Corruption and economic growth: A meta-analysis of the evidence on low-income countries and beyond

Ugur, Mehmet and Dasgupta, Nandini

University of Greenwich

20 April 2011

Corruption and economic growth: A meta-analysis of the evidence on low-income countries and beyond[1]

Mehmet Ugur, University of Greenwich, International Business and Economics
Nandini Dasgupta, University of Greenwich, Humanities

Abstract

Corruption is a symptom and outcome of institutional deficiency, with potentially adverse effects on economic growth. This paper aims to provide a synthesis of the existing evidence on the relationship between corruption and economic growth - controlling for effect type, data sources, and country groupings. Using 32 key search terms and 43 low-income country names, we searched in 20 electronic databases and obtained 1,002 studies. Initial screening on the basis of PIOS (Population-Independent Variable-Outcome-Study Design) criteria and critical evaluation on the basis VRA (Validity-Reliability-Applicability) criteria led to inclusion of 115 studies for analysis. We conduct a meta-analysis of the empirical findings in 72 empirical studies, using fixed-effect and random-effect weighted means and testing for significance through precision-effect tests (PETs). Our findings indicate that corruption has a negative effect on per-capita GDP growth overall. We also report that corruption is relatively more detrimental in mixed countries as opposed to low-income countries only and that indirect effects of corruption on growth (through the human capital and public finance channels) are larger than its direct effects.

1. Introduction

Corruption is an ancient problem, with which philosophers, economists, political scientists and policy-makers have grappled since 4th century BC (Bardhan, 1997). Nonetheless, mid-1990s constituted a 'structural break' with respect to the number of studies on the causes and consequences of corruption. Since then, not only has the volume of literature increased, but also this increase went hand in hand with extensive liberalisation reforms and widespread debate on globalisation and its consequences. This is not a surprising correlation because corruption tends to thrive when the speed of market opening is faster than the speed of institutional development necessary to address market failures and/or to reduce transaction costs.

Against this background, scholars, policy-makers and practitioners have been engaged in a strenuous effort to understand the causes and consequences of corruption; and to devise policy interventions that could reduce its incidence. The combined effort has

[1] We would like to thank the Department for International Development (DFID) of the UK for funding this research. We would also like to thank our external reviewers, Mark Petticrew and Alison Weightman, for their comments and recommendations on the protocol and the final report; and Toke Aidt and Ian Shemilt for reading the final report and providing additional comments.

produced a large volume of work, with a significant component examining the impact of corruption on economic growth (usually, measured as per-capita GDP or GDP growth). As such, the evidence base for researchers and policymakers interested in the impact of corruption on economic growth is large and expanding. However, differences in methodology, data sources, and country groupings – combined with an expanding volume of work – create high levels of heterogeneity and make it difficult for policy makers and researchers alike to derive synthesized estimates of the effect of corruption on economic growth.

In this systematic review, we aim to contribute to evidence-based policy-making and to academic research on the corruption-growth relationship by: (a) providing a meta-synthesis of the empirical evidence on the corruption-growth relationship; (b) identifying potential avenues for further research; and (c) pointing to policy implications of the synthesized evidence. In doing this, we will pay special attention to the synthesis of the empirical evidence on the corruption-growth relationship in the context of low-income countries. However, we will also provide findings on the corruption-growth relationship in a wider context, which consists of low-income and other countries pooled together.

The original studies reviewed here draw on different corruption data sources, use different estimation methods, cover different country groups and different time periods. This heterogeneity poses a serious challenge for meta-analysis. We address this challenge by nesting studies within coherent clusters and calculating fixed-effect and random-effect weighted means at different levels of nesting/clustering. At the most disaggregated level, each nest/cluster is determined by a unique combination of corruption and growth measures used in each original study. Then we define nests/clusters on the basis of growth measures and country types. In the third stage, we conduct precision-effect test (PETs) to establish whether or not the weighted means represent statistically-significant effects beyond bias. The PETs are conducted at the same level of nesting/clustering used to calculate weighted means. Finally, we mapped the results of the meta-analysis with a narrative synthesis of the theoretical/analytical conclusions to establish the existence/absence of congruence between theory and evidence – and to provide an additional check on the relevance of the synthesized empirical estimates.

The paper is organised in 4 sections. Following this introduction, section 2 presents the motivation for and methodology of the review. In section 3, we provide a brief review of the theoretical/analytical framework that informs original studies on the corruption-growth relationship and the meta-analysis in this paper. Section 4 is devoted to meta-analysis of the evidence reported in empirical studies – mainly regression estimates of corruption's effect on different measures of growth. The meta-analysis of this evidence, in turn, is carried out using fixed-effect estimates (FEEs) for study-level weighted means; random-effect estimates (REEs) for original estimates nested/clustered at increasing levels of aggregation; and precision-effect tests (PETs) for checking if the weighted means are statistically significant beyond bias. Finally, section 4 provides a summary of the findings and derives some policy and research implications.

2. The corruption-growth relationship: motivation and systematic review methodology

Like many concepts in social sciences, corruption refers to different practices involving different actors; and may have different consequences in different contexts. Despite this complexity, a principal-agent definition of corruption captures the nature of the problem fairly well. In this definition, corruption is a sub-optimal outcome that results from strategic interaction between an agent (usually a government official with a given level of authority and accountability) and a principal (usually a member of the public). The agent abuses public office to secure private gains from the principal, who is unable to hold the agent accountable due to high monitoring costs (see, Groenendijk, 1997).

Estimates of the growth-impact of corruption analysed in this review are based on corruption data from four main sources: (i) the corruption index provided by the International Country Risk Guide (ICRG); (ii) The corruption perceptions index provided by Transparency International (TI); (iii) control of corruption scores provided by the World Governance Indicators (WGI) project of the World Bank; and other sources such as Dreher et al (2007), Economist Intelligence Unit and Sachs and Warner (1997) indices. The corruption data consists of scores between a minimum and a maximum value for each country/year. These are averages of the scores given by individual interviewees at each time period. If surveys are conducted monthly, the country/year average is the 12-month average of the monthly scores. Each study indicates the source(s) of its corruption data and provides information about the score range (which is 0 to 6 for ICRG data, -2.5 to +2.5 for WGI data, 0 to 12 for TI data, and similar ranges in other corruption data sources).

This systematic review is motivated by increased national and international efforts aimed at reducing the incidence of corruption and improving governance quality in general. This drive has been at the centre of policy coordination and policy advice led by international organizations such as the United Nations, the World Bank, the IMF and government departments involved in issues of international development such as UK's Depertment for International Development (DFID).

The United Nations adopted a legally-binding Convention against Corruption in May 2004. The Convention obligates the 120 signatories to make corruption a criminal offence, develop institutions that will prevent it, and support policy coordination aimed at reducing the incidence of corruption. According to UNDP, this is justified because corruption not only impedes development, but also undermines democracy by corroding democratic institutions and the rule of law. In addition, the Convention acquires a special urgency because the negative effects of corruption mainly fall on already disadvantaged groups such as the poor, women and minorities.

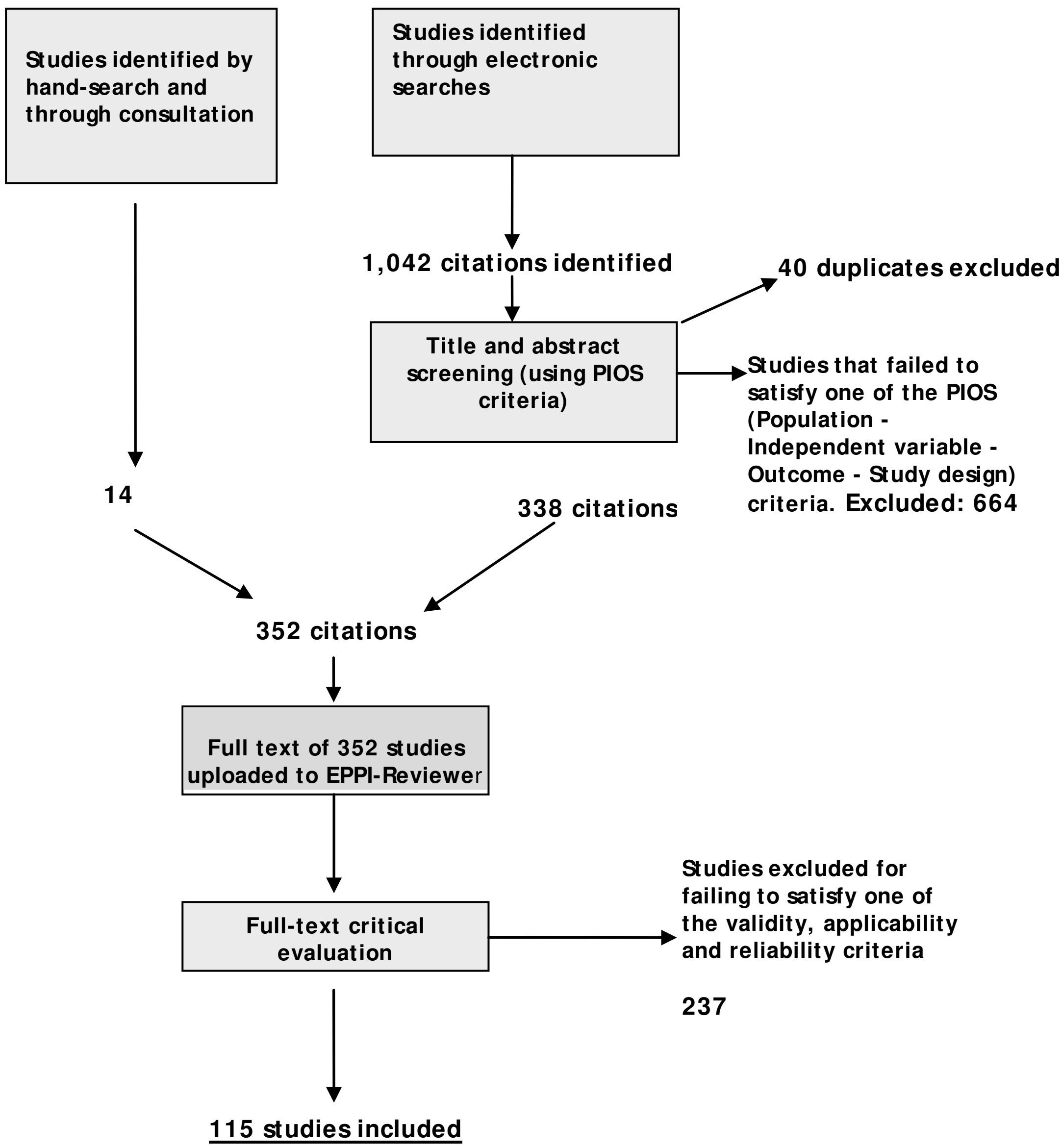
This approach is also observable within the World Bank. Faced with mounting evidence of corruption in developing countries in the 1990s, the World Bank began to place emphasis on the need to reduce corruption as a necessary step to reach the long-term goals of sustainable growth and poverty alleviation. As a result, the World Bank has been instrumental in the development of tools and frameworks aiming to reduce corruption and ensure transparency and accountability in aid and development policies. This approach is shared by national organisations such as DFID, who seeks to develop better measures of corruption and of the effectiveness and limitations of the 'legal instruments, institutions, and policies' required to tackle it.

The brief summary above indicates that a large number of actors are involved in the international effort to combat corruption. It also demonstrates that there is an evident consensus on the need to develop a better and firmer understanding of the causes and consequences of corruption. This systematic review aims to address this need by providing a meta-analysis and synthesis of corruption's estimated effect on economic growth in low-income countries (LICs) and a larger set of countries including LICs and non-LICs. This systematic review also maps the meta-analysis of empirical estimates with theoretical/analytical findings on the types of corruption and the context-specificity of its effects on growth.

The review methodology – i.e., the methods for searching, study selection, critical evaluation, and data extraction – is informed by the Campbell and Cochrane Collaboration guidelines on systematic reviews in healthcare and social policy. Particularly, we have drawn extensively on guidelines recommended by the Centre for Reviews and Dissemination (CRD, 2009) of the University of York. We have also benefitted from guidelines provided by the Evidence for Policy and Practice Information and Co-ordinating Centre (EPPI-Centre) of the Institute of Education.

We have searched in 20 electronic databases for journal articles, working papers, reports and PhD theses; using 32 keywords for corruption, growth and low-income countries, and 43 low-income-country names. In addition, we have conducted manual search and identified 14 studies that had not been picked up by the electronic searches. We uploaded all search results of EPPI-Reviewer as our data storage and management platform. The decision tree summarising the decisions at different stages of the review is given in Figure 1 below.

Figure 1: Decision tree for inclusion/exclusion of studies



The initial screening was carried out on the basis of PIOS (**P**opulation – **I**ndependent variable – **O**utcome – **S**tudy design) criteria. The choice of these criteria is informed by the PICOS framework recommended by CRD (2009). The PIOS criteria enabled us to interrogate each study with the following questions:

1. Does the study include ‘low-income countries’ or its synonyms in the abstract or title? (Population criterion)
2. Does the study include ‘corruption’ or its synonyms in the abstract or title? (Independent Variable criterion)
3. Does the study abstract indicate that it analyses/estimates the corruption-growth relationship? (Independent Variable criterion)

4. Does the study include 'growth' or its synonyms in the abstract or title? (Outcome criterion)
5. Does the study abstract indicate that it analyses/estimates the corruption-growth relationship? (Outcome criterion)
6. Is the study theoretical/analytical (TA)? (Study Type criterion)
7. Is the study empirical (EM) or mixed (EM2)? (Study Type criterion)

We created codes for each of these questions in EPPI-Reviewer and ticked the relevant code box when the study satisfied the criterion implied by the question. Our decision rule was to include a study for the next (critical evaluation) stage if it satisfied at least 4 out of 7 questions, provided that the first question is also satisfied. Using this decision rule and applying the PIOS criteria, we have chosen 338 studies for inclusion in the critical evaluation stage.

We conducted critical evaluation of 352 studies (338 from electronic searches + 14 from manual search) with respect to validity, reliability and applicability (VRA) criteria. Here, validity refers to methodological rigour that would minimise the risk of bias; reliability refers to the extent to which the findings of the study are re-producible; and applicability refers to the extent to which the findings are generalizable / applicable to low-income countries. To establish compliance/non-compliance with these criteria, each study was interrogated with the following questions:

1. Does the sample consist of LICs or does it include some LICs?
2. Does the corruption data come from a documented and recognised source?
3. Does the study report findings on growth impacts of corruption?
4. Does the study have a valid study design compatible with empirical growth literature?
5. Does the study carry out robustness checks for endogeneity and model specification?
6. Is the study theoretical analytical (TA) or empirical (EM) or Mixed (EM2).

Our decision rule was as follows: include if a theoretical/analytical (TA) study satisfies the first 4 questions; include if an empirical (EM) or mixed (EM2) study satisfies the first 5 criteria; and exclude otherwise. As a result, we included 115 studies; of which 84 were EM/EM2, 39 were TA and 8 were 'overlaps'. We extracted data from 84 empirical studies, but data from 12 of these is not used in the meta-analysis because it reports either simulation results without standard errors or estimations results related to potential determinants of growth (e.g., foreign direct investment) rather than growth. Hence, the meta-analysis in this review is based on 596 estimates reported in 72 empirical studies.

One characteristic of included studies is that their frequency distribution over time is congruent with that of all studies captured our search. The distribution over time reflects an increasing frequency for included studies and all studies captured by the search. The second characteristics relates to distribution of studies with respect to publication type. Among theoretical/analytical studies, we had 2 books, 6 working papers and 31 journal articles. The distribution of empirical studies is similar, with 3 books, 12 working papers and 69 journal articles.

The third characteristic relates to the method of estimating the impact of corruption on growth in empirical studies. Here there are two categories: studies that use simulation methods (3) and those that use regression methods (86). We have extracted data from simulation studies, but we did not use that data for meta-analysis. This is because simulation results are reported without standard errors or significance levels; and as such they are not appropriate for meta-analysis.

The empirical studies estimate the impact of corruption on growth using a wide range of model specifications and estimation methods. The estimation methods range from ordinary-least-squares (OLS) through 2-stage and 3-stage least-squares (2SLS and 3SLS) to generalised method of movements (GMM). With respect to model specification, it is generally the case that studies first report OLS estimation results as upper-bound estimates followed by 2SLS or 3SLS estimates and eventually GMM estimates to check for endogeneity thorough instrumentation. Despite this variation, however, all empirical studies estimate a growth model that is compatible with growth regressions discussed and tested in the empirics of growth literature (Barro, 1991; Mankiw et al, 1992; Renelt, 1991; Sachs and Warner, 1997; and Gyimah-Bermping and Taylor, 1999).

In this review, we included all estimates of corruption’s effect as reported in empirical studies, irrespective of the econometric method through which the estimates are obtained. However, each estimate is coded systematically to indicate whether the underlying estimation is instrumented and what kind of estimation method (2SLS, 3SLS or GMM) is used in the original studies. We have also coded each reported estimate as either ‘direct’ or ‘indirect’ effect. In addition, both direct and indirect effects are coded with respect to the outcome they relate to – which can be per-capita GDP growth, GDP growth, GDP levels or interaction terms between corruption and other income determinants that may act as transmission channels for the indirect effect of corruption on growth.

The alternative would have been to choose an aggregate statistic that summarizes the study-specific estimates (e.g. the average or median of the reported estimates) or an estimate chosen randomly from the reported set on the basis of significance or sample size or degrees of freedom. However, reliance on single estimates has two major shortcomings. First, it prevents the use of all available information. Secondly, the selection criterion is highly likely to have a subjective dimension. Therefore, we included all reported estimates and used the appropriate weighting method (fixed-effect weighting for within-study estimates and random-effect weighting for cross-study estimates) to account for heterogeneity.

We adopted World Bank's definition of low-income countries (LICs), which classifies a country as LIC if its per-capita GDP is \$995 or less. At the time of conducting this review, the number of LICs that met this criterion was 43. We report meta-analysis evidence on the growth effect of corruption for LICs separately. However, we supplement this evidence with further evidence on 'Mixed' countries (samples that include LICs and non-LICs) and on 'All' countries (LICs + Mixed).

3. Analysing growth effects of corruption: the theoretical/analytical framework

As indicated above, the incidence of corruption and interest in its causes and consequences began to increase in early 1990s. These developments unfolded against the background of transition from central planning to market economy in central and eastern European countries; and liberalisation of trade and capital movements across developing countries. Another point to note here is that the interest of researchers and policy makers in corruption was part of a paradigm shift that represented a relaxation of some of the central assumptions of the neo-classical economic theory. The latter had taken the existence of market-supporting institutions for granted and as such it relied too heavily on prices as a signal that generates an optimal equilibrium through their effects on rational economic agents' expectations and decisions. Yet, the quality of economic governance institutions (formal or informal rules, norms, and conflict-resolution arrangements) also affects economic actors' expectations and the incentive-cost structures under which they make decisions. Therefore, poor institutional quality may well lead to sub-optimal equilibria even if the price signal is not distorted through government control or intervention (North, 1990; Rodrik, 1999; Rodrik et al, 2004; Acemoglu, 2004).

The importance of governance institutions had been recognised since Adam Smith (1976: 910), who postulated that 'commerce and manufactures can seldom flourish in any state … in which there is not a certain degree of confidence in the justice of government.' In another section of his *Wealth of Nations*, Smith related the cross-country differences in investment rates (hence, the differences in growth rates) to differences in the quality of institutions such as rule of law and property rights. Despite largely marginalised interest in the role of governance institutions, the incorporation of the latter into mainstream economic analysis owes a lot to Douglas North's seminal contributions in early 1990s. In his book and in a seminal article published in 1994, North demonstrated how institutions form the incentive structure of a society and how they can act as the underlying determinant of economic performance (North, 1990; 1994).

Research into the impact of corruption on economic performance (including growth) has been part of this 'institutional revival' in economics. This is natural because corruption is both a cause and symptom of poor institutional quality, which distorts the true costs and incentives associated with economic decisions.

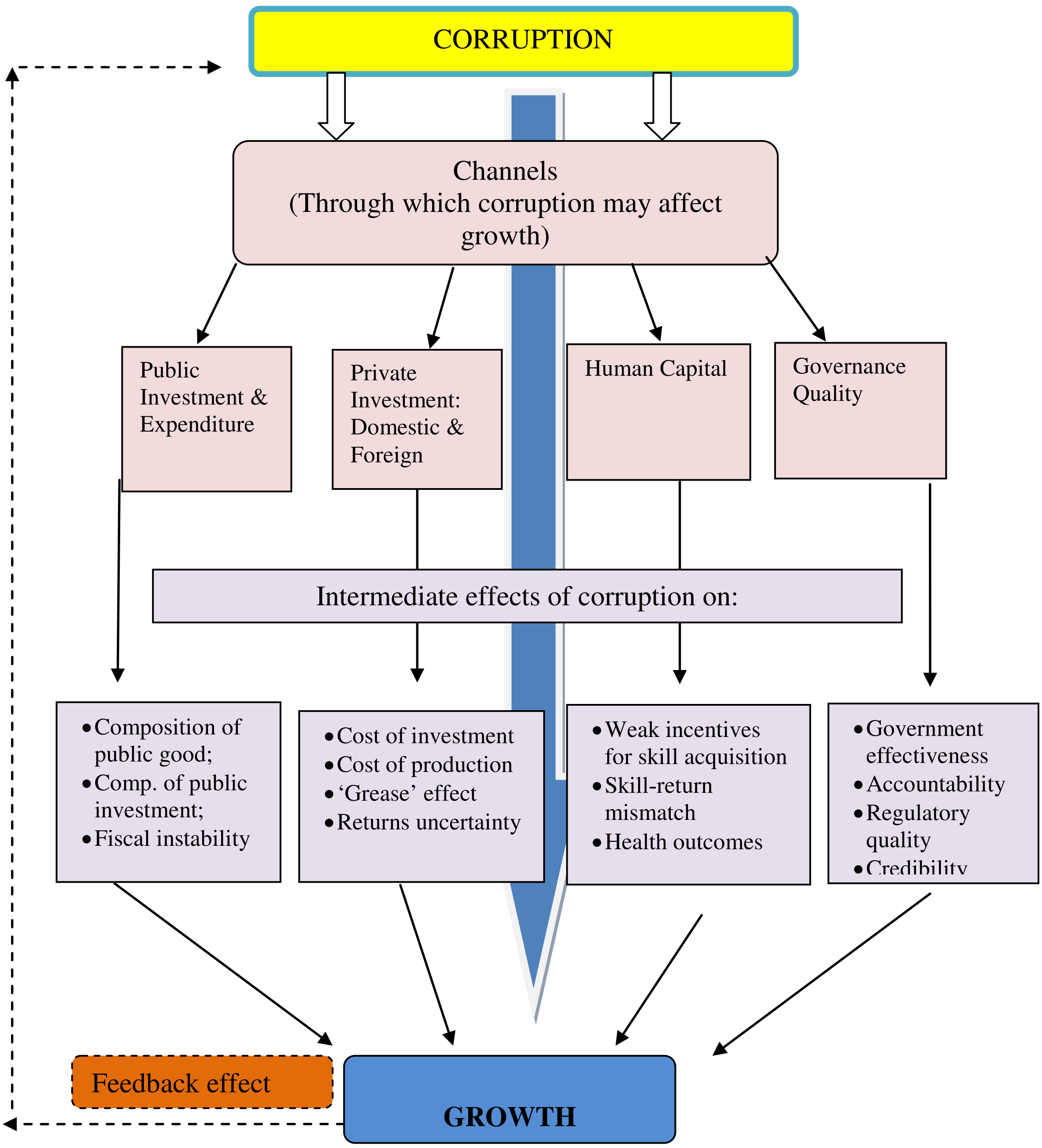
The analytical framework we rely upon to analyse the impact of corruption on growth is informed by the institutional literature in economics. In this framework, corruption is a principal-agent problem that is caused or exacerbated by institutional deficiencies in a society. As such, corruption is a 'state variable' that reflects the characteristics of the environment in which members of the public (the principals) are less able to monitor and hold accountable the public officials (the agents). This state variable differs between countries and over time within each country. In this review, we postulate that inter-country differences in economic growth (the observed outcome) are causally related to differences in the state variable (i.e. level of corruption). The causal mechanisms and transmission channels in the corruption-growth relationship are depicted in Figure 2 below.

One channel through which corruption may affect economic growth is private investment - domestic and foreign. The investment-induced effect of corruption on growth may occur as a result of: (i) increased cost of investment (hence lower investment); (ii) quicker investment permits (hence higher investment); (iii) increased indirect cost of production; and (iv) higher uncertainty about future returns on invested capital at the macro level.

Corruption may also affect growth through public investment and expenditure. The effect here may be due to adverse selection of public investment projects or bias in allocation of public funds towards large and capital-intensive projects. In the case of adverse selection, projects with higher political returns may be selected at the expense of projects with higher economic and social returns – with the consequence of inefficiencies and lower (or perhaps negative) growth effects. In the case of biased resource allocation, corruption may lead to unsustainably high levels of public investment financed at high costs of public borrowing – with the consequence of increased volatility and lower growth rates in the long run.

A third channel through which corruption may affect economic growth is private investment in human capital, measured in terms of years of education or educational qualifications. This effect may materialize because, under corruption, meritocracy does not function effectively as an institution that matches skills/competencies with earnings. Hence, corruption may reduce growth through reduced incentives for investment in human capital.

Figure 2: Corruption-growth relationship: channels causal mechanisms



Corruption also affects economic growth through its adverse effects on the quality of governance institutions in general. Corruption is a symptom of institutional deficiencies, but it may also exacerbate such deficiencies by rewarding deviations or defections from optimal norms and enforcement mechanisms. To the extent that this is the case, corruption affects the optimising decisions of economic actors through the distortions it causes in the cost and incentive structures they face. Corruption distorts the risks associated with investment decisions, the cost of transactions, the level of trust, and the capacity of the polity to resolve distributional or growth conflicts. As such, it distorts the capacity of a country to achieve economic growth through creation of new market opportunities or deepening of the existing ones.

The analytical framework outlined above informs this systematic review, but it also captures the causal mechanisms analysed in both empirical and theoretical/analytical studies analysed in this review. In the remaining paragraphs of this section, we will elaborate on two further issues in the analytical framework informing this review: the type of growth models estimated in the original studies; and the reliability and appropriateness of perception-based measures of corruption used in empirical research.

Model specification in the original studies follows a well-established method for cross-country or panel-data estimation of growth – which was introduced by Barro (1991). In these models, per-capita income is a function of investment, human capital, initial level of per-capita income, and a number of other variables such as openness to trade, public finance (government tax-expenditure variables), etc. This model was refined by Mankiw et al (1992), who have extended it to account for endogenous growth. Formally, the model can be stated as follows:

$$Y/N = F(I, HL, Y_0, Op, G) \qquad (1)$$

Where *Y/N* = per-capita income; *I* = investment; *HL* = human capital; Y_0 = initial level of income, O_p = openness to trade; *G* = public finance variables. Taking logs and first difference of the log values, the model can be linearized for estimation as follows:

$$g_{ti} = \alpha_0 + \alpha_1 k_{ti} + \alpha_2 hl_{ti} + \alpha_3 y_{0_{ti}} + \alpha_4 o_{p_{ti}} + \alpha_5 gov_{ti} + \varepsilon_{ti} \qquad (2)$$

Where $\boldsymbol{g}$ = growth rate of per-capita income; $\boldsymbol{k}$ = investment arte; $\boldsymbol{hl}$ = change in the level of human capital; $\boldsymbol{y_0}$ = initial level of income; $\boldsymbol{o_p}$ = change in the level of openness; $\boldsymbol{gov}$ = change in public finance indicators; $\boldsymbol{\varepsilon}$ = the error term; and subscripts $\boldsymbol{ti}$ = time and country indices. This model has been estimated by a large number of studies in the area of growth, including Levine and Renelt (1991), Mankiw et al (1992), Sachs and Warner (1997); and Gyimah-Bermping and Taylor (1999).

The empirical studies analysed in this review utilise a variant of this model, with an additional explanatory variable to capture the impact of corruption. As such, they can be considered as part of the growth/convergence literature that includes corruption as an additional explanatory variable. Given this lineage, the general form of the models used in the original studies can be stated as follows:

$$g_{ti} = \beta_{0ti} + \beta_1 Corr_{ti} + \beta_k CV_{kti} + u_{ti} \quad (3)$$

Where ***Corr*** is the corruption variable and $\boldsymbol{CV_k}$ is the kx1 vector of control variables that include all or part of the variables in equation (1); ant ***u*** is the error term. The coefficients are defined as follows: $\boldsymbol{\beta_0}$ = constant term; $\boldsymbol{\beta_1}$ = the partial effect of corruption on growth; and $\boldsymbol{\beta_k}$ = the kx1 vector of coefficients representing the partial effects of the control variables on growth.

Models such as (3) have the advantage of controlling for the initial income level and/or for other economic variables. However, if the vector of control variables includes investment, public finance or human capital (i.e., variables that correspond to the transmission channels through which corruption may affect growth indirectly), the estimated coefficient of the corruption variable itself would be biased downward (See, Mauro, 1995). This is because corruption affects not only growth, but also investment, public finance/expenditure and investment in human capital which, in turn, affect growth. Hence, the estimated coefficients of corruption may not reflect the full effect of corruption on growth. The 'missing' component of this coefficient may be captured by the coefficients of the control variables (investment, public finance/expenditure and human capital) that act as transmission channels.

Another problem faced in estimating models such as (3) is that the explanatory variables (e.g., corruption) may itself be affected by the dependent variable (i.e., growth). This is the endogeneity problem referred to above. If endogeneity exists and is not addressed, reported estimates are likely to be biased upward due to reverse causality.

The studies included in this review address both problems. They address the endogeneity problem by using instrumental variables that are closely correlated with corruption but are not likely to be influenced by the dependent variable (growth) itself. The most commonly used instrumental variable is ethnic fractionalisation. This variable measures the degree of ethnic, linguistic and religious fragmentation and tension within countries. As such, it is considered as an exogenous factor that affects institutional quality irrespective of the income level. It has been used by Alesina et al. (2003) to estimate the effects of fractionalization on institutional quality and economic growth. Among the studies reviewed here, ethnic fractionalization is used as an instrumental variable by Easterly et al (2006), Aidt et al (2005), and Aidt et al (2008) and a few others.

Another method for addressing the endogeneity problem is to use past values of endogenous regressors and current values of strictly exogenous regressors as instruments. This method has been suggested by Arelleano and Bond (1991) and has been used extensively in the growth literature. It is known as the General Method of Moments (GMM) estimation, which exploits the linear moment restrictions of the model. It has been shown to be an efficient method of instrumentation when there is not sufficient instrumentation data for the endogenous variables. Most studies reviewed here use the GMM method to isolate the endogeneity problem (e.g., Gyimah-Brempong 2002; Aixala and Fabro 2008; Attila el 2009; Imai et al 2010; Aidt et al 2005; Lutz and Ndikumana 2008, etc.).

The third method is to carry out simultaneous estimation of more than one equation, where the number of equations depends on the number of endogenous variables. This method enables 2-stage or 3-stage least-squares (2SLS or 3 SLS) estimations where reverse causality between endogenous variables is controlled for. Again several studies reviewed here use 2SLS or 3SLS methods of estimation to control for endogeneity (e.g., Li et al 2000; Mauro 1995; Ahlin and Pang 2008; Blackburn et al 2008; Pellegrini and Gerlagh 2004; Attila 2008; Haque and Kneller 2008, etc.)

The second problem we faced while estimating models such as (3) is the blurring of the corruption's direct effect on growth when corruption affects other determinants of growth such as investment, public finance or human capital. One way to address this problem is to obtain alternative estimates and check their robustness by changing the model specification. This involves adding or removing regressors in the model, to establish if the estimated effect of corruption (i.e., β_1 in equation 3 above) remains robust to addition or inclusion of other variables that are hypothesized to affect growth. However, this is only a partial remedy because at least one of the growth determinants likely to be affected by corruption remains in the regression. This is the case with all studies analysed in this review. Therefore, their reported estimates of corruption's direct effect on growth (i.e., β_1) should be considered as a lower bound.

The other method for addressing this problem is to introduce interaction terms - i.e., multiplicative terms - between corruption and other variables that transmits the indirect effects of corruption on growth, but retains it within its own coefficient. Stated differently, it is technically possible to capture the indirect effects of corruption on growth by regressing the latter on the standard variables plus interaction terms between corruption and transmission channels. However, the interaction terms are usually correlated with their components (which are retained in the regression) and this causes multi-collinearity problems in panel data estimations – which are the dominant approach in studies analysed here and within the wider literature on growth. Because multi-collinearity undermines the robustness of the estimated coefficients (including that of corruption), only few studies include interaction terms and report the estimates of indirect effects. Hence, we have only 8 studies out of 84 (and 97 out 596 reported estimates) that estimate the indirect effects of corruption on growth.

The final issue to be addressed here is the reliability and appropriateness of the perceptions-based data used to measure corruption. Because corruption is essentially an un-documented transaction, existing measures of corruption tend to consist of subjective scores. Perception-based corruption measures may suffer from what is described as 'halo effect' or reverse causality. On the one hand, respondents to surveys may be expressing satisfaction/dissatisfaction with economic performance (say, growth) in a particular year rather than the true level of corruption per se. On the other, higher levels of growth may enable countries to invest more resources in institutional capacity building, hence achieving lower levels of corruption over time. To the extent that such halo effects or endogeneity problems exist, regressing growth on corruption as a possible predictor may yield biased results because the measure of corruption used (i.e. the independent variable) may not be exogenous to the level of growth (i.e. the dependant variable) in a particular country/year. Such endogeneity or reverse causality problems have been highlighted in the literature, of which Kurtz and Schrank (2007) is a recent example.

However, such concerns and criticisms have also been addressed in various ways in the existing literature. For example, Acemoglu et al (2001) have introduced instrumental variables that are correlated with institutional quality but are not likely to be influenced by economic performance in a particular year - e.g. settler mortality rates in the early colonial period. Using settler mortality rates as an instrument for institutional quality, they have demonstrated institutional quality determines economic performance rather than the other way round. Knack and Keefer (1997), on the other hand, used a measure of ethnic cleavage and the number of law students as instrumental variables. They also reported that survey-based institutional indicators such as rule of law, pervasiveness of corruption, the risk of contract repudiation, etc. are correlated with these instruments, which are found to be significant predictors of a country's ability to catch up. Finally, using Granger causality tests for panel data, Rodrik et al (2004) have also demonstrated that the endogeneity problem can be addressed and that institutions tend to be more powerful determinant of economic performance compared to policy variables such as openness to trade.

Furthermore, Kaufmann et al (2007) demonstrate that economic performance (e.g. growth) is likely to impact on governance quality only in the long run. They report that the 'halo effect' pointed out by Kurtz and Schrank (2007) – i.e. the short-term effect of economic performance on corruption perceptions – does not hold when the long-run growth of countries are controlled for. Therefore, the short-run effect of growth on corruption perceptions reported by Kurtz and Schrank (2007) may be simply mimicking for the impact of long-run growth.

Nevertheless, there is an additional challenge posed by the use of perception-based corruption measures in empirical research: the risk of 'business bias' that may originate from survey design, which may involve over-representation of business representatives and/or selective choice of survey questions. This risk of bias must be assessed carefully because major sponsors or users of institutional quality data (including corruption data) are either business organisations trying to assess the political risk associated with a particular country/market or international organisations such as the International Monetary Fund and the World Bank, whose remit is to encourage reforms conducive to the establishment of effective market mechanisms.

However, the risk of business bias may be less serious than suspected. On this matter, Kaufmann et al (2007: 13) report that scores obtained from business surveys are highly correlated with governance quality scores obtained from household surveys conducted by NGOs. For example, in the case of the 'government effectiveness' indicator for 2005, the correlation between two major business surveys was 0.74. This correlation, however, is quite similar to the correlation between the results of these two business surveys and a survey of households in Africa - which was 0.70. Similarly, the correlation between the scores of various corruption data sources ranges from 60% - 75%.

This evidence does alleviate the concern about provider or end-user bias. However, it also raises the issue of divergence (of about 25% - 40%) between measures of corruption used in the original studies. Under this condition, it may be inappropriate to synthesize the estimates reported by studies using different corruption data. This is because differences between original estimates will reflect measurement errors or discrepancies rather than true differences concerning the effects of corruption on growth.

We addressed this measurement problem in three stages. In stage 1, we nested (clustered) the original studies on the basis of 8 types of corruption data and 6 measures of growth – generating 48 potential nests/clusters. In stage 2, we pooled together the two versions of the corruption measure that original studies have constructed from the same data source. This exercise led to semi-aggregate nesting/clustering with 24 potential nests/clusters – based on 4 types of corruption data and 6 measures of growth. Finally, we pooled together all studies using all 4 types of corruption data and nested them on the basis of country type (LICs, Mixed, and All countries) and growth measures – generating 18 (3x6) nests/clusters. We moved from one level of aggregation to the next only after verifying that the weighted means of the original estimates have consistent signs across different nests/clusters.

Although consistency between the signs of the synthesized evidence is verified, there remain evident differences between the nests with respect to the magnitude of the estimates. The difference (variation) between magnitudes is controlled for (taken into account) at the next of level of aggregation thanks to the properties of the random-effect estimate - which accords lower weights to original estimates associated with higher levels of within-study and between-study variations. In addition, we have also conducted precision-effect tests (PETs) for estimates at each level of aggregation/nesting to verify if the latter represents a genuine effect, given the underlying heterogeneity and the risk of publication-selection or small-study bias.

4. Meta-analysis of the empirical evidence

The meta-analysis method has allowed us to synthesize the empirical evidence reported in the original studies and to verify whether the synthesized evidence can be considered as a reliable measure of corruption's effect on economic growth. For meta-analysis, we first calculated simple and weighted means of the estimates reported in each empirical study. We divided the studies into 6 groups, corresponding to the measure of growth they estimate. Then we calculated simple and weighted means for studies clustered/nested on the basis of a corruption data they use and the measure of growth they estimate. The nesting/clustering procedure reflects increasing level of aggregation until all studies are clustered around country type and measure of growth estimated. Finally, at each level of clustering, we carried out precision-effect tests (PRTs) to verify if the weighted means can be taken as evidence of genuine effect The nesting concept is informed by de Dominicis et al (2008) in economics and earlier work in medical research such as Beacon et al (2000) and Goldstein et al (2000).

4.1 Calculating weighted means and conducting precision-effect tests

For each study, we calculated the simple and weighted mean effect, together with confidence intervals and average precision levels. For within-study weighted means, we used the fixed effect estimator (FEE) proposed by Stanley (2008), Stanley and Doucouliagos (2007), and de Dominicis et al (2008). The FEE of reported effects is calculated as follows:

$$\Omega = \frac{\sum w_i \theta_i}{\sum w_i} = \frac{\sum (1/SE_i^2)*\theta_i}{\sum 1/SE_i^2} \tag{4}$$

Where Ω is the weighted mean of the reported effects; θ_i is the series of reported effects ranging from 1 to N; and w_i is the weight. The weight, in turn, is the inverse of precision-squared – i.e., $wi = 1/SE_i^2$, where $\boldsymbol{SE_i^2}$ is the square of the standard error associated with each estimate. Then, the FEE is distributed normally around the population mean, subject to random disturbance from within-study variation.

In stage 2, we calculated simple and weighted means for estimates reported by a group of studies nested within a cluster characterised by a unique combination of corruption and growth measures or by a group of countries. For the cross-study weighted means within given nests, we used the random effect estimator (REE) proposed by Stanley (2008), Stanley and Doucouliagos (2007), and de Dominicis et al (2008). The REE of reported effects is calculated as follows:

$$\Psi = \frac{\sum w_i \theta_i}{\sum w_i} = \frac{\sum [1/(SE_i^2 + \sigma^2)]\theta_i}{\sum [1/(SE_i^2 + \sigma^2)]} \tag{5}$$

Where Ψ is the weighted mean of the reported effects; θ_i is the series of reported effects ranging from 1 to N; and w_i is the weight. The weight, in turn, is the inverse of the sum of two variances: the square of the standard error (SE_i^2) associated with the reported effect (i.e., the measure of within-study heterogeneity) and the variance (σ^2) for the set of reported studies (i.e., the measure of between-study heterogeneity). Stated formally, $wi = 1/(SE_i^2 + \sigma^2)$. The REE is distributed normally around the population mean, subject to random disturbance from two sources: within-study variations (SE_i^2) and between-study variations (σ^2).

In stage 3, we carried out precision-effect tests (PETs) to ascertain whether the synthesized evidence represent genuine effect - drawing on the meta-regression method proposed by Egger et al (1997) and used widely in work by Stanley (2008), Stanley and Doucouliagos (2007), Abreu et al (2005), Dalhuisen et al (2003), and Doucouliagos and Laroche (2003). The method consists of a weighted-least square (WLS) estimation, where the t-values of the reported estimates are regressed on the precision of the estimate. This method is built on the original model proposed by Egger et al (1997) to test for publication bias:

$$\theta_i = \beta_1 + \beta_0(SE_i) + u_i \qquad (1)$$

Here θ_i = reported effect estimate; (SE_i) = standard error of the reported estimate and β_1, β_0 = the intercept and slope coefficients to be estimated.

Egger et al (1997) demonstrated that there is evidence for publication bias if the coefficient β_0 is significantly different than zero. This was an important finding that provided a formal test for funnel asymmetry. In addition, the model implies that the reported effect (θ_i) will vary randomly around the 'true' effect β_1 in the absence of bias – i.e., if β_0 is not significantly different than zero.

However, model (1) is not suitable for testing whether the reported effect is genuine because it is inherently heteroskedastic. In other words, the reported estimates do not have constant variance. Therefore, it is recommended to convert model (1) into a weighted-least-squares (WLS) model by dividing across with the standard error - SE_i. This yields:

$$\frac{\theta_i}{SE_i} = t_i = \beta_1(1/SE_i) + \beta_0 + \varepsilon i \qquad (2)$$

Now we have the t-value (t_i) as the dependent and the precision ($1/SE_i$) as the independent variable, the slope and intercept coefficients have switched places, and a new error term (εi) defined. Equation (9) can be estimated by ordinary least squares (OLS) and provides a basis to test for both funnel asymmetry (funnel-asymmetry test - FAT) and also for genuine effect beyond publication selection (precision-effect test - PET)' (Stanley, 2008).

Testing for funnel-asymmetry requires the following test specification:

$$\begin{aligned} H_0: &\quad \beta_0 = 0 \\ H_1: &\quad \beta_0 \neq 0 \end{aligned} \tag{3}$$

On the other hand, testing for genuine effect requires:

$$\begin{aligned} H_0: &\quad \beta_1 = 0 \\ H_1: &\quad \beta_1 \neq 0 \end{aligned} \tag{4}$$

If the null hypothesis in (3) is rejected, asymmetry exists and the sign of the estimate of β_0 indicates the direction of the bias.

Yet, this test is known to have low power – i.e., the test has low probability of rejecting the null hypothesis when the latter is actually false. This increases the probability of committing Type II error and as such implies higher risk of not detecting bias when the latter exists.

Against this weakness, the model defined by equation (2) has the added advantage of identifying genuine empirical effect regardless of bias. In other words, it allows testing for β_1 separately. If the test for β_1 rejects the null-hypothesis, it implies that there is genuine effect beyond publication bias or small study effect. (Stanley, 2008: 108).

We carried out precision-effect tests (PETs) at different levels of study nesting/aggregation – and not for individual studies. This is in order to avoid the risk of within-study dependence – i.e., the bias that may result from correlation between the standard errors of the estimates reported by each study. Systematic reviews in healthcare and education address this problem by using multi-level linear models to estimate the degree of within-study dependence (Goldstein, 1995; Rosenthal, 1991; Beacon et al. 1999; Goldstein et al, 2000; and Rutter and Gatsonis, 2001). This method involves nesting patients or students/pupils within treatment groups or schools. Some economics reviews that have used nested models include de Dominicis (2008); Bijmolt and Pieters (2001); and Bateman and Jones (2003). This method enables reviewers to establish the existence or absence of a statistically-significant relationship between reported estimates and the estimation method, model specification or data source used in original studies.

We have drawn on the nesting methodology to address the issue of within-study dependence in a different way. We have nested studies within nests characterised by similar corruption and growth measures or methods of estimation and conducted PETs on that basis. Therefore, instead of trying to establish the existence or absence of relationship between reported estimates and the estimation method, model specification or data source used in original studies, we have tried to establish whether the random effect estimates (REEs) calculated for each nest represent a genuine effect of corruption on growth.

4.2 Meta-analysis results-1: simple means for individual studies and study clusters

Table 1 below presents the results of the meta-analysis for each study that reports estimates for one of the six effects of corruption on growth: 3 direct and 3 indirect effects. The estimates of the *direct effects* consist of estimated coefficients for the corruption variable when the dependent variable is: (i) per-capita GDP growth rates; (ii) per-capita GDP levels; and (iii) GDP growth rates. The estimates of the *indirect effects* consist of estimated coefficients for the corruption variable when the latter is multiplied with other determinants of per-capita GDP growth – i.e., with variables representing the transmission channels in Figure 1 above. The original studies estimate indirect effects of corruption on per-capita GDP growth through 3 channels: (i) investment; (ii) public finance; and (iii) human capital.

Estimates from studies reporting corruption's effects on investment, foreign direct investment, or GDP per worker were extracted but not used for meta-analysis. This is because these indicators are either incompatible with the growth measures commonly used in the growth literature (e.g., GDP levels); or they do not constitute a growth measure at all.

The table divides the studies into 6 groups, where each group consists of studies reporting estimates of corruption's effect on a particular measure of growth. The empirical studies report 596 estimates in total. The breakdown of the reported estimates with respect to growth measures (i.e., the growth indicator affected by corruption) indicate that 68% of reported estimates (408 out 596) concern the impact of corruption on per-capita GDP growth. This is followed by 75 estimates (12.5%) on the indirect effect on per-capita GDP through public finance; and 44 estimates (7.4%) on the direct effect on GDP growth. The predominance of the estimates related to per-capita GDP growth is in line with the empirics of growth literature – where per-capita GDP growth is the preferred measure of growth and cross-country convergence.

Table 1: Meta-analysis of original study estimates – sorted by precision level

Studies reporting effect on per-capita GDP growth	No. of Estimates	Corruption Data Source	Simple Mean	Lower Conf. Limit	Upper Conf. Limit	Weighted Mean (FEE)	Average precision
Mocan (2007)	14	Other	-0.0014	-0.0027	-0.0001	-0.0004	1078.9
Aidt et al (2005)	32	TI	-0.0017	-0.0025	-0.0009	-0.0012	745.2
Lee (2006)	6	Other	-0.0078	-0.0206	0.0051	-0.0012	562.5
Mauro (1995)	6	Other	-0.0052	-0.0103	-0.0001	-0.0026	522.9
Ahlin and Pang (2008)	48	ICRG, TI	-0.0469	-0.0694	-0.0243	-0.0091	251.5
Law (2006)	1	ICRG	-0.0200			-0.0200	123.0
Naude (2004)	7	WGI	0.0487	-0.0851	0.1824	-0.0006	83.3
Kalyuzhnova et al (2009)	1	TI	-0.0300			-0.0300	81.0
Shimpalee and Breuer (2006)	17	ICRG	-0.0329	-0.0419	-0.0240	-0.0197	78.5
Gupta et al (2002)	11	ICRG	0.2330	-0.2163	0.6823	0.0233	73.1
Gyimah-Brempong et al (2006)	27	TI	-0.1494	-0.2443	-0.0544	-0.0987	25.6
Guetat (2006)	15	Other	0.0086	-0.1867	0.2040	0.0095	21.3
Aixala and Fabro (2008)	3	WGI, TI	-0.1650	-0.1675	-0.1625	-0.1650	18.1
Haque and Kneller (2008)	8	ICRG	-0.7525	-2.0711	0.5661	0.0485	14.1
Gyimah-Brempong (2002)	5	TI	-0.2333	-0.2806	-0.1860	-0.0987	12.9
Gyimah-Brempong (2001)	5	TI	-0.2333	-0.2806	-0.1860	-0.2357	12.9
Blackburn et al (2008)	43	ICRG	0.0325	-0.1925	0.2575	0.0008	9.0
Tanzi and Davoodi (2000)	1	ICRG	-0.3600			-0.3600	8.3
Pellegrini and Gerlagh (2004)	9	TI	-0.2417	-0.4465	-0.0368	-0.2815	8.2
Khamfula (2007)	7	Other	-0.9694	-2.9509	1.0121	-0.3209	7.7
Gupta et al (1998)	6	Other, ICRG	-0.3500	-0.5906	-0.1094	-0.3473	7.5
Aidt (2009)	22	TI	-0.3940	-0.6186	-0.1694	-0.3794	5.5
Drury et al (2006)	11	ICRG	-0.2531	-0.5294	0.0232	-0.3459	5.1
Li et al (2000)	21	ICRG	-0.0514	-0.4396	0.3368	-0.0050	4.3
Easterly et al (2006)	1	WGI	-0.8290			-0.8290	4.0
Rahman et al (2000)	6	ICRG	0.5940	0.5202	0.6678	0.5888	3.5
Aidt et al (2008)	34	WGI, TI	-1.3623	-1.9004	-0.8241	-0.5225	2.9
Rock and Bonnett (2004)	12	WGI	-0.7630	-1.6680	0.1420	-0.0574	2.6
Li et al. (2001)	13	Other	-0.5425	-0.7532	-0.3318	-0.5910	2.2
Butkiewicz and Yanikkaya (2006)	4	Other	0.4233	-2.7175	3.5642	-0.2207	1.6
Meon and Sekkat (2005)	9	WGI, TI	-2.8800	-4.2111	-1.5489	-1.9705	1.2
Everhart et al (2009)	3	ICRG	-2.6000	-5.0142	-0.1858	-2.5961	0.4
Sub-Total	***408***						

Studies reporting effect on <u>GDP levels</u>	**No. of Estimates**	**Corruption Data Source**	**Simple Mean**	**Lower Conf. Limit**	**Upper Conf. Limit**	**Weighted Mean (FEE)**	**Average precision**
Dzhumashev (2009)	10	WGI	-0.050	-0.075	-0.024	-0.001	200.6
Baliamoune (2008)	3	ICRG	-0.061	-0.331	0.209	0.001	137.3
Lutz and Ndikumana (2008)	3		-0.061	-0.331	0.209	0.001	137.3
Imai et al (2010)	6	WGI	-0.559	-0.853	-0.264	0.672	7.0
Gyimah-Brempong (2002)	5	TI	0.123	-1.773	2.019	-0.259	5.6
Sub-Total	***27***						
Studies reporting effect on <u>GDP growth</u>	**No. of Estimates**	**Corruption Data Source**	**Simple Mean**	**Lower Conf. Limit**	**Upper Conf. Limit**	**Weighted Mean (FEE)**	**Average precision**
Ehrlich and Lui (1999)	6	Other1	-0.056	-0.100	-0.012	0.035	1347.8
Gupta et al (1998)	5	ICRG,WGI, Other	-0.008	-0.017	0.002	-0.002	617.2
Gyimah-Brempong (2001)	8	TI	-0.526	-0.611	-0.441	-0.549	11.2
Gyimah-Brempong (2002)	4	TI	-0.477	-0.582	-0.373	-0.486	10.5
Mo (2001)	6	TI	-0.279	-0.471	-0.087	-0.262	4.6
Studies reporting effect on <u>GDP growth (cont.)</u>	**No. of Estimates**	**Corruption Data Source**	**Simple Mean**	**Lower Conf. Limit**	**Upper Conf. Limit**	**Weighted Mean (FEE)**	**Average precision**
Anoruo and Braha (2005)	5	TI	-1.169	-1.607	-0.730	-1.197	3.3
Swaleheen (2007)	6	TI	-2.585	-3.556	-1.614	-2.133	2.6
Breslin and Samanta (2008)	2	ICRG, TI	-0.074	-2.309	2.161	0.075	1.9
Kandil (2009)	2	WGI	-1.300	-8.415	5.815	-0.841	1.6
Sub-Total	*44*						
Studies reporting effect on <u>per-capita GDP growth through public finance channel</u>	**No. of Estimates**	**Corruption Data Source**	**Simple Mean**	**Lower Conf. Limit**	**Upper Conf. Limit**	**Weighted Mean (FEE)**	**Average precision**
Li et al (2000)	2	ICRG	-0.002	-0.364	0.361	0.002	22.5
Attila (2008)	9	ICRG	-0.142	-0.200	-0.084	-0.091	18.7
Blackburn et al (2008)	64	ICRG	-0.950	-1.103	-0.797	-0.007	10.4
Sub-Total	***75***						

Studies reporting effect on per-capita GDP growth through investment channel	No. of Estimates	Corruption Data Source	Simple Mean	Lower Conf. Limit	Upper Conf. Limit	Weighted Mean (FEE)	Average precision
Dzhumashev (2009)	8	WGI	-0.017	-0.027	-0.008	-0.007	358.772
Guetat (2006)	10	Other	0.225	0.107	0.342	0.120	21.335
Pellegrini and Gerlagh (2004)	2	TI	-1.360	-4.918	2.198	-1.260	1.656
Sub-Total	***20***						
Studies reporting effect on per-capita GDP growth through human capital channel	**No. of Estimates**	**Corruption Data Source**	**Simple Mean**	**Lower Conf. Limit**	**Upper Conf. Limit**	**Weighted Mean (FEE)**	**Average precision**
Guetat (2006)	10	Other	-0.027	-0.088	0.035	-0.014	38.058
Pellegrini and Gerlagh (2004)	2	TI	-0.300	-2.079	1.479	-0.255	5.714
Sub-Total	***12***						
Total number of reported estimates	**596**						

The second observation that can be made is that the simple average of the estimates has a negative sign in 47 out of 55 studies (85%); and the sign remain stable when weighted means (FEES) are calculated. The preliminary conclusion is that about 85% of the studies report estimates that point out a negative growth-effect when the perceived corruption increases by one unit on the scale. We do not propose to rely on this finding to conclude that corruption has a genuine and negative effect on growth, but the sign congruence between simple and weighted means and the predominance of the estimates with negative sign point out in the direction of a negative effect – which nevertheless has to be verified through the precision-effect test procedure.

However, not all of the negative estimates are statistically significant. When we examine the confidence intervals, we can see that the proportions of statistically-significant average estimates (simple means and weighted means) is as follows: 23 out 32 (72%) for corruption's effect on per-capita GDP growth rates; 3 out 5 (60%) for the effect on per-capita GDP level; 6 out 9 (67%) for the effect on GDP growth rates; 2 out of 3 for the indirect effect through public finance; 1 out 3 (33%) for the indirect effect through investment; and 0 out of 2 (0%) for the indirect effect through human capital.

The third observation that can be made relates to the level of average precision associated with the average estimate for each study. We calculated the average level of precision as follows: $AP = \frac{\sum(1/SE_i)}{n}$; where SE_i is the standard error associated with each original estimate, and (n) is the number of estimates reported by each study. Examining the average precision, we can see that 16 out 32 average estimates (50%) for the impact of corruption on per-capita GDP has an average precision level 10 or more. The proportions for other measures of growth are: 4 out 5 (80%) for per-capita GDP levels; 4 out of 9 (44%) for GDP growth rates; 3 out 3 (100%) for the indirect effect through the public investment channel; 2 out 3 (67%) for the indirect effect through investment channel; and 1 out 2 (50%) for the indirect effect through the human capital channel. Overall, 32 out of 52 average estimates (58%) are associated with a precision level that is greater than 10 - which is usually the desired level of precision in randomised control trials.

However, we do not propose to use study-level summary measures to derive overall conclusions about the growth-effect of corruption. Usually, when original observational studies of the type reviewed here report multiple estimates, the latter are derived from different model specifications or different sample sizes (i.e, different number/groups of countries included/excluded). However, despite these variations in methods or sample size, the underlying gross sample is the same and therefore there is a high risk of within-study dependence. To the extent that this is the case, the standard errors associated with different estimates may not be distributed randomly. The other reason is that a small but statistically significant estimate from the growth regressions will be necessarily associated with a small standard error – and this will inflate the level of precision. A careful examination of Table 5 can reveal this association. Indeed, the highest levels of precision are associated with very small average estimates.

There is one further reason as to why summary estimates in Table 1 should not be taken as indicators of genuine effect: observational studies such as those presented above are characterised by a high degree of heterogeneity with respect to measurement, data sources, estimation methods, and sample choices. Given this heterogeneity, it would be inappropriate to aggregate the findings from each study without accounting for heterogeneity. For this, we follow a nesting method that would enable us to verify the extent to which study findings still point out a negative effect from corruption to growth when we nest studies at different levels of aggregation and within different country groupings.

4. 3 Meta-analysis results-2: Unweighted means for clusters of original estimates

The empirical studies reviewed here use 4 main sources/measures of corruption data. In addition, some studies have transformed the corruption measure such that the index refers to less corruption as its value increases. We have coded the transformed measures of corruption as ICRG1, WGI1, TI1 and Other1. For remaining studies, we have coded the corruption measure as ICRG2, WGI2, TI1, and Other2. In total, there are 8 measures of corruption with potential to be used in the original studies.

We began with nesting the estimates of the original studies on the basis of 8 corruption data sources and 6 growth measures used. At this level, the estimates can be nested within 48 potential nests, as can be seen in Table 2 below.

At this level of nesting, the signs of unweighted means are consistent with what is expected. Focusing on per-capita GDP growth (first row), we can see that the sign is positive for version 1 of the corruption indices (i.e., ICRG1, WGI1, TI1 and Other1) - with the exception of ICRG1, for which the mean of reported estimates is negative but very close to zero. On the other hand, the sign is negative for version 2 of the corruption indices (i.e., ICRG2, WGI2, TI2 and Other2). If we read down each column, we can also see that the sign is positive for version 1 corruption measures, and negative for version 2. Focusing on per-capita GDP growth rates, this pattern suggests that a one-unit *fall* in perceived corruption (i.e., a one-unit *increase* in version 1 corruption measures) is associated with an increase in measures of growth. In other words, corruption tends to have a harmful effect on growth performance. This pattern is consistent with that of studies using version 2 of the corruption data – where a one-unit increase in perceived corruption is associated with a decline in growth performance.

Table 2: Unweighted means for study clusters:
Nested within disaggregated corruption data source and effect type

	ICRG1	**ICRG2**	**WGI1**	**WGI2**	**TI1**	**TI2**	**Other1**	**Other2**	**Total Estimates**
Pcgdp_growth	-0.0018 (58)	-0.0990 (96)	1.0774 (40)	-1.6586 (14)	0.3725 (152)	-0.7886 (21)	0.3668 (8)	-0.3542 (45)	**434**
Gdp_growth	N.E.	-0.0078 (5)	1.3000 (2)	N.E.	0.9448 (31)	N.E.	N.E.	N.E.	**38**
Pcgdp_level	N.E.	-0.0612 (6)	0.5585 (6)	-0.0654 (5)	0.1228 (5)	-0.0338 (5)	N.E.	N.O	**27**
Corr*pubfin on Pcgdp_growth	N.E.	-0.8279 (75)	N.E.	N.O	N.O	N.O	N.O	N.E.	**75**
Corr*Investment on Pcgdp_growth	N.E.	N.O	N.E.	-0.243 (4)	N.E.	-0.4603 (6)	N.E.	N.E.	**10**
Corr*HumCap on Pcgdp_growth	N.E.	N.E.	N.E.	N.E.	-0.0267 (10)	-0.3000 (2)	NE	N.E.	**12**
Total estimates	**58**	**182**	**48**	**23**	**198**	**34**	**8**	**45**	**596**

(Number of reported estimates in parenthesis)
N.E. = No estimates reported in original studies

To elucidate interpretation, let us consider the entry in the cell at the intersection of per-capita GDP growth rate and WG1 corruption data. The unweighted mean of reported estimates is 1.0774. This should be interpreted as follows: a one-unit **decrease** in perceived **corruption** is associated with an increase in per-capita GDP growth rate of 1.077 percentage points. If we take the cell that combines per-capita GDP growth and TI2 data, the simple mean estimates of corruption's effect is -0.7866. This should be interpreted as follows: a one-unit increase in perceived corruption as measured by the TI index is associated with a decrease of 0.7866 percentage-point in per-capita GDP growth rates. It must be indicated here that the estimates in original studies are usually derived from panel data. Therefore, the 'one-unit change' in corruption is relative to other countries in the case of random-effect estimation and it is relative to the country's own past levels in the case of fixed-effect estimation.

The unweighted means for the corruption's impact on per-capita GDP level (row3), however, should be interpreted slightly differently. Focusing on the reported estimate using ICRG2 data (-0.0612), we infer that a one-unit increase in the perceived level of corruption is associated with 0.06% percent fall in the level (not growth rate) of per-capita GDP.

The practice in the growth literature is to focus on the growth rates of per-capita GDP or GDP rather than per-capita GDP levels. This is because GDP levels do not account for country size or for the distorting effects of natural resources such as oil, gas or minerals. In addition, per-capita GDP levels may provide some indication about the level of development relative to per-capita GDP in other countries, but they are of less interest for researchers interested in the extent to which the country is converging towards other countries in terms of development. Given these factors, studies on the growth-impact of corruption also tend to focus on per-capita GDP or GDP growth rates rather than levels. This practice is reflected in the number of estimates reported in the original studies analysed here. There are only 27 reported estimates for the impact of corruption on per-capita GDP level, but the number of estimates on growth rates is 478 – and this is only for direct effects.

In the next step, we have merged versions 1 and 2 of each corruption data source in order to obtain a single scale for each corruption data source. This was done by generating a new set of reported estimates in which the sign of the original estimate is multiplied by -1 if the original study uses version 1 of the corruption data (i.e., ICRG1, WG1, TI1 or Other1). Otherwise, the sign of the reported estimates remain the same. This method is justified because the *magnitude* of the reported estimates would have been the same had he original studies used version 2 of the index – only the sign would have changed. In fact, most of the studies using version 1 of the index acknowledge this. (See, for example, Ahlin and Pang, 2008; Aidt, 2009; Egger and Winner, 2005; Gyimah-Brempong, 2002).

Table 3 below presents unweighted means of the estimates when versions 1 and 2 of each corruption data source are merged.

An examination of Table 3 indicates that the unweighted mean of the direct effect of corruption on per-capita GDP growth and GDP growth is consistently negative across corruption data sources. A second observation is that the same pattern holds when the reported estimates represent the indirect effects of corruption on per-capita GDP growth rates too. The only exception to this pattern is the unweighted mean of the estimates from studies using ICRG data and estimating corruption's direct impact on per-capita GDP level – which is not the recommended measure in the growth literature. Given this pattern, but recalling that the unweighted mean of reported estimates does not take account of within-study and between-study heterogeneity, we can only conjecture (not conclude) that an increase in the level of perceived corruption is likely to reduce growth directly and indirectly.

Table 3: Unweighted means for study clusters:
Nested within merged corruption data source and effect type

	ICRG	WGI	TI	Other	Total N
Pcgdp_growth	-0.0612 (154)	-1.2280 (54)	-0.4230 (173)	-0.3561 (53)	**434**
Gdp_growth	-0.0078 (5)	-1.3000 (2)	-0.9448 (31)	N.E.	**38**
Pcgdp_level	0.0202 (6)	-0.3344 (11)	0.0445 (10)	N.E.	**27**
Corr*pubfin on Pcgdp_growth	-0.8279 (75)	N.E.	N.E.	N.E.	**75**
Corr*Investment on Pcgdp_growth	N.E.	-0.0243 (4)	-0.4603 (6)	N.E.	**10**
Corr*HumCap on Pcgdp_growth	N.E.	N.E.	-0.1633 (12)	NE	**12**
Total N	**240**	**71**	**222**	**53**	**596**

(Number of reported estimates in parenthesis)
N.E. = No estimates reported in original studies

When we compare the magnitudes of the average estimates, we observe that the magnitude is the largest when original studies use WGI data; followed by others using TI, Other and ICRG data. In other words, data heterogeneity is clearly associated with heterogeneity in the magnitude of the estimated effects of corruption on all measures of growth. Therefore, the simple means reported at this level of nesting/aggregation should be considered only as indicative yet non-robust measures of pooled estimates. Instead, more attention has to be given to weighted means; and to the bias and precision tests results to be reported later. While the random-effect estimates of weighted means take into account both within- and between-study heterogeneity, the precision effect tests will enable us to verify if the estimates pooled at different levels of nesting/aggregation reflect genuine effect beyond publication bias.

4.4.3 Meta-analysis results-3: Weighted means and precision-effect tests for clusters of original estimates

In this section, we report the weighted means of the original estimates, nested within 4 corruption data sources and 6 measures of growth (Table 4); and within 3 country types and 6 measures of growth (Table 5). These weighted means have been calculated in accordance with the random-effect estimator discussed above. As can be seen from Table 4 below**,** the weighted mean is consistently negative for all measures of growth and all corruption data sources. The exception we noted with respect to simple means above (the positive simple mean for estimates nested within the ICRG data and per-capita GDP level) no longer holds. A comparison with Table 3 also reveals that the magnitudes of the weighted means are smaller than that of simple means. This result is important because it demonstrates that the weighted means are weighted downward by the effects of within- and between-study heterogeneity. As such, they are more reliable measures of synthesized effect if they pass the precision effect test (PET).

Table 4: Weighted means for clusters:
Nested within merged corruption data source and effect type

	ICRG	WGI	TI	Other	**Total N**
Pcgdp_growth	**-0.0233*** (154)	-0.8191 (54)	**-0.2378*** (173)	-0.2242 (53)	**434**
Gdp_growth	**-0.0060*** (5)	-1.0258 (2)	**-0.8376*** (31)	N.E.	**38**
Pcgdp_level[a]	-0.0223 (6)	-0.2303 (11)	-0.1289 (10)	N.E.	**27**
Corr*pubfin on pcgdp_growth	**-0.7259*** (75)	N.E.	N.E.	N.E.	**75**
Corr*Investment on pcgdp_growth[b]	N.E.	-0.0213 (4)	-0.3023 (6)	N.E.	**10**
Corr*HumCap on pcgdp_growth[b]	N.E.	N.E.	**-0.1124*** (12)	N.E.	**12**
Total N	**240**	**71**	**222**	**53**	**596**

(Number of reported estimates in parenthesis)
bold* = Precision-effect test indicates genuine effect
N.E. = No estimates reported in original studies

We have conducted precision effect tests on the original study estimates that populate each of the nests in Table 4. The **bold entries*** in Table 4 indicate that the null hypothesis of the precision-effect test (i.e., the hypothesis that there is no genuine effect) should be rejected at 10%, 5% or 1% level. (The results of WLS regressions for precision-effect and bias tests are not presented here, but can be provided on request.) Hence, at this level of nesting, it can be concluded that 6 out of 14 nests return weighted mean estimates that satisfy the precision effect test; and the remaining 8 do not.

Four (4) genuine-effect estimates are related to corruption's direct effects on per-capita GDP and GDP growth rates; and these are observed within studies using ICRG and TI corruption data. Another 2 genuine-effect estimates are related to indirect effects of corruption on per-capita GDP growth through the public finance/expenditure and human capital channels. The weighted mean estimates that do not satisfy the precision-effect test relate impact of corruption on GDP growth and tend to be concentrated in studies using the WGI corruption data. In addition, the indirect effect through the investment channel remains statistically insignificant in two corruption data sources (WGI and TI).

Taken together, Table 3 and Table 4 provide evidence that would support four conclusions. First, random-effect estimates (REEs) provide synthesized results that are not only consistent with simple means, but they are also more reliable as they take account of within- and between-study heterogeneity. Secondly, the weighted means for all nests in Table 4 have a negative sign, suggesting that an increase in perceived corruption is associated with a fall in the growth measures. Third, precision effect tests are effective in identifying random-effect estimates (weighted means) that can be taken as measures of genuine effect beyond bias at this level of nesting. Finally, it is possible to nest studies at more aggregate level and conduct precision-effect tests to verify if the weighted means calculated at that level represent genuine effects.

Given these conclusions, and with a view to identify the country-specific effects of corruption on growth, we nested/clustered the estimates within 18 nests, corresponding to 3 country types (LIC, Mixed, and All) and 6 measures of growth (3 direct and 3 indirect effects). The weighted means and the results of precision-effect tests are given in Table 5 below.

Table 5: Weighted means for clusters:
Nested within growth measures and country type

	LIC	**MIXED**	**ALL**
Pcgdp_growth	**-0.0667*** (34)	**-0.1365*** (400)	**-0.1297*** (434)
Gdp_growth	**-0.6542*** (20)	**-0.5746*** (18)	**-0.6007*** (38)
Pcgdp_level	-0.1910 (13)	-0.1157 (14)	-0.1466 (27)
Corr*pubfin on pcgdp_growth	**-0.2319*** (12)	**-0.7382*** (63)	**-0.7259*** (75)
Corr*Investment on pcgdp_growth	0.1206 (2)	**0.0362*** (8)	**0.0481*** (10)
Corr*HumCap	**-0.2890*** (2)	**-0.0183*** (10)	**-0.1124*** (12)
Total N	**83**	**513**	**596**

N.E. = No estimates reported in original studies
bold* = precision-effect test satisfied

Comparing LICs with Mixed and All countries, we can see that the direct effect of corruption of per-capita GDP growth rates in LICs is significantly smaller than Mixed and All countries. Summing both direct and indirect effects, the corruption's negative effect is -0.59 in LICs and - 0.86 in Mixed countries. Corruption's effect on GDP growth, however, is similar in LICs (-0.65) and non-LICs (-0.57). Given that the preferred measure of growth is per-capita GDP growth in the growth literature, the smaller adverse effects in LICs merit some explanation.

The relatively smaller adverse effects in LICs are compatible with two types of theoretical/analytical evidence. On the one hand, it is compatible with theoretical/analytical studies that predict that corruption tends to be more harmful after a threshold of institutional quality and it is less harmful of has no effect in countries below the this threshold (Aidt et al, 2008; Mendez and Sepulveda (2006). On the other hand, it is also compatible with theoretical/analytical evidence that indicates that corruption, combined with weak institutional quality, has substantial adverse effects on growth; but its effect may not be captured empirically as growth is reduced by a host of institutional factors (Kimenyi, 2007; Heckman and Benjamin, 2008; Dellapiane-Avellaneda, 2009).

Another reason for the relatively smaller effect of corruption on per-capita GDP in LICs may be due to the existence of excessive regulation and barriers that limit the number of economic transactions in the first place. This is in line with 'greasing the wheel' hypothesis, which suggests that corruption can be less harmful or even beneficial in the early stages of development when economic freedom is limited and access to information is tightly controlled (Heckelman and Benjamin, 2008).

Although the overall effect of corruption on growth is less detrimental in LICs compared to non-LICs, the indirect effect through the human capital channel is significantly higher in the former. This finding ties in with the predictions of the theoretical/analytical literature that emphasize the distortionary effects of corruption on the allocation of talents and investment in human capital – by the individual and by the government (Murphy, Schleifer and Vishny, 1991; Batiz, 2001; Acemoglu, 1995; Ehrlich and Lui, 1999; Blackburn and Forgues-Puccio, 2007). We do not wish to overemphasize the importance of this finding as it is based on 2 observations only, but the correlation between high levels of corruption and low levels of human capital in LICs merit special attention to corruption's indirect effect through the human capital channel.

5. Conclusions and recommendations

The *direct* effect of corruption on per-capita GDP growth in LICs is statistically significant and negative (-0.07), but low. The *indirect* effects through the *public finance and human capital channels* are much higher (-0.23 and -0.29, respectively). Hence, the total effect that satisfies the precision-effect test is -0.59. This should be interpreted as follows: a one-unit fall in the perceived corruption index of a low-income country can be expected to lead to an increase of 0.59 percentage-points in the growth rate of its per-capita GDP. For the mixed-country group (i.e, for country groups that include both LICs and Non-LICs), the total (direct and indirect) effect on per-capita GDP growth is higher - at -0.86.

There is also congruence between the empirical and theoretical/analytical findings with respect to indirect effects of corruption. In LICs, corruption has a negative and genuine indirect effect through the public finance/expenditure channel (-0.23 percentage point). This effect is higher in mixed countries (-0.74 percentage-point).

The indirect effect of corruption through the human capital channel is also negative in both LICs (-0.29) and mixed countries (-0.14). However, these results are based only on 2 estimates for LICs and 10 estimates for Mixed countries. These estimates are statistically-significant, but are based on a narrow evidence base

The meta-analysis results we reported in this review should be considered as lower-bound estimates because the majority of the original studies estimate only the direct effects of corruption on growth. Yet, investment is included in all (exogenous and endogenous) models of growth; human capital measures are included in endogenous models; and public finance/expenditure measures are included in some models. Given these model specifications, the estimates of corruption's direct effect will be biased downwards, whilst the estimates of investment, human capital and/or public finance/expenditures will be biased upwards.

The main conclusions concerning policy implications and future research can be summarised as follows.

Subject to limitations associated with meta-analysis of observational study estimates, the evidence synthesized in this review indicates that corruption has negative and statistically-significant effects on growth – directly and indirectly; and in both LICs and non-LICs. Therefore, there is a *prima facie* case for policy interventions aimed at reducing the incidence of corruption in both low-income and mixed countries. However, the findings also indicate that the economic gains from targeting corruption in low-income countries are likely to remain small if interventions aimed at reducing corruption are not combined with a wider set of interventions aimed at improving the quality of governance institutions in general. The relatively lower adverse effect of corruption in LICs is highly likely to be due to the multiplicity of institutional weaknesses other than those captured by measures of perceived corruption – as suggested by theoretical/analytical literature.

The second policy conclusion is that anti-corruption policy initiatives should prioritise corruption that distorts incentives and allocation of resources/talents with respect to public investment/expenditures and investment in human capital – where we detect negative and significant indirect effects. Anti-corruption interventions aimed at these channels should promote meritocracy in public and private employment in order to provide better incentives for individual investment in human capital; transparency/accountability in public procurement; and performance-related incentives for public employees. Such interventions should also be combined with interventions aimed at increasing the quality of governance institutions such as democratic accountability, government effectiveness and bureaucratic quality.

The third policy conclusion relates to the growth-effect of corruption through the investment channel. The meta-synthesis of the original estimates suggests that the indirect effect of corruption through the investment channel in LICs is positive (0.12). However, the precision effect test result indicates that this estimate cannot be taken as evidence of genuine effect. Despite this ambiguity, we suggest that corrupt activities should be targeted across the board because of the non-divisibility of institutional quality as a public good.

The fourth conclusion concerns the dangers involved in the conventional wisdom that assumes that corruption would have more detrimental effects on growth in countries (usually, LICs) where its level is higher. Both the theoretical/analytical and empirical evidence we synthesize in this review indicates that this may not be the case. Corruption has a negative and statistically-significant effect on per-capita GDP growth in LICs and non-LICs, but its direct effect on non-LIC per-capita GDP is substantially higher. Therefore, corruption should be considered as an international problem with negative economic consequences rather than as a problem specific to LICs only.

We derive two main conclusions about the implications of this review for future research. First, we are convinced that sophisticated methods have been developed and used to reduce the risk of endogeneity or that of the so-called 'halo effect' in the estimation of the corruption-growth relationship. However, there is evident need to supplement the perceptions-based measures of corruption with relatively 'harder' measures. One possible avenue in that direction is to construct 'weighted' corruption measures, which combine the survey-based data with data on judicial quality, bureaucratic quality and democratic accountability. Another possible avenue is to estimate the determinants of corruption and the impact of the latter on growth simultaneously with a view to inject new information into growth regressions including corruption as a potential determinant.

The second conclusion concerns the need for greater attention to the indirect effects of corruption on growth by including interaction terms in the regressions. Currently, only 16 of 83 reported estimates for LICs account for indirect effects. In the all-country sample, the proportion is 97 out our 596. Further analysis of the indirect effects of corruption on growth may be deterred by two factors: the reluctance to deviate from standard growth models; and the risk of multicollinearity (i.e., correlation between the corruption variable and the interaction terms that include corruption).

We are of the view that recognising the need for deviating from standard growth models may be conducive to theoretical innovation. The problem of multicollinearity, on the other hand, can be detected and addressed by drawing on work by Dekker et al (2007, 2003), who propose new methods for addressing multicollinearity problems.

References

1. Empirical studies included in review

Abe Kazutomo, Wilson John S; (2008) *Governance, Corruption, and Trade in the Asia Pacific Region*. World Bank Policy Research Working Paper 4731

Ahlin Christian, Pang Jiaren (2008) Are financial development and corruption control substitutes in promoting growth?. *Journal of Development Economics*. 86(2): 414-433.

Aidt Toke S; (2009) *Corruption, Institutions and Economic Development*. : Cambridge Working Papers in Economics.

Aidt Toke S; Dutta Jayasri, Sena Vania (2005) *Growth, Governance and Corruption in the Presence of Threshold Effects: Theory and Evidence*. : Cambridge Working Papers in Economics.

Aidt Toke S; Dutta Jayasri, Sena Vania (2008) Governance regimes, corruption and growth: Theory and evidence. *Journal of Comparative Economics*. 36(2): 195-220.

Aixalá José, Fabro Gema (2008) Does the impact of institutional quality on economic growth depend on initial income level? *Economic Affairs*. 28(3): 45-49.

Ali F A; Fiess N, MacDonald R (2010) Do Institutions Matter for Foreign Direct Investment?. *Open Economies Review*. 21(2): 201-219.

Anoruo Emmanuel, Braha Habtu (2005) Corruption and Economic Growth: the African Experience. *Journal of Sustainable Development in Africa*. 7(1): 43-55.

Asiedu E (2006) Foreign direct investment in Africa: The role of natural resources, market size, government policy, institutions and political instability. *World Economy*. 29(1): 63-77.

Asiedu Elizabeth, Freeman James A; (2009) The Effect of Corruption on Investment Growth: Evidence from Firms in Latin America, Sub-Saharan Africa, and Transition Countries. *Review of Development Economics*. 13(2), 200-214.

Attila G, Chambas G, Combes J L; (2009) Corruption and Mobilisation of Public Income: an Econometric Analysis. *Recherches Economiques De Louvain-Louvain Economic Review*. 75(2)

Attila Gbewopo (2008) Corruption, taxation and economic growth: theory and evidence. *CERDI, Etudes et Documents*. (E 2008.29): .

Aysan A F; Nabli M K; Veganzones-Varoudakis M A; (2007) Governance institutions and private investment: An application to the Middle East and North Africa. *Developing Economies*. 45(3): 339-377.

Baliamoune-Lutz Mina, Ndikumana Leonce (2007) *Corruption and Growth in African countries: Exploring the Investment Channel*. African Economic Conference 2007, United Nations Economic Commission for Africa Working Papers.

Barbier E B; (2010) Corruption and the Political Economy of Resource-Based Development: A Comparison of Asia and Sub-Saharan Africa. *Environmental & Resource Economics*. 46(4): 511-537.

Blackburn Keith and Forgues-Puccio Gonzalo F; (2009), 'Why is corruption less harmful in some countries than in others?'. *Journal of Economic Behavior & Organization*. 72(3): 797-810.

Blackburn Keith, Neanidis Kyriakos C; Haque M Emranul; (2008) *Corruption, Seigniorage and Growth: Theory and Evidence*. CESinfo Working Paper No 2354.

Breslin Thomas P; Samanta Subarna K; (2008), 'Investment flows, economic growth, and corruption in African countries: An analysis.' *Journal of African Business*. 9(2): 287-307.

Busse Matthias, Hefeker Carsten (2007) Political risk, institutions and foreign direct investment. *European Journal of Political Economy*. 23(2): 397-415.

Butkiewicz J L; Yanikkaya H (2006) Institutional quality and economic growth: Maintenance of the rule of law or democratic institutions, or both?. *Economic Modelling*. 23(4): 648-661.

Campos J Edgardo; Lien D, Pradhan S (1999) The impact of corruption on investment: predictability matters. *World development*. 27(6): 1059-1068.

Cuervo-Cazurra Alvaro (2007) Better the Devil You Don't Know: Type of Corruption and FDI in Transition Economies. *Journal of International Management, 2008*. : .

De La Croix, David and Delavallade, Clara (2009), 'Growth, public investment and corruption with failing institutions'. *Economics of Governance*. 10(3): 187-219.

Drury A Cooper; Krieckhaus Jonathan, Lusztig Michael (2006) Corruption, Democracy, and Economic Growth. *International Political Science Review / Revue internationale de science politique*. 27(2): 121-136.

Dzhumashev, Ratbek (2009), *Is there a direct effect of corruption on growth?*, MPRA Working paper, No. 18489.

Easterly William, Ritzen Jozef, Woolcock Michael (2006) Social cohesion, institutions and growth. *Economics & Politics*. 18(2): 103-120.

Egger Peter, Winner Hannes (2005) Evidence on corruption as an incentive for foreign direct investment. *European Journal of Political Economy*. 21(4): 932-952.

Ehrlich Isaac, Lui Francis T; (1999), 'Bureaucratic corruption and endogenous economic growth'. *The Journal of Political Economy*. 107(6): S270-S293.

Everhart Stephen S; Martinez-Vazquez Jorge, McNab Robert M; (2009) Corruption, governance, investment and growth in emerging markets. *Applied Economics*. 41(13): 1579-1594.

Feng Yi (2003) *Democracy, Governance and Economic Performance - theory and evidence*. Cambridge, MA: MIT Press. xvii 383 pp: Massachuset Institute of Technology.

Ghura Dhaneshwar (2002) Tax Revenue in Sub-Saharan Africa: Effects of Economic Policies and Corruption. In: Sanjeev Gupta, George T Abed; *Governance, Corruption & Economic Performance.* Washington D.C.: IMF, pages 369-395.

Guetat Imène (2006) The effects of corruption on growth performance of the MENA countries. *Journal of Economics & Finance*. 30(2): 208-221.

Gupta Sanjeev, Davoodi Hamid, Alonso-Terme Rosa (2002) Does corruption affect income inequality and poverty?. *Economics of Governance*. 3(1): 23.

Gyimah-Brempong Kwabena (2002) Corruption, Economic Growth and Income Inequality in Africa. *Economics of Governance*. 3: 183-209.

Gyimah-Brempong Kwabena, De Camacho , Samaria Munoz (2006) Corruption, Growth, and Income Distribution: Are there Regional Differences?. *Economics of Governance*. 7(3): 245-269.

Habib Mohsin, Leon Zurawicki (2002) Corruption and Foreign Direct Investment. *Journal of International Business Studies*. 33(2): 291-307.

Haque Emranul M; Kneller Richard (2008) *Public Investment and Growth: The Role of Corruption*. University of Manchester Centre for Growth & Business Cycle Research Discussion Paper Series No 098.

Hongyi Li, Lixin C. Xu, Heng-Fu Zou (2000) Corruption, income distribution and growth. *Economics & Politics*. 12(2): 155-182

Hsiao Cheng, Shen Yan (2003) Foreign Direct Investment and Economic Growth: The Importance of Institutions and Urbanization. *Economic Development and Cultural Change*. 51(4): 883-896.

Imai Katsushi S; Gaiha Raghav, Thapa Ganesh (2010) Is the Millennium Development Goal on Poverty Still Achievable? The Role of Institutions, Finance and Openness. *Oxford Development Studies*. 38(3): 309-337.

Imam, Patrick A. And Davina F. Jacobs (2007), *Effect of corruption on tax revenues in Middle east countries*, IMF Working Paper, no. WP/07/270.

Javorcik B S; Wei S J; (2009) Corruption and cross-border investment in emerging markets: Firm-level evidence. *Journal of International Money and Finance*. 28(4): 605-624.

Kalyuzhnova Yelena, Kutan Ali M; Yigit Taner M; (2009) Corruption and Economic Development in Energy-Rich Economies. *Comparative Economic Studies, Vol. 51, Issue 2, pp. 165-180, 2009.* : .

Kandil Magda (2009) Determinants of institutional quality and their impact on economic growth in the MENA region. *International Journal of Development*. Vol. 8(No. 2): .

Ketkar Kusum W; Murtuza Athar, Ketkar Suhas L; (2005) Impact of corruption on foreign direct investment and tax revenues. *Journal of Public Budgeting, Accounting & Financial Management*. 17(3): 313-341.

Khamfula Yohane (2007) Foreign Direct Investment and Economic Growth in EP and IS Countries: The Role of Corruption. *World Economy*. 30(12): 1843-1854.

Law Siong Hook; (2006) Institutional quality and economic performance: Panel data evidence from Asian developing economies. *The IUP Journal of Applied Economics*. V(5): 37-51.

Lee J H; (2006) Business corruption, public sector corruption, and growth rate: time series analysis using Korean data. *Applied economics letters*. 13(13): 881-885.

Mauro Paolo (1995) Corruption and Growth. *The Quarterly Journal of Economics*. 110(3): 681-712.

Mauro Paolo (1997) The Effects of Corruption on Growth, Investment and Government Expenditure: A Cross-Country Analysis. *Institute for International Economics*. : 83-107.

Mauro Paolo (2004), 'The Persistence of corruption and slow economic growth'. *IMF Staff Papers*. 51(1): 1-18

Méon Pierre-Guillaume, Sekkat Khalid (2005) Does Corruption Grease or Sand the Wheels of Growth?. *Public Choice*. 122(1/2): 69-97.

Mishra Anil, Daly Kevin (2007) Effect of quality of institutions on outward foreign direct investment. *Journal of International Trade & Economic Development*. 16(2): 231-244.

Mo Hung Pak; (2001), 'Corruption and economic growth'. *Journal of Comparative Economics*. 29: 66-79

Mocan Naci (2009) Corruption, corruption perception and economic growth. *Economic performance in the Middle East and North Africa*. : 1-39.

Naude W A; (2004) The effects of policy, institutions and geography on economic growth in Africa: an econometric study based on cross-section and panel data. *Journal of international development*. 16(6): 821-850.

Pellegrini Lorenzo, Gerlagh Reyer (2004) Corruption's Effect on Growth and its Transmission Channels. *Kyklos*. 57(3): 429-456.

Rahman Aminur, Kisunko Gregory, Kapoor Kapil (2000) *Estimating the Effects of Corruption: Implications for Bangladesh*. World Bank Policy Research Working Paper (No 2479).

Rock Michael T; Bonnett Heidi (2004) The Comparative Politics of Corruption: Accounting for the East Asian Paradox in Empirical Studies of Corruption, Growth and Investment. *World Development*. 32(6): 999-1017.

Sayan Serdar, Acemoglu Daron (2009) *Economic performance in the Middle East and North Africa: institutions, corruption and reform*. London, New York: Routledge.

Sayan Serdar (2009) Institutions and economic performance in the MENA region. *Economic performance in the Middle East and North Africa*.

Shimpalee Pattama L; Breuer Janice Boucher; (2006) Currency crises and institutions. *Journal of International Money and Finance*. 25(1): 125-145.

Sindzingre Alice N; Milelli Christian (2010) *The Uncertain Relationship between Corruption and Growth in Developing Countries: Threshold Effects and State Effectiveness*. : University of Paris West - Nanterre la Defense, Document De Travail Working Paper.

Swaleheen Mushfiq Us; (2007) Corruption and Investment Choices: A Panel Data Study. *Kyklos*. 60(4): 601-616.

Tanzi Vito, Davoodi Hamid (1997) *Corruption, Public Investment and Growth*. IMF Working Paper Series – WP/97/139.

Voyer Peter A; Beamish Paul W; (2004) The Effect of Corruption on Japanese Foreign Direct Investment. *Journal of Business Ethics*. 50(3): 211-224.

2. Theoretical/analytical studies included in the review

Aidt Toke S; Dutta Jayasri, Sena Vania (2005) *Growth, Governance and Corruption in the Presence of Threshold Effects: Theory and Evidence*. Cambridge Working Papers in Economics.

Aidt Toke S; Dutta Jayasri, Sena Vania (2008), 'Governance regimes, corruption and growth: Theory and evidence'. *Journal of Comparative Economics*. 36(2): 195-220.

Baliamoune-Lutz M (2009), 'Human well-being effects of institutions and social capital'. *Contemporary Economic Policy*. 27(1): 54-66.

Bardhan, Pranab (1997), 'Corruption and development: A review of issues'. *Journal of Economic Literature*. 35(3): 1320.

Blackburn Keith and Forgues-Puccio Gonzalo F; (2009), 'Why is corruption less harmful in some countries than in others?'. *Journal of Economic Behavior & Organization*. 72(3): 797-810.

Blackburn Keith, Neanidis Kyriakos C; Haque M Emranul; (2008) *Corruption, Seigniorage and Growth: Theory and Evidence*. CESinfo Working Paper Series.

Breslin Thomas P; Samanta Subarna K; (2008), 'Investment flows, economic growth, and corruption in African countries: An analysis.' *Journal of African Business*. 9(2): 287-307.

Chang Ha-joon (1998) 'The role of institutions in Asian development.' *Asian development review*. 16(2): 64-95.

Clausen Bianca, Kraay Aart, Nyiri Zsolt (2009) *Corruption and Confidence in Public Institutions - Evidence from a Global Survey*. World Bank Policy Research Working Paper 5157.

De La Croix, David and Delavallade, Clara (2009), 'Growth, public investment and corruption with failing institutions'. *Economics of Governance*. 10(3): 187-219.

Dellepiane-Avellaneda Sebastian (2010) 'Good governance, institutions and economic development: beyond the conventional wisdom'. *British journal of political science*. 40(1): 195-224.

Drury A Cooper; Krieckhaus Jonathan, Lusztig Michael (2006), 'Corruption, democracy, and economic growth'. *International Political Science Review / Revue internationale de science politique*. 27(2): 121-136.

Ehrlich Isaac, Lui Francis T; (1999), 'Bureaucratic corruption and endogenous economic growth'. *The Journal of Political Economy*. 107(6): S270-S293.

Feng Yi (2003) *Democracy, Governance and Economic Performance - theory and evidence*. Cambridge, MA: MIT Press. Massachuset Institute of Technology.

Fosu A (2006), ‘Institutions, governance and economic development in Africa – Preface’. *Journal of African Economies*. 15: I-II.

Heckelman Jac C; Powell Benjamin (2010), ‘Corruption and the institutional environment for growth’. *Comparative Economic Studies, Vol. 52, Issue 3, pp. 351-378, 2010.* : .

Hillman Arye L. (2004), ‘Corruption and public finance: an IMF perspective’. *European Journal of Political Economy*. 20(4): 1067-1077.

Khan Mushtaq (1999), ‘Patron-client networks and the economic effects of corruption in Asia’. *European Journal of Development Research.* 10(1): 15 — 39.

Kimenyi Mwangi S; (2007), ‘Markets, institutions and Millennium Development Goals’. *Economic Affairs*. 27(2): 14-19.

Kumssa Asfaw, Mbeche Isaac M; (2004), ‘The role of institutions in the development process of African countries’. *International Journal of Social Economics*. 31(9): 840-854.

Larsson Tomas (2006), ‘Reform, corruption, and growth: Why corruption is more devastating in Russia than in China’. *Communist and Post-Communist Studies*. 39(2): 265-281.

Luiz J M; (2009), ‘Institutions and economic performance: implications for African development’. *Journal of international development*. 21(1): 58-75.

Mauro Paolo (2004), ‘The Persistence of corruption and slow economic growth’. *IMF Staff Papers*. 51(1): 1-18.

Mijiyawa Abdoul' Ganiou; (2008), ‘Sustained economic growth: Do institutions matter and which one prevails?’. *CATO Journal*. 28(3): 385-420.

Mishra Anil, Daly Kevin (2007), ‘Effect of quality of institutions on outward foreign direct investment’. *Journal of International Trade & Economic Development*. 16(2): 231-244.

Mo Hung Pak; (2001), ‘Corruption and economic growth’. *Journal of Comparative Economics*. 29: 66-79

Moran J (1998), ‘Corruption and NIC development: A case study of South Korea’. *Crime Law and Social Change*. 29(2-3): 161-177.

Moran J (1999), ‘Patterns of corruption and development in East Asia’. *Third World Quarterly*. 20(3): 569-587.

Murphy Kevin M; Shleifer Andrei, Vishny Robert W; (1993), ‘Why Is rent-seeking so costly to growth?’. *The American Economic Review*. 83(2): 409-414.

Nwabuzor Augustine (2005), ‘Corruption and development: New initiatives in economic openness and strengthened rule of law’. *Journal of Business Ethics*. 59(1/2): 121-138.

Pajunen Kalle (2008), ‘Institutions and inflows of foreign direct investment: A fuzzy-set analysis’. *Journal of International Business Studies*. 39(4): 652-669.

Paldam Martin, Gundlach Erich (2008), ‘Two views on institutions and development: The grand transition vs the primacy of institutions’. *Kyklos*. 61(1): 65-100.

Pande Rohini (2007) *Understanding Political Corruption in Low Income Countries*. CID Working Paper No 145, Centre for International Development at Harvard.

Pellegrini Lorenzo, Gerlagh Reyer (2004), ‘Corruption's effect on growth and its transmission channels’. *Kyklos*. 57(3): 429-456.

Rodrik Dani (2000), ‘Institutions for high-quality growth: What they are and how to acquire them’. *National Bureau of Economic Research Working Paper Series*. No. 7540

Rowley Charles K; (2000), ‘Political culture and economic performance in sub-Saharan Africa’. *European Journal of Political Economy*. 16(1): 133-158.

Schleifer Andrew, Vishny Robert (1993), ‘Corruption’. *The Quarterly Journal of Economics*. August 1993 599-617.

Tebaldi Edinaldo, Elmslie Bruce (2008), ‘Institutions, innovation and economic growth’. *Journal of Economic Development*. 33(2): 27-53.

Ventelou Bruno (2002), ‘Corruption in a model of growth: Political reputation, competition and shocks’. *Public Choice*. 110(1/2): 23-40.

Wedeman Andrew (1997), ‘Looters, rent-scrapers, and dividend-collectors: Corruption and growth in Zaire, South Korea, and the Philippines’. *The Journal of Developing Areas*. 31(4): 457-478.

3. Other references used in the text of the technical report

Abreu, Maria, Henri L.F. de Groot and Raymond J.G.M. Florax (2005), ‘A meta-analysis of beta convergence’, *Tinbergen Institute Discussion Papers*, no. TI 2005-001/3.

Acemoglu, D., S. Johnson and J. Robinson (2004), ‘Institutions as the fundamental cause of long-run growth’, *NBER Working Paper*, No. 10481 (May 2004).

Acemoglu, D., S. Johnson and J. A. Robinson (2001), ‘The colonial origins of comparative development: an empirical investigation’, *American Economic Review*, 91 (5), pp. 1369-1401.

Aidt, T., J. Duttaz and V. Sena (2006), ‘Governance regimes, corruption and growth: Theory and evidence’, Department of Economic Studies, University of Naples “Parthenope” Discussion Papers, No. 15.

Aidt, T. (2009), ‘Corruption, institutions, and economic development’, *Oxford Review of Economic Policy*, 25(2), pp. 271-291.

Alesina, Alberto, Arnaud Devleeschauwer, William Easterly, Sergio Kurlat, and Romain Wacziarg (2003), ‘Fractionalization’, *Journal of Economic Growth* 8 (June), pp. 155-194.

Bardhan, Pranab (1997), ‘Corruption and development: A review of issues’, *Journal of Economic Literature*, vol. 35 (September 1997), pp. 1320-1346.

Barro, R. (1991), ‘Economic growth in a cross-section of countries’, *Quarterly Journal of Economics,* 106: 407–443

Bateman, I. J. and A. P. Jones (2003), ‘Contrasting conventional with multi-level modelling approaches to meta-analysis: expectation consistency in U.K. woodland recreation values’, *Land Economics*, 79(2), 235–58.

Beacon, H., R. Clarke, and H. Frost (2000), ‘Use of hierarchical models for meta-analysis: experience in the metabolic ward studies of diet and blood cholesterol’, *Statistics in Medicine*, 18(13), pp. 1657–76

Bijmolt, T. H. A. and R. G. M. Pieters (2001), ‘Meta-analysis in marketing when studies contain multiple measurements’, *Marketing Letters*, 12(2), 157–69.

Cooper, H.M. and Hedges, L. V. (eds.) (1994), *Handbook of Research Synthesis.* New York: Russell Sage.

CRD – Centre for Reviews and Dissemination (2009), *Systematic Reviews: CRD’s Guide for Undertaking Reviews in Health Care*, York: York Publishing Services.

Dalhuisen, J., R. J. G. M Florax, H. L. F. de Groot and P. Nijkamp, P. (2003), ‘Price and income elasticities of residential water demand: a meta-analysis’, *Land Economics*, Vol. 79(2), pp. 292–308.

de Dominicis, Laura, Raymond J. G. M. Florax and Henri L. F. de Groot (2008), ‘A meta-analysis on the relationship between income inequality and economic growth’, *Scottish Journal of Political Economy*, 55(5), pp. 654-682.

Donaldson, J. A. (2008), ‘Growth is good for whom, when, how? Economic growth and poverty reduction in exceptional cases’, *World Development*, 36(11), 2127-2143.

Doucouliagos, C. and Laroche, P. (2003). ‘What do unions do to productivity: a meta-analysis’, *Industrial Relations*, Vol. 42(4), pp. 650–691.

Dreher, Axel, Christos Kotsogiannis & Steve McCorriston (2007), 'Corruption around the world: Evidence from a structural model', *Journal of Comparative Economics*, 35(3), pp. 443-466

Egger, M., G. D. Smith, M. Schnieder, and C. Minder (1997), 'Bias in meta-analysis detected by a simple, graphical test', *British Medical Journal*, 315(7109), pp. 629–634.

Florax, R. J. G. M. (2002). 'Methodological pitfalls in meta-analysis: publication bias', in Florax R., Nijkamp P. and Willis K. (eds), *Comparative Environmental Economic Assessment*, Edward Elgar, Cheltenham.

Fosu, A. (2009), 'Inequality and the Impact of Growth on Poverty: Comparative Evidence for Sub-Saharan Africa. *Journal of Development Studies*, 45(5), pp. 726-745.

Goldstein, H. (1995). *Multilevel Statistical Models* (2nd edn.). London: Edward Arnold.

Goldstein, H., m. Yang, R. Omar, R. Turner, and S. Thompson (2000). 'Meta-analysis using multilevel models with an application to the study of class size effects.' *Applied Statistics*, 49(3), pp. 399–412.

Groenendijk N. (1997), 'A principal-agent model of corruption', *Crime, Law and Social Change*, 27(3-4), pp. 203-227.

Hedges, L. V. (1992). 'Modelling publication selection effects in meta-analysis', *Statistical Science*,
vol. 7, pp. 246–255.

Huntington, S. P. (1968), *Political Order in Changing Societies*, New Haven: Yale University Press.

Kaufmann, D., A. Kraay, and M. Mastruzzi (2007) 'The Worldwide Governance Indicators Project: Answering the critics', *World Bank Policy Research Working Paper*, no. 4149.

Knack, S. and P. Keefer (1997b), 'Why don't poor countries catch up? A cross-national test of institutional explanation', *Economic Inquiry*, 35(4), pp. 590-602.

Knack, Stephen (2002), 'Social capital, growth, and poverty: A survey of cross-country evidence', in C. Grootaert and T. van Bastelaer (eds), *The Role of Social Capital in Development: An Empirical Assessment*, Cambridge: Cambridge University Press, ch. 11).

Kurtz, M. J. and A. Schrank (2007), 'Growth and governance: Models, measures, and mechanisms', *Journal of Politics,* 69 (2), pp. 538–554.

Leff, Nathaniel H. (1964), 'Economic development through bureaucratic corruption', *American Behavioral Scientist*, 8(3), pp. 8-14

Levine, R. And D. Renelt (1992), ‘A sensitivity analysis of cross-country growth regressions’, *American Economic Review* 82(4), pp. 942–963

Macaskill, P., S. D. Walter and L. Irwig (2001). ‘A comparison of methods to detect publication bias in meta-analysis’, *Statistics in Medicine*, Vol. 20, pp. 641–654.

Mankiw, N. G., D. Romer and D. N. Weil (1992), ‘A contribution to the empirics of economic growth’, *Quarterly Journal of Economics,* 107(3), pp. 407-437.

Mauro, P. (1995), ‘Corruption and growth’, *Quarterly Journal of Economics*, 110(3), pp. 681-712.

Mauro, P. (1996), ‘The effects of corruption on growth, investment, and government expenditure’, *IMF Working Papers*, no. WP/96/98.

Méon P-G. And K. Sekkat (2005), ‘Does corruption grease or sand the wheels of growth?’, *Public Choice*, 122(1/2), pp. 69-97.

Meon, P-G and L. Weill (2010), ‘Is corruption an efficient grease?’, *World Development*, 38(3), pp. 244–259,

Mo, Hung Pak (2001), ‘Corruption and economic growth’, *Journal of Comparative Economics*, 29(1), pp. 66-79

Myrdal, G. (1968), *Asian Drama*, New York: Random House.

Podobnik, B. (2008), ‘Influence of corruption on economic growth rate and foreign investment’, *European Physical Journal B*, vol. 63, no. 4, pp. 547-550

Nijkamp, p. and K. Willis (eds), *Comparative Environmental Economic Assessment*, Cheltenham: Edward Elgar.

North, D. C. (1990), *Institutions, Institutional Change and Economic Performance*, New York: Cambridge University Press.

North. D. C. (1994), ‘Economic performance through time’, *American Economic Review*, vol. 84(3), pp. 359-368.

Rodrik, D. (1999), ‘Where did all growth go? External shocks, social conflict, and growth collapses’ *Journal of Economic Growth*, 4(4), pp. 385-412.

Rodrik, D., A. Subramanian and F. Trebbi (2004), ‘Institutions rule: the primacy of institutions over geography and integration in economic development, *Journal of Economic Growth*, 9 (2), pp. 131-165.

Rosenthal, R. (1991), *Meta-Analytic Procedures for Social Research.* (Revised ed.). Newbury Park, CA: Sage Publications.

Rutter, C. M. and C.A. GATSONIS (2001), ‘A hierarchical regression approach to meta-analysis of diagnostic test accuracy evaluations’, *Statistics in Medicine*, 20, pp. 2865–84.

Sachs, J. And A. Warner (1997) Fundamental Sources of Long-Run Growth. *American Economic Review* 87(2), pp. 184–188

Sachs, J. D. and A. M. Warner (1997), ‘Sources of slow growth in African economies’, *Journal of African Economies*, 6(3), pp. 335-376.

Stanley, T. and H. Doucouliagos (2007), ‘Identifying and correcting publication selection bias in the efficiency-wage literature: Heckman Meta-Regression’, Deakin University Working Papers 2007-11.

Stanley, T. D. (2001). ‘Wheat from chaff: meta-analysis as quantitative literature review’, *Journal of Economic Perspectives*, Vol. 15, pp. 131–150.

Stanley, T. D. (2005). ‘Beyond publication bias’, *Journal of Economic Surveys*, 19(3), pp. 309–345.

Stanley, T. D., Stephen B. Jarrell and Hristos Doucouliagos (2009), ‘Could it be better to discard 90% of the data? A statistical paradox’, Deakin University, *Economics Working Papers* No. SWP 2009/13

Stanley, T.D. (2008). “Meta-regression methods for detecting and estimating empirical effects in the presence of publication selection,” *Oxford Bulletin of Economics and Statistics*, 70(2), pp. 103-127.

Sterne, J. A., M. Egger and G. D. Smith (2001), ‘Investigating and dealing with publication and other biases in meta-analysis’, *British Medical Journal*, 323(7304), pp. 101–105.

Svensson, J. (2005), ‘Eight questions about corruption’, *Journal of Economic Perspectives*, 19(3), pp. 19–42

Taylor, K. W. and J. Frideres (1972), ‘Issues versus controversies: substantive and statistical significance’, *American Sociological Review*, 37 (4), pp. 464-472

Wei, Shang-Jin (1999), ‘Corruption in economic development - beneficial grease, minor annoyance, or major obstacle?’ *World Bank Policy Research Working Papers*, No. WPS 2048, 1999.