha_2$, so that the contribution of the direct effect relative to the total effect is $\alpha_2 / (\alpha_2 + \alpha_3\beta_2)$. The transmission channels are captured through the vector multiplication $\alpha_3\beta_2$. The relative contribution of the direct impact of corruption is 19%, the relative contribution of the investment channel to the total effect is 32%, the relative contribution of the schooling channel to the total effect is 5%, the rel-

ative contribution of the openness channel to the total effect is 28%, and the relative contribution of the political instability channel to the total effect is 16%. Thus, the main effect of corruption on economic growth is transmitted through the investment decision. This result is consistent with the empirical literature that underlined the importance of corruption on investment (e.g. Mauro 1995). The effect of corruption on trade openness is second-most important. We emphasize this finding as even though it has been noted in the theoretical literature, it has been overlooked by previous empirical analyses. Jointly, the transmission channels studied here account for 81 per cent of the total negative effect of corruption on growth.

*Table 4*

Relative Importance of Transmission Channels, as in equation (3)

| Transmission channels | $\alpha_3$ (Table 1) | $\beta_2$ (Table 2) | Contribution to $\alpha_2 + \alpha_3\beta_2$ | Relative Contribution |
|---|---|---|---|---|
| Corruption | | | −0.073 | 19% |
| Investment | 0.136 | −0.894 | −0.122 | 32% |
| Schooling | 0.113 | −0.183 | −0.021 | 5% |
| Openness | 1.541 | −0.068 | −0.105 | 28% |
| Political Instability | −2.582 | 0.023 | −0.059 | 16% |
| Total | | | −0.38 | 100% |

## IV. THE LONG-TERM EFFECT OF CORRUPTION ON THE TRANSMISSION VARIABLES

In this section we estimate the long-term effects of corruption on the transmission variables, investment, schooling, openness, and political instability. These long-term effects can help us to appreciate the pervasive effect of corruption on growth. There are two approaches through which we can estimate these long-term effects. First, we can use a technique similar to the one we used to calculate the long-term effects of corruption on growth. That is, we use the results from the previous section to calculate the direct effect of corruption on the transmission variables as presented in *Table 2* and add the indirect effect through the income channel based on data presented in *Table 1* and *Table 2*. Second, we run regressions of the transmission channel variables assuming institutions to be the only determinants of the transmission variables (i.e. we exclude initial income as an explanatory variable). Comparing the results from both approaches provides a robustness check of our findings.

The long-term effect of corruption on the transmission variables, as they were estimated in the previous session, can be calculated as:

$$\Delta Z_{\infty} / C = \beta_2 + (-(\alpha_2 + \alpha_3\beta_2) / (\alpha_1 + \alpha_3\beta_1))\ \beta_1 \qquad (4)$$

The first term, on the right hand side, is the direct effect of corruption on the transmission variables (from equation (2)). It measures the effect of corruption on the transmission variables abstracting from income effects. The second term, on the right hand side, multiplies the long-term income effect of corruption (based on coefficients as expressed in equation (3))[11] multiplied by the effect of income on the transmission variables (from equation (2)). The second term can be interpreted as the long-term effect of corruption on the transmission variables operating through the income variable. The results are summarized in *Table 5*.

*Table 5*

Long-term effects of Corruption on Transmission Variables, as in equation (4)

| | Investment | Schooling | Openness | Political instability |
|---|---|---|---|---|
| Direct effect | −0.89 | −0.18 | −0.07 | 0.02 |
| Indirect income effect | −0.87 | −0.62 | −0.04 | 0.00 |
| Long-term effect | −1.76 | −0.80 | −0.11 | 0.02 |

A one standard deviation decrease in corruption levels increases the long-term level of investment by 4.86 per cent points, consistent with Mauro's (1995) finding. It further increases schooling by 2.21 years (for the population more than 25 years old), increases the openness coefficient by 0.30 and increases the political instability index by 0.06. These results reveal the substantial long-term effect of corruption on those variables that are drivers of economic growth.

As a check for these estimates, we also directly estimate the dependence of the transmission channel variables on the corruption level. We recall from the introduction that the recent literature, backed by various empirical studies, argues that institutions are persistent over time and it suggests that they are the main determinants of the long-term economic performance. Therefore, we may estimate the long-term effects of corruption on the transmission variables omitting the initial income variable as an explanatory variable. The specification of equation (2) becomes:

11. See *Appendix 1* for a derivation of the long-term income effects.

$$Z^i = \gamma_0 + \gamma_1 C^i + \nu^i \tag{5}$$

where the variable $\ln Y_{1975}$ has been omitted as independent variable, $\gamma_0$ and $\gamma_1$ are four-dimensional vectors of coefficients; the latter describes the effect of corruption on the vector of dependent variables $Z^i$ and $\nu^i$ is the vector of residuals. The coefficients are presented in *Table 6*.

*Table 6*

Indirect Transmission Channels calculated as in equation (5)

| | (9) | (10) | (11) | (12) |
|---|---|---|---|---|
| Dependent Variable: | Investment | Schooling | Openness | Political instability |
| Constant | 26.70 | 8.59 | 1.04 | −0.02 |
| Corruption | −1.63*** | −0.71*** | −0.10*** | 0.02*** |
| (2.76) | (0.32) | (0.10) | (0.02) | (0.01) |
| N | 48 | 48 | 48 | 48 |
| Adjusted $R^2$ | 0.34 | 0.50 | 0.35 | 0.23 |

Notes: Standard errors for coefficients in parentheses, standard deviation in parenthesis under the independent variable. Superscripts *** correspond to a 1% level of significance.

Comparing the results of *Table 5* associated with equation (4) and *Table 6* associated with equation (5), we observe a close resemblance between the values found for the long-term effect of corruption on the transmission variables. The estimates of the coefficients in equation (4) are slightly larger, in absolute value, than those from equation (5). This result can be explained by the fact that equation (4) implicitly assumes the level of corruption to be constant over time, and thus it gives too much weight to the future effect of present corruption levels. At the same time, the small gap between the two sets of values strongly supports the robustness of our results and the relative persistence over time of corruption levels.

## V. CONCLUSIONS

In this paper, we have studied the effect of corruption on economic growth, directly and through its impact on investment, schooling, trade openness, and political instability. The outcomes confirm a negative effect of corruption on growth, a conclusion accepted by most of the literature. The indirect impact of corruption is substantial, and our results justify the recent emphasis that international organizations put on corruption in particular and institutional soundness in general as important determinants of economic development (Meier 2001).

Now that a consensus is emerging on the importance of institutional characteristics, the obvious search is for strategies that can be used to attack corruption. This will not prove simple, as the past has shown corruption to be persistent over time.

Based on the empirical results, we can search for a better understanding of the transmission channels through which corruption affects the economic performance. While combating corruption is a long-term task, an understanding of the transmission channels through which corruption affects the economy may suggest ways to limit corruption's negative, but indirect, effects on growth. Our results suggest that the most important (for its effect on growth) policy variables that are likely to be distorted by the presence of corruption are investments and trade openness. As a further issue for investigation, we hope to study the interaction effects. Such an analysis could help us to understand whether corruption reduces investments, or reduces the positive effects of investments on growth, e.g. because of an inferior allocation.

## APPENDIX 1: LONG-TERM INCOME EFFECTS

In this appendix, we derive the long-term income effects as in equation (11). To be sure, let us recall that the conditional convergence hypothesis assumes that all countries, when the independent variables remain constant, converge to a steady state with the same positive economic growth rate but with different levels of income. Each country converges to its own growth trajectory. The long-term income effects we calculate thus measure the persistent difference in income levels, without assuming that income levels themselves converge.

We assume that economic growth $G$ for country $i$ depends on its initial income $Y_0$, corruption $C$, and a vector of other explanatory variables $Z$, as described in equation (1). Since $G^i$ represents income growth over a period of $T$ years, we can re-write equation (1) as:

$$(\ln(Y_T{}^i) - \ln(Y_0{}^i)) / T = \alpha_0 + \alpha_1 \ln(Y_0{}^i) + \alpha_2 C^i + \alpha_3 Z^i + \varepsilon_0{}^i \qquad (6)$$

and after rearranging terms, we derive income for country $i$ at the end of the period (year $T$).

$$\ln(Y_T{}^i) = \alpha_0 T + (\alpha_1 T + 1) \ln(Y_0{}^i) + \alpha_2 C^i T + \alpha_3 Z^i T + \varepsilon_0{}^i T \qquad (7)$$

We are interested in the expected difference in income between two scenarios labelled $i$ and $j$, each with its own characteristics ($C^i$; $Z^i$) and ($C^j$; $Z^j$), and thus we eliminate the error terms:

$$E(\Delta \ln(Y_T)) = (\alpha_1 T + 1)\, \Delta \ln(Y_0) + \alpha_2 T\, \Delta C + \alpha_3 T\, \Delta Z \tag{8}$$

where $\Delta \ln(Y_t) = \ln(Y_t^j) - \ln(Y_t^i)$, $\Delta C = C^j - C^i$, and $\Delta Z = Z^j - Z^i$. To assess the long-term effects of $C$ and $Z$ on income, we assume $\Delta C$ and $\Delta Z$ constant over time, and we study propagation of income differences over time. After two periods of $T$ years, income differences are equal to:

$$E(\Delta \ln(Y_{2T})) = (\alpha_1 T + 1)^2\, \Delta \ln(Y_0) + (\alpha_1 T + 2))\, (\alpha_2 T \Delta C + \alpha_3 T \Delta Z) \tag{9}$$

After three periods, we have

$$E(\Delta \ln(Y_{3T})) = (\alpha_1 T + 1)^3\, \Delta \ln(Y_0) + (1 + (\alpha_1 T + 1) + (\alpha_1 T + 1)^2)\, (\alpha_2 T \Delta C + \alpha_3 T \Delta Z) \tag{10}$$

For regressions (1)–(3), we have $0 < \alpha_1 T + 1 < 1$ (e.g., regression (3) has $\alpha_1 = -0.0196$, $T = 21$), so that for $t \to \infty$, the first term at the right hand side vanishes and the other terms reduce to

$$E(\Delta \ln(Y)) = -(\alpha_2/\alpha_1)\, \Delta C - (\alpha_3/\alpha_1)\, \Delta Z \tag{11}$$

The ratio $-(\alpha_2 / \alpha_1)$ captures the long-term income effect of changes in the corruption index. Similarly, the ratio $-(\alpha_3 / \alpha_1)$ captures the long-term impact of changes in other explanatory variables. Taking exponentials we can rewrite the equation and calculate the relative long-term income effect as:

$$(\Delta Y_\infty)/Y_\infty = \exp(-(\alpha_2/\alpha_1)\, \Delta C - (\alpha_3/\alpha_1)\, \Delta Z) - 1 \tag{12}$$

For small values of $(\alpha_2/\alpha_1)\, \Delta C$ and $(\alpha_3/\alpha_1)\Delta Z$, we can use the approximation

$$\Delta Y_\infty / Y_\infty \approx -(\alpha_2/\alpha_1)\, \Delta \mathrm{C} - (\alpha_3/\alpha_1)\, \Delta Z \tag{13}$$

## APPENDIX 2:
## INSTRUMENTAL VARIABLES AND ROBUSTNESS CHECKS

In this appendix, we present the analysis that is essential for testing causality and robustness of coefficients. A common way to test for the causality is the use of instrumental variables in 2 Stage Least Squares (2SLS) regressions. A good instrumental variable is highly correlated with the instrumented variable and should not affect the dependent variable apart from its effect on the corruption variable. For our analysis of transmission channels, we should find an instrument variable that is highly correlated with corruption, but that is otherwise not related to the transmission variables.

In the literature, two variables have been used as instrument for corruption: ethnolinguistic fractionalization (e.g. Mauro 1995) and legal origins (e.g. Fredriksson and Svensson 2003). On the basis of a validity test, we choose legal origins as instrumental variable for corruption. The Hausman test for legal origins does not reject the null hypothesis of the validity of the instrument in all but one regressions at the 5% level of confidence. The validity of the instrument is rejected at the 10% level of confidence when we estimate the effect of corruption on investment. As noticed in the main text, the Hausman test rejection suggests a careful interpretation of the 2SLS results for investment. The rejection of the null hypothesis in the Hausman test can be interpreted as an evidence that legal origins have some effect on investment that does not go through corruption. Therefore the coefficient on the instrumental variable will be overestimated. Indeed we find the investment transmission channel to have a much larger effect than in the original regressions.

The results of the 2SLS are presented in *Table 7, Table 8, Table 9*, and *Table 10*. The results remain qualitatively the same as for our basis analysis. That is, our basis results are supported qualitatively with the use of the instrumental variable. At the same time, caution note is needed as the $R^2$ of the regression of legal origins on corruption is 13%; the instrumental variable's results should be interpreted with care. We highlight the two main results. First, in the final growth regression (20), *Table 9*, that includes the indirect transmission channels, instrumented corruption has a coefficient of –0.33 compared to –0.38 for the basis estimation in the main text. Second, as shown in *Table 10*, investment remains the most important transmission channel and openness the second one.

After controlling for causality using the instrument, we provide checks for robustness adding a variable for political freedom and a set of regional dummies. The variable we use for democracy is an average for the years 1980–1985 of the democracy score from the Polity IV dataset (see Plümper and Martin (2003) for a description of the variable and for a recent survey of the literature on democracy and growth). Regional dummies have been found to be significant in many recent empirical analyses and adding them to our analysis controls that our results are not driven by geographical factors or by any particular group of countries (e.g. Rodriguez and Rodrik 2001).

In *Table 11*, *Table 12* and *Table 13* we present our results including the control variables. The overall effect of corruption holds surprisingly well: the coefficient becomes –0.37 (was –0.38). As for the transmission channels, and their relative importance, we find that the direct effect of corruption is increased and we still find that investment and openness are the most important transmission channels.

*Table 7*

Growth regressions as in equation (1)

| Independent variable: $G_{75-96}$ | (13) | (14) | (15) |
|---|---|---|---|
| Constant | 6.39 | 12.98 | 12.95 |
| $lnY_{1975}$ | −0.35 | −1.70*** | −1.80*** |
| (0.88) | (0.27) | (0.37) | (0.40) |
| Investment | | 0.11*** | 0.12*** |
| (6.20) | | (0.04) | (0.04) |
| Schooling | | 0.15 | 0.19 |
| (2.63) | | (0.11) | (0.12) |
| Openness | | 1.622*** | 1.65*** |
| (0.44) | | (0.498) | (0.50) |
| Political instability | | −2.33 | −2.62* |
| (0.13) | | (1.38) | (1.44) |
| Corruption | −0.33 | | 0.13 |
| (1.14) | (0.21) | | (0.17) |
| N | 37 | 37 | 37 |
| Adjusted $R^2$ | 0.04 | 0.53 | 0.53 |

Notes: 2SLS estimation with average annual GDP per capita growth rate as dependent variable. Superscripts *, **, *** correspond to a 10, 5, 1% of significance respectively. Standard deviations are in parenthesis under the independent variables, standard errors are in parenthesis under the coefficients. The variable Corruption is the predicted value of corruption (instrumented by the legal origins variable).

*Table 8*

Indirect Transmission Channels as in equation (2)

| | (16) | (17) | (18) | (19) |
|---|---|---|---|---|
| Dependent Variable: | Investment | Schooling | Openness | Political instability |
| Constant | 4.78 | −13.23 | −1.49 | 0.40 |
| $lnY_{1975}$ | 3.54*** | 2.35*** | 0.27*** | −0.05** |
| (0.88) | (0.95) | (0.27) | (0.07) | (0.02) |
| Corruption | −1.64** | −0.44** | −0.06 | 0.03* |
| (1.14) | (0.74) | (0.21) | (0.06) | (0.02) |
| N | 37 | 37 | 37 | 37 |
| Adjusted $R^2$ | 0.39 | 0.72 | 0.33 | 0.19 |

Notes: Standard errors for coefficients in parentheses, standard deviation in parenthesis under the independent variable. Superscripts *** correspond to a 1% level of significance.

Overall our main results are supported by the use of the instrumental variable and by the use of control variables. The evidence presented in this section support the results we reported in the main text.

*Table 9*

Growth regressions as in equation (3)

| Independent variable: $G_{75-96}$ | (20) |
|---|---|
| Constant | 6.39 |
| $\ln Y_{1975}$ | –0.35* |
| | (0.88) | (0.19) |
| $\mu_1$ (Investment) | 0.12*** |
| | (4.68) | (0.04) |
| $\mu_2$ (Schooling) | 0.19 |
| | (1.34) | (0.12) |
| $\mu_3$ (Openness) | 1.65*** |
| | (0.35) | (0.50) |
| $\mu_4$ (Political instability) | –2.62* |
| | (0.11) | (1.44) |
| Corruption | –0.33** |
| | (1.14) | (0.15) |
| N | 37 |
| Adjusted $R^2$ | 0.53 |

Notes: Superscripts *, **, *** correspond to a 10, 5, 1% of significance, respectively. Standard deviations are in parenthesis under the independent variables, standard errors are in parenthesis under the coefficients.

*Table 10*

Relative Importance of Transmission Channels, as in equation (3)

| Transmission channels | $\alpha_3$ *(Table 7)* | $\beta_2$ *(Table 8)* | Contribution to $\alpha_2 + \alpha_3\beta_2$ | Relative Contribution |
|---|---|---|---|---|
| Corruption | | | 0.134 | –41% |
| Investment | –1.639 | 0.121 | –0.198 | 60% |
| Schooling | –0.442 | 0.187 | –0.083 | 25% |
| Openness | –0.063 | 1.651 | –0.105 | 32% |
| Political Instability | 0.030 | –2.616 | –0.079 | 24% |
| Total | | | –0.330 | 100% |

*Table 11*

Growth regressions as in equation (1)

| Independent variable: $G_{75-96}$ | (21) | (22) | (23) |
|---|---|---|---|
| Constant | 18.75 | 16.37 | 18.75 |
| $\ln Y_{1975}$ | –1.64*** | –1.75*** | –1.64*** |
| (0.96) | (0.39) | (0.37) | (0.31) |
| Investment | | 0.09*** | |
| (7.51) | | (0.03) | |
| Schooling | | 0.01 | |
| (2.72) | | (0.10) | |
| Openness | | 1.24** | |
| (0.46) | | (0.53) | |
| Political instability | | –2.17 | |
| (0.12) | | (1.40) | |
| Democracy | 0.00 | –0.03 | 0.00 |
| (3.59) | (0.08) | (0.06) | (0.06) |
| Dummy for Latin America | –1.52** | –0.81 | –1.52*** |
| | (0.58) | (0.50) | (0.45) |
| Dummy for Africa | –3.64*** | –2.13*** | –3.64*** |
| | (0.72) | (0.67) | (0.56) |
| Dummy for South Asia | –0.63 | –0.16 | –0.63 |
| | (0.79) | (0.64) | (0.61) |
| Dummy for OECD | –0.18 | –0.27 | –0.18 |
| | (0.72) | (0.68) | (0.56) |
| $\mu_1$ (Investment) | | | 0.09*** |
| (4.68) | | | (0.03) |
| $\mu_2$ (Schooling) | | | 0.01 |
| (1.34) | | | (0.10) |
| $\mu_3$ (Openness) | | | 1.24** |
| (0.35) | | | (0.53) |
| $\mu_4$ (Political instability) | | | –2.17 |
| (0.11) | | | (1.40) |
| Corruption | –0.37*** | –0.18* | –0.37*** |
| (2.76) | (0.11) | (0.10) | (0.08) |
| N | 47 | 47 | 47 |
| Adjusted $R^2$ | 0.49 | 0.69 | 0.69 |

Notes: OLS estimation with average annual GDP per capita growth rate as dependent variable. Superscripts *. **. *** correspond to a 10. 5. 1% of significance respectively. Standard deviations are in parenthesis under the independent variables. standard errors are in parenthesis under the coefficients.

*Table 12*

Indirect Transmission Channels as in equation (2)

| | (24) | (25) | (26) | (27) |
|---|---|---|---|---|
| Dependent Variable: | Investment | Schooling | Openness | Political instability |
| Constant | 9.10 | −9.66 | 1.89 | 0.32 |
| $\ln Y_{1975}$ | 2.14 | 1.87*** | −0–0.16 | −0.04 |
| (0.96) | (1.87) | (0.54) | (0.11) | (0.04) |
| Democracy | 0.17 | −0.05 | 0.01 | 0.00 |
| (3.59) | (0.38) | (0.11) | (0.02) | (0.01) |
| Dummy for Latin America | −5.78** | −0.85 | −0.05 | 0.06 |
| | (2.77) | (0.79) | (0.16) | (0.06) |
| Dummy for Africa | −11.37*** | −1.03 | −0.45** | −0.04 |
| | (3.45) | (0.99) | (0.20) | (0.07) |
| Dummy for South Asia | −3.73 | −0.07 | −0.28 | −0.10 |
| | (3.76) | (1.08) | (0.22) | (0.08) |
| Dummy for OECD | −5.70 | 0.33 | 0.57*** | 0.05 |
| | (3.46) | (0.99) | (0.20) | (0.07) |
| Corruption | −1.08** | −0.16 | −0.04 | 0.02* |
| (2.76) | (0.51) | (0.15) | (0.03) | (0.01) |
| N | 47 | 47 | 47 | 47 |
| Adjusted $R^2$ | 0.48 | 0.68 | 0.53 | 0.19 |

Notes: Standard errors for coefficients in parentheses. standard deviation in parenthesis under the independent variable. Superscripts *** correspond to a 1% level of significance.

*Table 13*

Relative Importance of Transmission Channels. as in equation (3)

| Transmission channels | $\alpha_3$ (Table 12) | $\beta_2$ (Table 11) | Contribution to $\alpha_2 + \alpha_3\beta_2$ | Relative Contribution |
|---|---|---|---|---|
| Corruption | | | −0.178 | 48% |
| Investment | 0.090 | −0.098 | −0.098 | 26% |
| Schooling | 0.010 | −0.002 | −0.002 | 0% |
| Openness | 1.241 | −0.050 | −0.050 | 14% |
| Political Instability | −2.171 | −0.043 | −0.043 | 12% |
| Total | | | −0.371 | 100% |

## APPENDIX 3:
## REGRESSIONS' VARIABLES SOURCES AND DESCRIPTION

The data on corruption are taken from the Transparency International database. Transparency International is an international organization whose objective is to struggle against corruption and among other activities spreads information about it. The Corruption Perception Index is a composite index available from the period 1980–85 and is based on interviews of 'credible' sources (Lambsdorff 2001). The scores of the index range between 0 and 10. where a low (high) score indicates high (low) levels of corruption. Corruption in the survey refers both to the magnitude of bribes and to the frequency of bribe asking. In the present paper the values of the original index has been subtracted from 10. so that an increase in the index will have the intuitive meaning of an increase in corruption[12].

The data collected and elaborated in the paper are from the following database:

- **Penn World Table 6.0** (preliminary version) by Alan Heston & Robert Summers (http://pwt.econ.upenn.edu/; http://webhost.bridgew.edu/baten). Income measures and rates. Data on investment.
- **Natural Resource Abundance and Economic Growth** by Jeffrey D. Sachs and Andrew M. Warner (http://www.cid.harvard.edu/ciddata/ciddata.html). Data on trade openness and political instability.
- **Barro-Lee Data Set for a Panel of 138 Countries** Robert J. Barro and Lee Jong-Wha. (http://www.cid.harvard.edu/ciddata/ciddata.html). Data on schooling (as updated in April 2000) and political instability.
- **Corruption Perception Index** by Transparency International (http://www.transparency.org/) and Center for Globalization and Europeanization of the Economy. Georg-August-University of Goettingen (http://www.gwdg.de/~uwvw/). Data on corruption.
- **Polity IVd Dataset** by Monty G. Marshall and Keith Jaggers, CIDCM, University of Maryland (http://www.cidcm.umd.edu/inscr/polity/index.htm#polity4d). Data on democracy.
- **The World Bank Dataset** by the World Bank (http://www.worldbank.org/research/growth/pdfiles/request2.xls). Data on Legal origins.

12. For a summary of advantages, and disadvantages, of perceptive corruption indexes cf. Mauro 1997, p. 83.

$Y_{1975}/L_{1975}$ GDP per capita in the year 1975 (1996 international prices; Chain index; Penn World Table 6.0).

$Y_{1996}/L_{1996}$ same variable for 1996.

*investment* is the average of the share of Real Gross Domestic Investment (private and public) on Real GDP per capita (Penn World Table 6.0) in the period 1975–1996.

*openness* is the proportion of years in which the country has been open (according to Sachs and Warner's (1995) definition) in the period 1965–1990 (Natural Resource Abundance and Economic Growth).

*corruption* is an average of the value of the corruption perception index for the period 1980–1985 (Corruption Perception Index**).**

*political instability* is an average of the number of assassinations per million of inhabitants and revolutions in the period 1970–1985.

*schooling* is the average number of schooling years in the population over the age of 25 in 1975.

*democracy* is the sum of the score in autocracy and democracy. The original index ranges from –10 to 10, we reorganized it on a 0 to 10 scale.

*legal origins* is a set of dummy variables that characterize the country as Scandinavian, French, English or German.

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SUMMARY

A common finding of recent theoretical and empirical literature is that corruption has a negative effect on economic growth. In the paper, through growth regression analysis, we estimate the direct and indirect effects of corruption on economic growth. The indirect transmission channels, specifically investments, trade policy, schooling, and political stability, analysed in our study prove to be significant in explaining the deleterious effect of corruption on growth rates. We find that one standard deviation increase in the corruption index is associated with a decrease in investments of 2.46 per centage points, which in turn decreases economic growth by 0.34 per cent per year. The second, by importance, transmission channel is openness: a standard deviation increase in the corruption index is associated with a decrease of the openness index by 0.19, resulting in a decrease in economic growth by 0.30 percent per year. Jointly, the transmission channels explain 81 per cent of the effect of corruption on growth. While combating corruption is a long-term task, an understanding of the transmission channels, through which corruption affects the economy, may suggest ways to limit corruption's negative, but indirect, effects on growth.

ZUSAMMENFASSUNG

Ein häufig zu findendes Resultat in der theoretischen und empirischen Literatur ist, dass Korruption eine negative Auswirkung auf das Wirtschaftswachstum hat. In diesem Essay schätzen wir anhand einer Regressionsanalyse die direkten und indirekten Einflüsse, welche die Korruption auf das Wachstum ausübt. Es stellt sich heraus, dass die indirekten Faktoren, die wir in unserer Studie analysieren, nämlich Investitionen, Handelspolitik, Ausbildung und politische Stabilität, auf signifikante Weise den mindernden Effekt erklären, den Korruption auf Wachstumsraten ausübt. Eine Erhöhung des Korruptionsindexes um eine Standardabweichung bewirkt eine Verringerung von Investitionen um 2.46 Prozentpunkte, was wiederum das Wirtschaftswachstum um 0.34% pro Jahr vermindert. Der zweitwichtigste Faktor ist der Grad der Offenheit einer Volkswirtschaft: Eine Erhöhung des Korruptionsindexes um eine Standardabweichung ist assoziiert mit einem Rückgang des Offenheitsindexes um 0.19 Prozentpunkte, was in einer Verringerung des Wirtschaftswachstums um 0.30% pro Jahr resultiert. Alle Faktoren zusammen erklären 81 Prozent des Effektes von Korruption auf das Wachstum einer Volkswirtschaft. Korruptionsbekämpfung ist eine langfristige Aufgabe. Ein gutes Verständnis der Transmissionskanäle, durch welche die Korruption die Wirtschaft beeinflusst, könnte dabei helfen, die negativen, wenngleich indirekten, Auswirkungen der Korruption auf das Wachstum einzuschränken.

RÉSUMÉ

Un résultat partagé à la fois par la littérature théorique et empirique est que la corruption a un effet négatif sur la croissance économique. Dans cet article, nous estimons les effets directs et indirects de la corruption sur la croissance économique en appliquant une analyse par régression. Les canaux de transmissions indirects, notamment les investissements, la politique commerciale, l'éducation et la stabilité politique, analysés dans notre étude, s'avèrent être significatifs dans l'explication des effets nuisibles de la corruption sur le taux de croissance de l'économie. Nos estimations montrent qu'une augmentation de l'écart type de l'indice de corruption est associée à une diminution des investissements de 2.46%, ce qui à son tour entraîne une diminution de la croissance économique de 0.34% par an. Le second canal de transmission, par ordre d'importance, est le degré d'ouverture de l'économie: une augmentation de l'écart type de l'indice de corruption est associée à une diminution de 0.19% de l'indice d'ouverture, résultant en une diminution de la croissance économique de 0.30% par an. Pris dans leur ensemble, les canaux de transmission expliquent 81% des effets de la corruption sur la croissance. La lutte contre la corruption étant un combat qui se conçoit sur le long terme, comprendre les canaux de transmission à travers lesquels la corruption affecte l'économie peut permettre de limiter ses effets négatifs, bien qu'indirects, sur la croissance.