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Corruption, Public Investment, and Growth[1]

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Abstract

Corruption, particularly political or "grand" corruption, distorts the entire decision-making process connected with public investment projects. The degree of distortions is higher with weaker auditing institutions. The evidence presented shows that higher corruption is associated with (i) higher public investment; (ii) lower government revenues; (iii) lower expenditures on operations and maintenance; and (iv) lower quality of public infrastructure. The evidence also shows that corruption increases public investment while reducing its productivity. These are five channels through which corruption lowers growth. An implication is that economists should be more restrained in their praise of high public sector investment, especially in countries with high corruption.

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Contents

SUMMARY

Corruption, particularly political or "grand" corruption, distorts the decision-making process connected with public investments projects. This will happen especially when some of the essential controlling or auditing institutions are not well developed and, therefore, institutional controls are weak.

Economists favor high capital spending because they believe that it contributes to growth. Politicians have internalized this pro-investment bias and have, other things being equal, pushed for larger investment budgets. However, larger expenditure for highly visible investment projects such as roads, airports, power plants, and ports may come at the cost of smaller expenditures for less visible and less politically attractive expenditure on operations and maintenance (O&M). When "commissions" paid out by enterprises to public officials to win an investment contract are tied to the projects' costs, an incentive may be created for larger projects. The net results are (1) an increase in the share of public investment in the total budget; (2) a fall in the average productivity of public investment; and, because of budgetary constraints and other considerations, (3) a possible reduction in some other categories of public spending, such as O&M expenditures and expenditures on education and health. Reductions in O&M expenditures result in deteriorating infrastructures and lower growth rates.

We use cross-country data and regression analysis to see if the ideas developed in the paper receive any support from the data. We find that, controlling for real per capita GDP (a proxy for the stage of economic development) and other variables, higher corruption is associated with (1) higher public investment; (2) lower government revenues; (3) lower O&M expenditures; and (4) lower quality of public infrastructure. The evidence also shows that corruption increases public investment while reducing its productivity, thus providing a possible reason for the negative impact of public investment on growth found in some studies.

An important implication of this paper is that economists should be more restrained in their praise of high public sector investment spending, especially in countries where corruption, and specifically high-level corruption, is a problem.

I. INTRODUCTION

Up to the time when a huge corruption scandal, popularly labeled "tangentopoli" (bribe city), brought down the political establishment that had ruled Italy for several decades, that country had reported one of the largest shares of capital spending in GDP among the OECD countries. After the scandal broke out and several prominent individuals were sent to jail, or even committed suicide, capital spending fell sharply. The fall seems to have been caused by a reduction in the number of capital projects being undertaken and, perhaps more importantly, by a sharp fall in the costs of the projects still undertaken. Information released by *Transparency International (TI)* [2] reports that, within the space of two or three years, in the city of Milan, the city where the scandal broke out in the first place, the cost of city rail links fell by 52 percent, the cost of one kilometer of subway fell by 57 percent, and the budget for the new airport terminal was reduced by 59 percent to reflect the lower construction costs. Although one must be aware of the logical fallacy of *post hoc, ergo propter hoc*, the connection between the two events is too strong to be attributed to a coincidence. In fact this paper takes the view that it could not have been a coincidence

The basic hypothesis of this paper is that corruption, and especially political or "grand" corruption,[3] is often tied to capital projects. Corruption is likely to increase the number of projects undertaken in a country, and to change the design of these projects by enlarging their sizes and their complexity. The net result is: (a) an increase in the share of public investment in GDP; (b) a fall in the average productivity of that investment; and, because of budgetary constraints and other considerations, (c) a possible reduction in some other categories of public spending, such as "operation and maintenance," education, and health. As a consequence of these and other effects of corruption on the economy, the rate of growth of a country where corruption is significant is negatively affected.

In section II we discuss reasons why we assume that public investment is particularly sensitive to the existence of (political) corruption. In section III we present empirical evidence on the basic hypotheses. In section IV we draw conclusions.

II. CORRUPTION AND GOVERNMENT SPENDING

At least from the time, after World War II, when influential economists such as Harrod, Domar, Rostow, and others argued that countries need capital to grow and, more importantly, that there is an almost mechanical relation (the capital-output ratio) between

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[2] *TI* is a nongovernmental organization with headquarters in Berlin which traces corruption trends around the world and which has as its goal the elimination of corruption.

[3] The literature distinguishes between petty or bureaucratic corruption and "grand" or political corruption.

increased capital spending and increased growth, there has been a strong intellectual bias in the economic profession in favor of capital spending. For example, when economists evaluate the allocation of public money between current and capital spending in government budgets, they tend to be critical of countries that allow the share of current spending to grow. On the other hand, they generally praise countries where the share of capital spending in total government expenditure goes up.

The above bias is enshrined in the "golden rule" that many economists advocate for countries. That rule essentially states that it is all right to borrow as long as the borrowing is for investment projects.[4] Thus, it is all right to borrow to finance the building of new roads but not to finance the repairs of existing roads; or to borrow for the building of a new hospital, but not for the hiring of doctors or nurses or for buying medicines. This rule continues to be invoked as a good guide to policy even in the face of much evidence that some current spending--such as "operation and maintenance" that keeps the existing infrastructure in good condition or spending that contributes to the accumulation of human capital--can promote growth more than capital spending.

Politicians have internalized this bias and to some extent have exploited it. For example, ribbon-cutting ceremonies, when new investment projects related to roads, dams, irrigation canals, power plants, ports, airports, schools, and hospitals are completed and inaugurated, are very popular with politicians. They like to be pictured in newspaper articles in the act of cutting the ribbons and, thus, presumably, contributing to the future growth of the country. In a particular Latin American country, capital projects completed under the current administration have been painted orange to send a clear signal to the population that the present government is promoting growth. This pro-investment bias increases the investment budget. We will argue that another factor that also increases the size of the investment budget is corruption.

There is nothing routine about the investment budget and its composition. While much current government spending reflects, to a large extent, explicit or implicit entitlements or previous commitments,[5] thus allowing limited discretion, in the short run, to politicians and, especially, to specific politicians, capital spending is highly discretionary.[6] For the latter, high political figures--members of parliament, general secretaries, ministers, or even heads of state--must make some of the basic decisions. These decisions relate to: (a) the size of the total

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[4]The rule simply states that only current expenditure needs to be balanced by ordinary revenue: a country can have a fiscal deficit equal to the net capital spending of the government.

[5]Pensions, interest payments on the debt, salaries, subsidies, and so on.

[6]Specific politicians generally do not have the power to change the pensions, salaries, or subsidies of specific individuals.

public investment budget; (b) the general composition of that budget, i.e., the broad allocation among different categories of capital spending; (c) the choice of the specific projects and their locations; and (d) even the size and the design of each project. In these decisions, and especially those in (c) and (d), some high-level individuals will have considerable control or influence. This will happen especially when some of the essential controlling or auditing institutions are not well developed and, therefore, institutional controls are weak.

Public investment projects tend to be large and in some cases they are very large. Their execution is often contracted out to domestic or foreign private enterprises. There is thus a need to choose the enterprise that will be responsible for undertaking the project. For a private enterprise, getting a contract to execute a project, and especially a large one, can be very profitable. Therefore, the managers of these enterprises may be willing to pay a "commission" to the government officials that help them win the contract.[7] In some countries, commissions paid by their enterprises to foreign politicians are both legal and tax deductible. Such "commissions" are often calculated as percentages of the total cost of the projects.

A commission of even a few percentage points on a project that costs millions or even hundreds of millions of dollars can be a large sum, one large enough to exceed the temptation price for many individuals.[8] When commissions are calculated as a percentage of projects' costs, the public officials who receive the payments for helping the enterprises win the bid will have a vested interest in increasing the scope or the size of the projects so that they can get larger commissions.[9]

The process of approval of an investment project involves several phases. For example, a civil construction project (roads, buildings, ports) requires decisions related to: (a) specification and design issues; (b) issue of tender (limited or open?); (c) tender scrutiny; (d) tender negotiations; and (e) tender approval and contracting process. The completion of the project will require verification that the work has been done according to the stipulated contract. It will also require some arbitration about points of disagreement. The writing of contracts for complex projects is very difficult and inevitably there will be many areas of uncertainty and eventual disagreement.

In some of these phases, it will be possible for a strategically-placed high-level official to influence the process in ways that lead to the selection of a particular enterprise. For example, the specifications of the design can be tailor-made for a given enterprise. The

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[7]Commission is often a euphemism for what is essentially a bribe.

[8]Actually, in many cases the act of bribery may not start with the enterprises but with the officials who control the decisions. Foreign enterprises report that in some countries it is impossible to get a government contract without paying a bribe.

[9]For a useful discussion of corruption in public investment, see Patrick Meagher (1997).

issuance of tenders can be accompanied by the provision of insider information to favored enterprises, and so on.

The enterprise that pays the commission will not suffer from the payment of the bribe if it is able to recover that cost in several ways: (a) through up-front cost recovery if it can win the bidding competition with an offer that includes the cost of the commission; (b) it can have an understanding with the influential official that the initial low bid can be adjusted upward along the way, presumably, to reflect modifications to the basic design;[10] or (c) reduce its project costs by skimping on the quality of the work done and on the materials used, thus delivering, at completion, an inferior product.[11] In cases when the contract is stipulated in a cost-plus fashion, the enterprise can recover the cost of the commission by overpricing.

In all these alternatives which require the collaboration of the corrupt official, the country will end up with either a higher cost for the specified project than would have been the case in the absence of corruption; with a bigger or more complex project than would have been necessary; or with a project of inferior quality that will not perform up to the anticipated standards and will require costly upkeeping and repairs. The experience with public sector projects, especially in developing countries, is full of stories about roads that needed to be repaired a short time after completion, power plants that worked at much lower capacity than anticipated, and so on.

The above discussion has highlighted cases where corrupt high-level officials or political personalities steer the approval of investment projects towards particular domestic or foreign enterprises in exchange for bribes. This is an important part of the way in which corruption, defined in the broader sense of rent seeking, affects public investment. However, it is not the full story. Important cases of corruption exist also when political personalities steer public investments towards their home districts or their own land. In a recent case reported in the *Financial Times* of July 29, 1997, the President of a country was accused of having built an airport with public funds in his small home town even though there seemed to be little economic justification for it. This is far from an isolated case. At other times, projects are steered toward particular areas in order to increase the value of assets (such as lands owned by political personalities) in those areas.

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[10]This second option may be less attractive to the enterprise if it fears that the official may require additional payments when the cost-increasing modifications are made or if it fears that the official may no longer have the power to influence the process. In countries where the same individuals remain in power for a long time, the strategy of the low initial bid followed by adjustments over the period when the project is executed is a common strategy.

[11]This has been a frequent occurrence in road building where the thickness of the base of the road may be much reduced. It has also been an occurrence in the building of bridges and buildings which, at times, have collapsed causing loss of lives and economic costs.

In all of these cases, the productivity of the capital spending is reduced, thus reducing the growth rate of the country. Therefore, corruption can significantly distort the relationship between the capital input and the output generated by that capital, thus increasing the capital output ratio.

When the approval of investment projects comes to be much influenced by corrupt, high-level officials, the rate of return of projects as calculated by cost-benefit analysis ceases to be the criterion for project selection.[12] Capital spending becomes much less productive and much less of a contributor to growth than generally believed. Unfortunately, situations of this type are far from rare. In these situations, those who carry out the projects (the executing enterprises) come to care mostly about the profits that they make. And the political figures that authorize the projects and choose the enterprises care mostly about the bribes, or the other advantages that they get. Thus, corruption distorts the whole decision-making process connected with the investment budget. In the extreme case of a totally corrupt country, projects are chosen exclusively for their bribe-generating capacity and not for their productivity. The productivity of the projects becomes almost irrelevant.[13]

When corruption plays a large role in the selection of projects and contractors, the result of this process is a capital budget that is highly distorted. "White elephants" and "cathedrals in the desert" are produced. Some projects are completed but never used. Some are much larger and complex than necessary. Some are of such low quality that they will need continuous repairs and their output capacity will be much below initial expectations. In these circumstances, it is not surprising that capital spending does not generate the results in terms of growth that economists expect.

Widespread corruption in the investment budget will not only reduce the rate of return to *new* public investment, but will also affect the rate of return that a country gets from its existing infrastructure. The reasons are several.

First, to the extent that corruption is not a new phenomenon but one that has been around for some time, the existing infrastructure has also been contaminated because *past* investments were also misdirected or distorted by corruption.

Second, higher spending on capital projects will reduce the resources available for other spending. Of the other spending one that is not protected by the existence of entitlements or implicit commitments is "operation and maintenance," that is the kind of current public spending that is required to keep the existing physical infrastructure of a

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[12]In Italy, before tangentopoli, those hired to evaluate projects often found that they were totally ignored.

[13]This may be part of the reason why we observe extremely high capital-output ratios in some countries.

country in good working conditions. Therefore, a frequently observed phenomenon is the poor conditions of the existing infrastructure (roads with potholes, buildings badly in need of repairs, etc.). One often observes situations where new projects are undertaken while the existing structure is left to deteriorate.

Third, and more speculatively, in cases of extreme corruption, operation and maintenance on the physical infrastructure of a country may be intentionally reduced so that some infrastructures, such as roads, will deteriorate quickly to the point where they will need to be rebuilt, thus allowing some high-level officials the opportunity to extract another commission from the enterprise that will undertake the project. Some World Bank Reports have hinted that this may have happened in some countries.

A country can squeeze more output out of the existing infrastructure by keeping it in good working condition so that it can be used at close to 100 percent capacity.[14] It is easy to think of situations where the deterioration of this infrastructure retards growth more than the new capital projects add to growth. Additionally when generalized corruption in a country reduces resources because of the negative impact on tax revenue that is caused by corrupt tax administrators, operation and maintenance will be reduced far more than public investment because of the intellectual bias listed above that supports borrowing for capital projects but not for current expenditure.

III. Empirical Analysis

A. Data description

In our empirical analysis we use indices of corruption data from two sources: *Business International* (*BI*) and *Political Risk Services, Inc.* The *BI* index has been used by Mauro (1995), among others, and is available for 68 countries over the 1980-83 period (one observation per country). The second source publishes a closely related index in the *International Country Risk Guide* (*ICRG*). Unlike the *BI* index, the *ICRG* index is annual; it covers the 1982-95 period and, depending on the year, is available for 42 to 95 countries. This index has been used by Knack and Keefer (1995) and many others.

Both indices are assessments of the degree of corruption in a country by informed observers, the *BI*'s network of correspondents, in the case of the *BI* index, and foreign investors, in the case of the *ICRG* index. The *BI* index has been discontinued, while the *ICRG* index is updated annually and is sold as part of a package to potential investors worldwide. Corruption in the *BI* indicates "The degree to which business transactions involve corruption or questionable payments". The index ranges from 0 (most corrupt) to 10 (least corrupt). In the *ICRG* index higher corruption indicates that "high government officials are likely to demand special payments" and "illegal payments are generally expected throughout lower

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[14]World Bank studies indicate that in many countries public infrastructure including roads, power plants, irrigation canals, often can be used only at a fraction of their full capacity.

levels of government" in the forms of "bribes connected with import and export licenses, exchange controls, tax assessment, police protection, or loans". The *ICRG* index ranges from 0 (most corrupt) to 6 (least corrupt).

We have re-scaled the *ICRG* index by multiplying it by 10/6 so that both indexes range from 0 to 10 and have spliced them to form a single corruption index from 1980 to 1995.[15] For ease of interpretation of the regression results, we have multiplied the resulting index by minus one so that higher values of the index imply higher corruption.

The discussion in section II underscored the interaction between corruption, public investment, operations and maintenance (O&M) expenditures, and other aspects of the government's budgetary position. For public investment, capital expenditure data from the International Monetary Fund's *Government Finance Statistics* (*GFS*) are used. Unfortunately, cross-country data on O&M expenditures are not available. We have, thus, chosen two proxies called "expenditure on other goods and services" which includes O&M expenditures, and "wages and salaries as a fraction of current expenditures." The rationale behind these proxies will be explained below.

To investigate the impact of corruption on the *quality* of public investment, we use the following indicators of quality of infrastructure:

- Paved roads in good condition as a percentage of total paved roads
- Electric power system losses as a percentage of total power output
- Telecommunication faults per 100 mainlines per year
- Water losses as a percentage of total water provision
- Railway diesels in use as a percentage of total diesel inventory

The above data are often referred to as performance indicators of infrastructure and seem adequate for our purpose; they are measured from the perspective of both infrastructure providers and the users; they cover a large number of countries and most importantly, they have many characteristics that make them the responsibility of governments. These data are taken from International Telecommunications Union and the World Bank's World Development Indicators data base. Paved roads in good condition are roads substantially free of major problems and requiring only routine maintenance. Electric power system losses consist of technical losses such as resistance losses in transmission and distribution and non-technical losses such as illegal connection to the electricity and other sources of theft. System losses are then expressed as a fraction of total output. Telecommunication faults per 100 mainlines per year refer to the number of reported faults per 100 main lines for each year. Water losses include physical losses (pipe breaks and overflows) and commercial losses (meter

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[15]The two indices are highly correlated with a correlation coefficient of 0.81. Other indices are also available including one issued by *Transparency International*. These indices are also highly correlated.

under-registration, illegal use including fraudulent or unregistered connections, and legal, but not usually metered, uses such as firefighting). Railway diesels in use as a percentage of total diesel inventory measures technical and managerial performance.

Finally, government revenue data, taken from the *GFS*, are expressed as fractions of GDP. Data on GDP and real per capita GDP (the latter is a control variable in regression) come from the World Bank's *World Development Indicators* data base.

B. Regression results

The discussion in section II suggests testable hypotheses about the relationship between corruption on one hand and public investment, government revenue, O&M expenditures and quality of infrastructure on the other. We use regression analysis to test these hypotheses using cross-country data. It is of course difficult to draw causality statements from regression equations, and one must guard against spurious regression results. We do so by controlling for other variables, such as real per capita GDP, government revenue-GDP ratio, and public investment-GDP ratio.

(1) Corruption and public investment

Hypothesis 1: Other things being equal, high corruption is associated with high public investment.

To test this hypothesis, we regress the public investment-GDP ratio on a constant and the corruption index. We subsequently add real per capita GDP and government revenue-GDP ratio to see if the corruption-investment relationship is robust to the inclusion of these two variables. We add real per capita GDP since it is typically a proxy for the stage of economic development and different levels of development may require different needs for public investment. Government revenue-GDP ratio is added because the higher are these revenues the easier it is to finance public investment. The results are three regressions shown in Table 1. In all the regressions, we cannot reject hypothesis 1 at the 1 percent significance level.[16] Government revenue-GDP variable has a statistically significant positive coefficient indicating that such revenues are important sources of financing public investment. The results shown in Table 1 are for the world sample, but they also hold up for the sub-samples of developing countries and members of the Organization for Economic Cooperation and Development (OECD).

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[16]Note that corruption reduces aggregate investment (Mauro, 1995) which is the sum of public and private capital investment. Thus, corruption must reduce private capital investment by more than it increases public capital investment.

Table 1. The Effects of Corruption on Public Investment, 1980-95

(As a ratio of GDP; annual data)

Independent Variables	(1)	(2)	(3)
Constant	6.75 (23.4)	6.47 (19.5)	4.71 (13.9)
Corruption index	0.38 (8.97)	0.27 (4.15)	0.48 (7.48)
Real per capita GDP*		-0.71 (-2.94)	-1.21 (-5.18)
Government revenue-GDP ratio			0.13 (12.6)
Adjusted R^2	0.069	0.082	0.207
Number of observations	1,081	1,011	1,000

Sources: IMF, *Government Finance Statistics*; *World Tables*; *Business International*; and *Political Risk Services*. The corruption index is taken from Mauro (1995) and *International Country Risk Guide* compiled by Political Risk Services. A high value of the index means a country has high corruption; t-statistics are in parentheses. Estimation technique is OLS.

* Indicates that the coefficient is multiplied by 10,000.

(2) Corruption and government revenues

Regressions in Table 1 show the direct impact of corruption on public investment and do not rule out the possibility of an indirect impact, say, through government revenues. Corruption can reduce government revenues if it contributes to tax evasion, improper tax exemptions or weak tax administration. This leads to the second hypothesis:

Hypothesis 2: Other things being equal, high corruption is associated with low government revenue.

To test this assertion we regress government revenue-GDP ratio on a constant and corruption. We then add real per capita GDP to control for stage-of-economic development effects. The results given in Table 2 for the world sample show that we cannot reject hypothesis 2 at the 1 percent significance level. Similar results also hold up for sub-samples of developing and OECD countries.

(3) Corruption and O&M expenditures

An observation made in section II, and one closely related to Hypotheses 1 and 2, is the underfunding of O&M expenditure. Since corruption and bribery are more effectively related to new investments, corruption may result in lower O&M expenditure. These observations lead to the third hypothesis:

Hypothesis 3: Other things being equal, high corruption is associated with low O&M expenditures.

As stated earlier, direct cross-country data on O&M expenditures are not available.[17] We therefore use two proxies: (1) "expenditures on other goods and services", a component of current expenditure, expressed as a fraction of wages and salaries; and (2) wages and salaries expressed as a fraction of current expenditure. These data are taken from the IMF's GFS data base. The rational behind the first proxy is obvious since, according to the GFS manual on Government Finance Statistics, expenditures on other goods and services include O&M expenditures. We have expressed this expenditure relative to wages and salaries in order to highlight potential trade-offs between O&M expenditure and expenditure on wages and salaries. The ratio of wages and salaries to current expenditure is a reasonable proxy for O&M expenditures because governments often tend to award wage increases but cut O&M expenditures. Hence, increases in wages and salaries can be interpreted as cuts in O&M expenditures.

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[17]Ideally, we want shortfalls in O&M expenditures. This requires knowledge of the so-called "r" coefficients and actual O&M expenditures. The r coefficient is the ratio of net recurrent expenditure requirements to the total investment cost of a project; see Heller (1991).

Table 2. The Effects of Corruption on Government Revenue, 1980-95

(As a ratio of GDP; annual data)

Independent Variables	(1)	(2)
Constant	9.99	12.9
	(12.1)	(13.7)
Corruption index	-2.51	-1.71
	(-20.4)	(-9.28)
Real per capita GDP*		3.73
		(5.34)
Adjusted R^2	0.272	0.28
Number of observations	1,114	1,042

Sources: IMF, *Government Finance Statistics*; *World Tables*; *Business International*; and *Political Risk Services*. The corruption index is taken from Mauro (1995) and *International Country Risk Guide* compiled by Political Risk Services. A high value of the index means a country has high corruption; t-statistics are in parentheses. Estimation technique is OLS.

* Indicates that the coefficient is multiplied by 10,000.

To test hypothesis 3, we regress each of the above proxies on a constant and a corruption index and, as usual for sensitivity analysis, we add real per capita GDP to each regression. The results are shown in Table 3. Unlike the previous regressions, we present the results for three samples (world, OECD and developing) as there are differences across these samples. With respect to the first proxy, results in Table 3 indicate that high corruption is indeed associated with low O&M expenditures. However, one can reject hypothesis 3 at the 1 percent significance level only for the developing country sample. Once we control for real per capita GDP, hypothesis 3 is rejected at the 1 percent significance level for all three samples. One interpretation of this finding is that the first proxy is a noisy indicator of O&M expenditure.

As regards the second proxy for O&M expenditures, we cannot reject hypothesis 3 for all three samples at the 1 percent significance level whether or not we control for real per capita GDP (Table 3, panel b). Countries with high corruption do tend to have high ratio of wages and salaries to current expenditure.[18] The evidence is much stronger statistically and economically for the developing country sample than the OECD sample.

(4) Corruption and quality of public investment

Infrastructure investments are often lumpy and require substantial up-front financial capital. It has been known for some time that corruption is most prevalent in the infrastructure sector (Wade, 1982; Rose-Ackerman, 1996). Regressions in Table 1 in this paper have provided evidence that high corruption is indeed associated with high public investment. See also Mauro (1997). However, this evidence links corruption to *quantity* of investment, and not the *quality*. In section II we argued that countries take on new infrastructure investment without maintaining the existing infrastructure capital stock. Therefore, we expect the quality of the infrastructure to deteriorate and more so if corruption leads to O&M expenditure cutbacks. These observations lead to the fourth hypothesis:

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[18]This does not mean that the level of salaries in corrupt countries is higher. In fact a recent study has found a negative relationship between salary levels in the public sector and corruption. See Van Rijckeghem and Weder (1997).

Table 3. The Effects of Corruption on O&M Expenditure

a. Expenditures on Other Goods and Services, 1980-95
(As a ratio of wages and salaries, 1980-95)

	World		OECD		Developing	
Independent variable	(1)	(2)	(1)	(2)	(1)	(2)
Constant	72.9	97.2	-20.2	43.4	84.2	82.3
	(8.15)	(9.29)	(-0.558)	(1.19)	(7.08)	(6.65)
Corruption index	-3.54	4.44	-14	5.96	-1.24	1.43
	(-2.69)	(2.20)	(-3.53)	(1.23)	(-0.57)	(0.60)
Real per capita GDP*		0.42		0.81		0.63
		(5.55)		(6.99)		(3.93)
Adjusted R^2	0.006	0.038	0.037	0.182	-0.01	0.021
Number of observations	999	927	300	273	699	654

b. Wages and Salaries, 1980-95
(As a ratio of current expenditure; annual data)

	World		OECD		Developing	
Independent variable	(1)	(2)	(1)	(2)	(1)	(2)
Constant	47.3	42.2	34.2	30.8	39.7	39.7
	(41.7)	(33.2)	(12.2)	(11.3)	(26.1)	(25.2)
Corruption index	3.1	1.48	2.17	0.75	1.22	1.16
	(18.5)	(6.03)	(7.02)	(2.07)	(4.43)	(3.83)
Real per capita GDP*		-0.84		-0.65		-0.067
		(-9.13)		(-7.54)		(-0.327)
Adjusted R^2	0.255	0.319	0.139	0.31	0.026	0.023
Number of observations	1,000	925	300	273	700	652

Sources: IMF, *Government Finance Statistics*; *World Tables*; *Business International*; and *Political Risk Services*. The corruption index is taken from Mauro (1995) and *International Country Risk Guide* compiled by Political Risk Services. A high value of the index means a country has high corruption; t-statistics are in parentheses. Estimation technique is OLS.

* and ** Indicate that the coefficients are multiplied by 100 and 1,000, respectively.

Table 4. Corruption and Quality of Infrastructure, 1980-95

(Annual data)

Dependent Variable	Constant	Corruption Index	Real Per Capita GDP*	Adjusted R^2	N
Paved roads in good condition	19.2 (4.97)	-3.84 (-5.40)		0.052	513
Paved roads in good condition	15.5 (3.87)	-2.22 (-2.89)	5.4 (9.85)	0.268	373
Power outages	18.7 (27.7)	1.1 (8.69)		0.07	997
Power outages	18.8 (32.5)	0.95 (8.17)	-0.56 (-7.07)	0.162	922
Telecommunication faults	97.6 (6.93)	4.17 (1.63)		0.007	241
Telecommunication faults	94.5 (6.31)	-0.54 (-0.18)	-9.33 (-5.01)	0.127	201
Water losses ⊤	43.8 (6.89)	2.25 (1.86)		0.089	26
Water losses⊤	43.6 (7.19)	1.52 (1.14)	-2.92 (-1.63)	0.186	25
Railway diesels in use⊤⊤	47.1 (7.45)	-3.66 (-3.80)		0.17	67
Railway diesels in use ⊤⊤	59.4 (8.62)	-0.58 (-0.46)	1.37 (3.39)	0.285	67

Sources: IMF, *Government Finance Statistics*; *World Tables*; *Business International*; and *Political Risk Services.* The corruption index is taken from Mauro (1995) and *International Country Risk Guide* compiled by Political Risk Services. A high value of the index means a country has high corruption; t-statistics are in parentheses. Estimation technique is OLS.

⊤ and ⊤⊤ denote averages of data over 1980-89 and 1990-95 periods, respectively.

* Indicates that the coefficient is multiplied by 10,000.

Hypothesis 4: Other things being equal, high corruption is associated with poor quality of infrastructure.

To test this hypothesis we regress indicators of quality of infrastructure on a constant, the corruption index and real per capita GDP. The results are given in Table 4 for five indicators of quality of infrastructure. Hypothesis 4 cannot be rejected at the usual significance levels: Countries with high corruption do tend to have poor quality of infrastructure. In terms of statistical significance, the impact of corruption is strongest on the quality of roads (paved roads in good condition), power outages, and railway diesels in use. When we control for real per capita GDP, corruption changes its sign in only one regression (telecommunication faults) and looses its statistical significance at the usual levels in three regressions (telecommunication faults, water losses, and railway diesels in use). The fit of every regression improves, as judged by the adjusted R-squared, when we add real per capita GDP. Moreover, real per capita GDP in every regression has the right sign: countries with higher real per capita GDP tend to have better quality of infrastructure. An important implication of the results in Table 4 is that the costs of corruption should also be measured in terms of the deterioration in the quality of the existing infrastructure. These costs can be very high in terms of their impact on growth.

Does corruption reduce the quality of infrastructure through public investment?

To answer the above question, we conduct a more rigorous test of hypothesis 4 for the quality of roads.[19] We regress paved roads in good conditions on a constant, real per capita GDP, the corruption index (i.e., the same regression as in Table 4) and two additional variables: public investment-GDP ratio and its interaction with the corruption index. Results are shown in Table 5. Columns (1) and (2) show that even when we control for public investment, we still cannot reject hypothesis 4 at the 1 percent significance level. The regression in column (3) shows that corruption is still significant in the presence of the interaction variable. If corruption reduces the quality of roads through public investment, we should find that corruption looses its significance when the interaction variable is added to the regression, given the presence of public investment-GDP ratio and real capita GDP. Comparison of columns (4) and (2)-- with and without the interaction term respectively-- shows this to be the case. In addition, the statistically significant interaction term in column (4) shows that the impact of corruption on the quality of roads depends on public investment. The negative sign on the interaction term suggests that the higher is the public investment, the higher is the negative impact of corruption on the quality of roads. This additional evidence is consistent with the finding in Table 1 that higher corruption is indeed associated with higher public investment.

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[19]Results with other measures of quality of infrastructure are similar.

Table 5. The Effects of Corruption on Quality of Roads, 1980-95

Dependent variable: Paved roads in good condition as a percentage of total paved roads (Annual data)

Independent Variables	(1)	(2)	(3)	(4)
Constant	-1.03	7.55	1.83	19.6
	(-0.150)	(1.01)	(0.193)	(1.82)
Corruption index	-7	-2.56	-6.51	-0.32
	(-8.68)	(-2.20)	(-4.74)	(-0.17)
Public investment-GDP ratio	2.03	3.09	1.15	-0.2
	(2.65)	(4.00)	(0.53)	(0.10)
Public investment-GDP ratio x corruption index			-0.16	-0.58
			(-0.44)	(-1.56)
Real per capita GDP*		0.24		0.25
		(6.38)		(6.57)
Adjusted R^2	0.186	0.326	0.184	0.329
Number of observations	322	269	322	269

Sources: IMF, *Government Finance Statistics*; *World Tables*; *Business International*; and *Political Risk Services.* The corruption index is taken from Mauro (1995) and *International Country Risk Guide* compiled by Political Risk Services. A high value of the index means a country has high corruption; t-statistics are in parentheses. Estimation technique is OLS.

* Indicates that the coefficient is multiplied by 100.

Does higher corruption reduce the productivity of public investment?

Suppose that we measure productivity of public investment by improvements in the quality of roads per dollar of public investment. The regression in column (4) of Table 5 shows that the impact of investment on the quality of roads depends on the existence of corruption. Specifically, the negative sign on the interaction term shows that higher corruption can reduce the productivity of public investment.

IV. Concluding Remarks

There are many channels through which higher corruption reduces economic growth. Mauro (1995, 1997) provides evidence and summarizes some of these arguments. The new evidence presented in this paper supports four additional arguments.

First, corruption can reduce growth by increasing public investment *while reducing its productivity*.[20] This finding is consistent with typical reduced-form cross-country growth regressions. For example, Devarajan, Swaroop and Zou (1996) have found that higher public investment is associated with lower growth, given other determinants of growth and Tanzi (1994) found that the relation between growth and investment is highly sensitive to the inclusion of a couple of countries.

Second, corruption can reduce growth by increasing public investment *that* is not accompanied by its recurrent current expenditure, i.e., adequate non-wage O&M expenditures. Our evidence shows that higher corruption is associated with higher total expenditure on wages and salaries. Wages and salaries are a large component of government consumption and higher government consumption has been shown to be unambiguously associated with lower growth (Commander et al, 1997; Barro, 1996; Barro and Sala-i-Martin, 1995).

Third, corruption can reduce growth by reducing the quality of the existing infrastructure. A deteriorating infrastructure increases the cost of doing business for both government and private sector (e.g., congestion, delays, break-downs of machineries, etc) and thus leads to lower output and growth. The importance of infrastructure in growth has been shown in many cross-country growth regressions (Canning and Fay, 1993; Easterly and Levine, 1996; Hulten, 1996).

Finally, corruption can reduce growth by lowering government revenue needed to finance productive spending.

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[20]Please note that because corruption reduces tax revenue, the relative increase in public investment (i.e., its share of the total government budget) is likely to be higher than the absolute increase in public investment.

The implication of this paper is that economists should be more restrained in their praise of high public sector investment spending and of rules such as the golden rule, especially in countries where corruption, and especially high level corruption, is a problem.

This paper has focused on the problem of corruption and not on solutions. As far as corruption relates to the activities of foreign enterprises, the OECD is currently attempting to induce industrial countries: (a) to make the payments of bribes to foreign officials not tax deductible; and (b) to criminalize the payment of bribes. So far the ministers representing the OECD countries have accepted these recommendations, but the legislative bodies of those countries must still act. The OECD proposal, however, would not affect public investment projects in non-OECD countries carried out by domestic contractors or by contractors from non-OECD countries.[21]

[21]For a discussion of steps to reduce corruption, see Tanzi (1997).

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