Systematic review

Evidence on the economic growth impacts of corruption in low-income countries and beyond

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August 2011

UKaid from the Department for International Development
University of Greenwich
EPPI Centre
IOE London
Leading education and social research
Institute of Education
University of London

The EPPI-Centre reference number for this report is 1914.

This report should be cited as: Ugur M, Dasgupta N (2011) *Evidence on the economic growth impacts of corruption in low-income countries and beyond: a systematic review*. London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London.

ISBN: 978-1-907345-21-0

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List of abbreviations

2SLS	Two-stage least square regression/estimation
3SLS	Three-stage least square regression/estimation
BERI	Business Environment Risk Intelligence
CPIA	World Bank Country Policy and Institutional Assessments
EM/EM2	Empirical/mixed studies included in the review
FAT	Funnel-asymmetry test
FEE	Fixed-effect estimates
GDP	Gross domestic product
GMM	General method of movements estimation
ICRG	International Country Risk Guide measure of corruption
ICRG1	ICRG corruption data – higher values refer to *more* corruption
ICRG2	ICRG corruption data – higher values refer to *less* corruption
LIC	Low-income countries as defined by the World Bank
MLPSE	Maximum likelihood publication selection estimator
MST	Meta-significance test
NGO	Non-governmental organisation
OLS	Ordinary least squares regression/estimation
PET	Precision-effect test
RCT	Randomised control trial
REE	Random-effect estimate
TA	Theoretical/analytical studies included in the review
TI	Transparency International Corruption Perception Index
TI1	TI corruption data – higher values refer to *more* corruption
TI2	TI corruption data – higher values refer to *less* corruption
WGI	World Wide Governance Index measure of corruption
WGI1	WGI corruption data – higher values refer to *more* corruption
WGI2	WGI corruption data – higher values refer to *less* corruption
WLS	Weighted-least-square

Abstract

Background

Corruption is a symptom and an outcome of institutional weakness, with potentially adverse effects on a country's economic performance. In the last two decades, a wide range of scholars, policy-makers and practitioners have expressed concerns that corruption has gone hand-in-hand with extensive liberalisation reforms and led to poor economic outcomes, including slow growth and high levels of growth volatility. This systematic review aims to provide comparable, reliable and verifiable estimates of the effect of corruption on economic growth by controlling for study heterogeneity in terms of growth measures, data sources and country groupings.

Objectives

Our objectives are to address the impact of corruption on economic growth theoretically and empirically with a view to: (a) providing a narrative synthesis of the types of corruption and the causal links between corruption and growth; (b) providing a meta-synthesis of the empirical evidence on the direct and indirect effects of corruption on growth; and (c) mapping the narrative synthesis with the meta-analysis in order to derive policy conclusions and indicate potential avenues for further research. The review focuses on the growth impacts of corruption in low-income countries (LICs), but we also provide evidence for a larger set of countries for comparative purposes.

Study search and evaluation

We used 32 key search terms and 43 low-income country names to search in 20 electronic databases. The search yielded 1,002 studies, which were first screened on the basis of PIOS (Population-Independent Variable-Outcome-Study Design) criteria. PIOS screening led to the inclusion of 338 studies for critical evaluation. We also conducted a hand search that led to the inclusion of 14 studies. After critical evaluation, the total number of studies included for narrative synthesis and meta-analysis was 115. Included studies have similar distributions as the full sample with respect to publication date and publication type.

Methods

We combined the narrative synthesis method for theoretical/analytical studies with the meta-analysis method for empirical investigations. We used the narrative synthesis to uncover the mechanisms and country-specific factors through which the growth impact of corruption is mediated. Meta-analysis, on the other hand, is used to derive synthesised estimates of the direct and indirect effects of corruption on growth by grouping (nesting) studies on the basis of coherent

measures of corruption and growth. The meta-analysis results are presented as random-effect weighted averages. The statistical significance of the random-effect estimates is verified through precision-effect tests (PETs) that detect 'genuine' effects beyond bias.

Synthesis results

We report that corruption has a negative and genuine effect on growth in low-income countries. This aggregate result is obtained after controlling for growth measures, corruption data sources and country types. The direct effect of corruption on growth in LICs is small (−0.07 percent) but negative. The indirect effect through the public finance and human capital channels is −0.52 percent. Hence the total impact of corruption on per capita GDP growth in LICs is -0.59 percent. This should be interpreted as follows: a one-unit increase in the perceived corruption index is associated with 0.59 percentage-point decrease in the growth rate of per capita income in an LIC. For the mixed-country group, the estimated total impact of corruption on per capita GDP growth is −0.86. These results are obtained by clustering studies within 18 nests, each of which is defined by a given metric for growth and a country type. As such, the risk of within-study dependence affecting these estimates is minimised but may not be eliminated altogether.

Conclusions and recommendations

Despite a residual risk of within-study dependence, the statistical significance of the estimated effect sizes suggests that there is a prima facie case for anti-corruption policy interventions in both low-income and mixed countries. However, economic gains from reducing corruption in low-income countries can be increased if anti-corruption interventions are combined with a wider set of policies aimed at improving institutional quality and providing correct incentives for investment in human capital. This systematic review also indicates that levels of corruption in LICs may be higher than in non-LICs, but the latter stand to gain more from reducing the incidence of corruption. With respect to implications for future research, we report that innovation is both necessary and feasible with respect to construction of better corruption data, estimation of indirect effects of corruption on growth, and addressing multicollinearity problems in cross-section or panel-data estimations.

Executive summary

Background

Corruption is an ancient problem with which philosophers, economists, political scientists and policy-makers have grappled since 4th century BC (Bardhan, 1997). Nonetheless, research on the causes and consequences of corruption has recorded a significant increase in the last two decades. This increased interest has been underpinned by two developments. On the one hand, corruption has appeared to become more manifest as countries have embarked on a wide range of liberalisation reforms in the context of rapid globalisation. On the other hand, the descriptive evidence appeared to be suggesting a negative association between the level of perceived corruption in a country and the latter's capacity to benefit from liberalisation reforms and globalisation.

Corruption is defined as abuse of public office for private gains by an agent. The agent is appointed to provide public service to a principal (usually a member of the public), who is unable to hold the agent accountable due to high monitoring costs. The corruption data used in the original studies aim to capture practices that include nepotism, job reservations, 'favour-for-favours', secret party funding, suspiciously close ties between politics and business, bribery of public officials, kickbacks in public procurement, embezzlement of public funds and 'capture' of the state by elites and private interests.

The increased volume of research on economic consequences of corruption has meant an increase in heterogeneity with respect to findings and in terms of estimation methodology, data sources and country coverage. This combination has made it difficult to derive comparable, reliable and verifiable conclusions about the effect of corruption on economic growth.

This systematic review aims to contribute to existing knowledge by: (a) providing a narrative synthesis of the types of corruption and the causal links between corruption and economic growth; (b) providing a meta-analysis of the empirical evidence on the direct and indirect effects of corruption on growth; and (c) mapping the narrative synthesis with the meta-synthesis in order to derive policy conclusions and to indicate potential avenues for further research. We present the results of the meta-synthesis for low-income countries separately, but we also provide findings on the corruption-growth relationship in a wider context, including low-income and other countries.

Because corruption is essentially an undocumented transaction, measures of corruption used in the original studies usually consist of average scores per country/year compiled from surveys conducted by international public and private

organisations – including Transparency International, the World Bank and the International Country Risk Guide.

Methods

We have followed a systematic review methodology that draws on the principles developed by the Centre for Reviews and Dissemination (CRD) of the University of York and the Cochrane and Campbell Collaborations. We have adapted these principles to address the specific issues/needs that arise in the context of systematic reviews of econometric and qualitative evidence on the growth impacts of corruption. The resulting methodology provides for a predefined set of criteria for: (a) identifying the relevant studies; (b) selecting, evaluating and including/excluding the relevant studies; (c) collecting, recording and coding data in a systematic way; (d) clustering/nesting the evidence; and (e) using the appropriate methods for synthesis.

Our strategy was designed to capture the maximum number of studies by using 32 keywords/concepts and synonyms and 43 country names in electronic searches of 20 databases. We identified 1,002 studies, of which 338 were selected for critical evaluation. During critical evaluation, we conducted a manual search and consulted references, which led to the inclusion of 14 studies in the sample. At the end of the critical evaluation, we included 115 studies for analysis, with 8 studies included in both the empirical and the theoretical/analytical sets.

For synthesis, we combined the narrative synthesis method (Popay et al, 2006; CRD, 2009) with the meta-analysis method (Stanley, 2008). This combination enabled us to map the meta-analysis results based on estimates from 84 empirical studies with the narrative synthesis results obtained from 39 theoretical/analytical studies. The narrative synthesis uncovered the causal mechanisms, transmission channels and country-specific political economy factors through which corruption affects growth. The meta-analysis method has allowed us to synthesise the estimates reported in the original studies and to verify whether the synthesised evidence can be considered as a reliable measure of corruption's effect on economic growth. For meta-analysis, we first calculated the weighted means of the estimates reported by the original studies nested/clustered at different levels of aggregation. The weighted means for nests/clusters of studies account for variations (heterogeneity) within and between studies. Secondly, we verified the reliability of the weighted means by conducting precision-effect tests (PETs) at the same levels of nesting/clustering.

The nesting concept is informed by de Dominicis et al. (2008) in economics and earlier work in medical research such as Frost et al. (1999) and Goldstein et al. (2000). The aim of the nesting procedure is to pool a number of studies into a particular cluster defined by a unique measure of growth and corruption data type or country type. This procedure minimises the risk of dependence between

multiple effect sizes reported by a given study in two ways. On the one hand, it distributes the multiple estimates into different nests and thereby reduces the number of multiple estimates drawn from a single study. On the other hand, it pools the multiple estimates from a single study together with estimates from other studies and thereby reduces the effect of the residual dependence on the weighted mean effect to be calculated for each nest. To test for statistical significance of the estimates within each nest and hence that of the weighted mean, we use the precision-effect tests (PETs) proposed by Stanley (2008) and used widely in the literature.

Details of the included studies

Included studies (115) follow a similar distribution to all the search results (1,002), which reflects an increasing number of studies per year from the mid-1990s to 2010. As a rule, we included empirical work that estimated the impact of corruption on growth by utilising a variant of the growth regression models in the 'empirics of growth' literature that follows Barro (1991) and Mankiw et al. (1992).

The majority of the unweighted and weighted averages of the estimates reported in the empirical studies suggest that corruption has negative direct and indirect effects on various measures of growth, including per capita GDP growth as the main indicator used in this review and in the empirical growth literature. However, there is a high degree of within- and between-study divergence with respect to estimation methods, corruption data sources, measures of growth analysed and the number of estimates reported. Therefore, we nested the studies first within 48 nests (groups) defined by 6 measures of growth and 8 types of corruption data. Then we narrowed down the number of nests to 24 by combining the two variants of the corruption data used from the same data source. Finally, we reduced the number to 18 nests, defined by 6 measures of growth and 3 country types.

We have classified the theoretical/analytical studies (39) into two major categories, corresponding to Type I (bureaucratic) and Type II (political) corruption. Studies focusing on Type I corruption examine its adverse effects on growth through higher transaction costs, misallocation of resources and talent, and higher risks for innovators/investors. Studies on Type II corruption, on the other hand, tend to analyse the adverse impact of corruption on growth through the public finance and expenditure channels. Studies on Type II corruption tend to report negative effects on growth due to distortions in the public finance/expenditure channel. Studies on Type I corruption, however, tend to point to contextual factors that may lead to non-linear effects across countries and over time. The contextual factors include the level of development, the quality of governance institutions in general, and the extent of entralisation/decentralisation of corrupt activities.

Synthesis results

The narrative synthesis of the theoretical/analytical literature has enabled us to derive a number of conclusions concerning the types of corruption, the channels through which corruption affects growth, the causal mechanisms in the corruption-growth relationship, and the country-specific political economy factors that mediate the effect of corruption on growth.

With respect to type, we report that bureaucratic (Type I) corruption tends to distort the allocation of talent and skills away from productive (entrepreneurial) activities towards non-productive (rent-seeking) activities. Political (Type II) corruption, on the other hand, tends to distort the allocation of public funds and sale of public assets in a way that produces political rents or unlawful economic rents. Although both types tend to affect economic growth adversely, the effects of Type I corruption are more likely to be context-dependent compared to Type II corruption. With respect to contextual factors, we report that the level of development, the overall quality of governance institutions and the extent of co-ordination/centralisation in corrupt practices mediate the effect of corruption on growth. The negative relationship between corruption and economic growth can be expected to become more detrimental as we move from countries with the lowest levels of per capita income, institutional quality and co-ordination/centralisation of corrupt practices to others with higher scores for these attributes. So far as transmission channels are concerned, the narrative synthesis suggests that Type I corruption would tend to affect growth through the investment, human capital and institutional channels; whereas Type II corruption works through the public finance/expenditures channel.

The meta-analysis results concur with those of the narrative synthesis. First, they confirm the narrative synthesis result that the effect of corruption on growth is likely to be non-linear. Secondly, they demonstrate that corruption would have both direct and indirect effects on growth, and that the indirect effects would tend to percolate through transmission channels such as investment, human capital and public finance/expenditures. Third, they confirm that corruption should include both Type I and Type II corrupt practices and that the latter has significantly adverse effects on growth through the public finance/investment channel.

We report that the adverse effect of corruption on growth in LICs is negative but less detrimental than the effect in mixed-country samples consisting of LICs and non-LICs. This finding indicates that corruption is detrimental for low-income countries where faster growth rates are required for catching up and poverty reduction. However, it also contradicts the received wisdom that corruption is essentially a problem for LICs, where its incidence is high. On the contrary, we found that corruption is an international problem and that middle-income and

developed countries stand to gain more than LICs from reducing the incidence of corruption further.

The direct effect of corruption on per capita GDP growth in LICs is statistically significant and negative (-0.07 percentage point), but low. The indirect effects through the public finance and human capital channels are higher (−0.23 and −0.29 percentage points, respectively). Hence, the total effect that satisfies the precision-effect test is −0.59 percentage point. This should be interpreted as follows: a one-unit increase in the perceived corruption index of a low-income country can be expected to lead to a fall of 0.59 percentage point in the growth rate of its per capita GDP. The corresponding effect in 'mixed' countries (including LICs and more developed countries) is −0.86 percentage point. These results are obtained by clustering studies within 18 nests, each of which is defined by a given metric for growth and a country type. As such, the risk of within-study dependence affecting these estimates is minimised but may not be eliminated altogether.

There is also congruence between the meta-synthesis and narrative synthesis results with respect to transmission channels. In LICs, corruption has a negative indirect effect through the public finance/expenditure channel (−0.23 percentage point) and through the human capital channels (−0.29 percentage point). The indirect effects for mixed countries are −0.74 and −0.14, respectively. The synthesised estimates of the indirect effects are statistically significant, but are based on a narrow evidence base.

Finally, the indirect effect of corruption on per capita GDP growth through the investment channel is positive both for LICs (+0.12) and for mixed countries (+0.04). The precision-effect test is satisfied only for mixed countries. Therefore, we can conclude that corruption has a positive and genuine indirect effect on growth through the investment channel only in mixed countries. However, this finding can also be considered as indirect confirmation of a positive effect through the investment channel in LICs too as the latter are part of the mixed country group. Thus, it is possible to infer that corruption may be having a 'greasing the wheel effect' through the investment channel by enabling investors to 'get things done' in the presence of excessive bureaucratic obstacles. However, this 'greasing the wheels' effect through the investment channel is more than outweighed by the negative direct and indirect effects summarised above.

Conclusions and recommendations

Bearing in mind the residual risk of within-study dependence, the evidence we synthesised in this review indicates that corruption has negative and statistically significant effects on growth, both directly and indirectly and in both LICs and non-LICs. Therefore, there is a prima facie case for anti-corruption policy interventions in both low-income and other countries. However, the findings also indicate that the economic gains from targeting corruption in low-income countries are likely to

remain small if anti-corruption policies 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 the theoretical/analytical literature.

The second policy conclusion is that anti-corruption policy initiatives should prioritise corruption that distorts incentives with respect to public investment/expenditures and human capital channels – where we detect highly negative and significant indirect effects. Anti-corruption interventions aimed at these channels should promote: (i) meritocracy in public and private employment in order to provide better incentives for individual investment in human capital; (ii) transparency/accountability in public procurement; and (iii) 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 third channel through which corruption may affect growth – namely investment. The meta-synthesis of the original estimates suggests that the indirect effect of corruption through the investment channel in LICs is positive (0.12 percentage point). However, results of the precision-effect test indicate 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 inadequacy of 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 synthesise 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 effect in non-LICs is higher. Therefore, corruption should be considered as an international problem with varying degrees of adverse economic consequences rather than as a problem confined to low-income countries.

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 'hard' measures. One possible avenue in that direction is to construct 'weighted' corruption measures, which combine the survey-based data with 'hard 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 injecting 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 of 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. (2003, 2007), who propose semi-partialling tests that are robust against multicollinearity.

1. Background

1.1 Aims and rationale for the review

Corruption is an ancient problem, with which philosophers, economists, political scientists and policy-makers have grappled since the fourth century BC (Bardhan, 1997). Yet the increase in the volume of research on the causes and consequences of corruption is fairly recent – with a peak in the 1990s and a continuing momentum through the 2000s. That this timing has been coincidental with liberalisation reforms and rapid globalisation is not surprising 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. This effort has 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 policy-makers is large and expanding.

However, differences in methodology, data sources and country groupings – combined with an expanding volume of work – lead to high levels of heterogeneity and make it difficult for policy-makers and researchers alike to derive synthesised estimates of the effect of corruption on economic growth. In addition, it is necessary to develop an overview of the distribution of the research work in terms of country context, methodology and data sources, in order to control for within- and between-study heterogeneity and to ascertain whether one can identify a genuine effect given such heterogeneity.

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) indicating policy implications of the synthesised 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 consisting of low-income and other countries pooled together.

The original studies reviewed here draw on different corruption data sources, use different estimation methods, and cover different country groups and different time periods. This heterogeneity poses a serious challenge for systematic reviews.

We addressed this challenge by calculating fixed-effect and random-effect estimates (weighted means) at different levels of nesting/clustering. At the most disaggregated level, the nests/clusters consist of individual studies grouped on the basis of the growth measure used. Then we define nests/clusters on the basis of corruption data sources, growth measures and country types. In the third stage, we conduct precision-effect test (PETs) for the weighted mean effects synthesised at each level of nesting/clustering. Finally, we map the results of the meta-analysis with a narrative synthesis of the theoretical/analytical studies to establish the existence/absence of congruence between theory and evidence – and to provide an additional check on the reliability of the synthesised evidence.

1.2 Definitional and conceptual issues

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 captures the nature of the problem fairly well. We define corruption as 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 potential recipient of the public service). 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). Studies analysed in this systematic review examine two types of corruption: abuse of public office by government employees/bureaucrats (Type I or bureaucratic corruption); and abuse of political authority by high-level policy-makers such as ministers, ministry officials, and political representatives at central or local tiers of government (Type II or political corruption). Both types are compatible with the definition of corruption as a principal-agent problem because of the asymmetric information and/or power between the principal and the agent.

Empirical estimates we synthesise 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) the corruption scores provided by the World Governance Indicators (WGI) project of the World Bank; and other corruption measures compiled by Dreher et al. (2007) or Sachs and Warner (1997).

ICRG is part of the Political Risk Services (PRS) group, which is a private-for-profit institution that provides political and economic risk data to investors, international organisations and academic researchers. Transparency International is a non-governmental advocacy organisation whose mission is 'to create change towards a world free of corruption'.[1] The World Bank is an international governmental

[1] www.transparency.org

organisation and the aim of the WGI project is to aggregate findings from a diverse range of surveys conducted by institutes, think tanks, non-governmental organisations and international organisations. Hence, it is safe to conclude that the risk of provider or end-user bias that may be associated with the underlying data is minimised due to significant differences between data providers, their aims and their survey/aggregation methods.

We can also indicate that the underlying data is compatible with the definition of corruption as a principal-agent problem between the general public (the principals) and public officials/political actors (the agents). For example, ICRG data tries to captures the perceptions of respondents with respect to 'actual or potential corruption in the form of excessive patronage, nepotism, job reservations, 'favour-for-favours', secret party funding, and suspiciously close ties between politics and business.' (Arestis and Caner 2010). The Transparency International (TI) index, on the other hand, aims to capture 'information about the administrative and political aspects of corruption', through questions related to 'c' and questions that 'probe the strength and effectiveness of public sector anti-corruption efforts'. Finally, the WGI corruption scores aim to capture 'perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as 'capture' of the state by elites and private interests.'[2]

The corruption data consist 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). A movement up the range may refer to higher or lower levels of perceived corruption. If movement up the scale refers to lower level of corruption, we have coded the corruption data source as ICRG1, WGI1, TI1 and Other1; otherwise the corruption data source is coded as ICRG2, WGI2, TI2 or Other2.

Because corruption is essentially an undocumented transaction, existing measures of corruption tend to consist of subjective scores. As such, use of corruption data in empirical research poses significant challenges not only for the original studies but also for systematic reviews thereof. In what follows, we will summarise the debate around the use of perception-based corruption data in empirical research and elaborate on how the challenge is addressed in the original studies.

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[2] All quotes and information are from the following sources.
International Country Risk Guide (ICRG): http://www.prsgroup.com/ICRG.aspx
Transparency International (TI): http://www.transparency.org/policy_research/surveys_indices/cpi
World Wide Governance Indicators (WGI): http://info.worldbank.org/governance/wgi/sc_country.asp

Perception-based corruption measures may suffer from what is described as the '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 dependent 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, they have also been addressed in various ways.

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 that 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 a 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 is controlled for. Therefore, the short-run effect of growth on corruption perceptions reported by Kurtz and Schrank (2007) may be simply mimicking 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. Given this state of affairs, measures of corruption may be influenced by questions reflecting the concerns or preferences of the business decision makers rather than the true levels of corruption.

However, this risk may be less serious than suspected. For example, 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 to 75 percent.

This evidence does alleviate the concern about provider or end-user bias. However, it also raises the issue of divergence (of about 25 percent – 40 percent) between measures of corruption used in the original studies. Under this condition, it may be inappropriate to synthesise 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 four stages. In stage 1, we created study-based nests/clusters on the basis of six growth measures. In stage 2, we nested the original estimates within 48 possible groups corresponding to 8 types of corruption data and 6 measures of growth. In stage 3, we pooled together the two versions of the corruption measure that original studies had 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 had consistent signs across different nests/clusters.

Although consistency between the signs of the synthesised evidence is verified, there remain evident differences between the nests with respect to the *magnitude* of the estimates. The variation (heterogeneity) between magnitudes is accounted for by using random-effect estimates (REEs), which accord lower weights to original estimates associated with higher levels of within-study and between-study variation. In addition, we also conducted precision-effect tests (PETs) for estimates

at each level of aggregation/nesting to verify whether the latter represented a genuine effect, given the underlying heterogeneity and the risk of publication-selection or small-study bias.

The final definitional issue to be addressed here concerns the measures of growth. The growth literature in economics (reviewed in section 1.4), tend to use per capita gross domestic product (GDP) growth rates as the main measure of growth. This measure is preferred to others, such as GDP growth, because it accounts for population size and growth. In addition, per capita GDP is the main measure of interest in the growth literature that examines the extent of income convergence between countries.

The empirical literature on the growth impact of corruption is essentially an extension of the growth/convergence literature, with corruption introduced into the analysis as an institutional determinant of growth and convergence. This is why a large majority of the estimates reported in the original studies (434 out of 596) estimate the direct effect of corruption on per capita GDP growth, and a sizeable number (97) estimate the indirect effect of corruption on per capita GDP growth. Nevertheless, we also meta-analyse the reported estimates of corruption's effect on other measures of growth too – including GDP growth rates (38 out of 596) and per capita GDP levels (27 out of 596).

1.3 Policy and practice background

Attempts to reduce the incidence of corruption and improve governance quality in general have been at the centre of policy co-ordination and policy advice led by international organisations such as the United Nations, the World Bank, the IMF and government departments involved in issues of international development such as the Department for International Development of the UK (DFID).

The United Nations' Mexico conference of 2003 led to the adoption of a legally binding *Convention against Corruption* in May 2004. The Convention obliges the 120 signatories to make corruption a criminal offence, to develop institutions that will prevent it, and to engage in collaboration and policy co-ordination aimed at reducing the incidence of corruption. According to the United Nations Development Programme (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.

Faced with mounting evidence of corruption in transition and developing countries in the 1990s, the World Bank also began to place emphasis on the need to reduce corruption as a necessary step towards reaching the long-term goals of sustainable growth and poverty alleviation. As a result, it has played an active role in the

development of tools and frameworks aiming to reduce corruption and ensure transparency and accountability in aid and development policies. To this effect, the World Bank has developed diagnostic tools, commissioned and produced analytical work, and provided training programmes.

Similar concerns have also influenced national governmental organisations such as the DFID, which defines corruption 'as a symptom of governance and institutional failures, rooted in social systems and political culture.' The DFID is interested in both national and international causes of corruption, and one of its main objectives is to develop better measures of corruption and evaluate the effectiveness and limitations of the 'legal instruments, institutions, and policies' required to tackle it.[3]

Finally, the IMF commits to 'work with its members to promote good governance and to prevent and address corruption' in areas where it has a 'mandate and expertise'.[4] The most prominent among these are public resource management, tax administration, financial sector soundness and central bank safeguards. The IMF is also of the view that tackling corruption requires strong and transparent procedures and institutions that would ensure accountability. Like the World Bank, the IMF too provides technical assistance to its members to strengthen their capacity to combat corruption.

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.

1.4 Research background

1.4.1 Existing non-systematic reviews of the literature

As indicated above, corruption can be conceptualised as a principal-agent problem. In this setting, the agent (usually a public official) abuses his/her public authority to impose a surcharge on the delivery of a service (which may be legal or illegal) to a principal, who may be a natural or legal entity unable to hold the principal to account. Thus defined, corruption leads to a number of questions that researchers have to address. Svensson (2005) identifies eight such questions on issues such as the definition and measure of corruption, range and effectiveness of anti-corruption policies and the impact of corruption on economic growth.

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[3] See http://webarchive.nationalarchives.gov.uk/+/http://www.dfid.gov.uk/fightingpoverty/corruption.asp

[4] *The Role of the IMF in Governance Issues: Guidance Note* (Approved by the IMF Executive Board, July 25, 1997), http://www.imf.org/external/pubs/ft/exrp/govern/govindex.htm

Early work on the corruption-growth relationship suggests that corruption may result from excessive government regulation and intervention, which induce firms or individuals to bribe public officials to 'get things done'. In such settings, corruption may have a positive effect on economic growth, as it allows firms and individuals to engage in economically beneficial activities despite high levels of bureaucratic hold-ups and 'bad' laws (Huntington, 1968). However, Myrdal (1968) pointed out that the distortions that private agents try to circumvent through corruption should not be taken as given. Instead, they and corruption itself should be considered as symptoms of some underlying institutional weaknesses that, in turn, induce public officials to increase the level of administrative hold-ups in order to secure higher levels of bribes.

The debate that followed in the 1970s and 1980s tended to draw on Huntington's emphasis on excessive regulation. Unlike Huntington, however, the contributors to the debate went on to examine the unproductive rent-seeking activities that excessive regulation induces. The overall policy recommendation that followed from that debate pointed in the direction of liberalisation reforms as an antidote to rent seeking. The pioneering work in this area is Krueger (1974), who examined the causes and consequences of rent-seeking behaviour in the context of trade restrictions in Turkey.

Yet the proliferation of corrupt practices during liberalisation in transition countries and other developing countries, coupled with developments in institutional economics that followed the contributions by North (1990, 1994), have revived interest in Myrdal's insights concerning institutional weaknesses as drivers of both excessive regulation/interventions and corruption at the same time. Initially, the new research agenda was focused mainly on the microeconomic level, examining the negative impact of corruption on entrepreneurial skills, firms' choice of technology and farmers' choice of cultivation methods. This type of work became prominent in the 1980s and early 1990s, and is reviewed in Svensson (2005).

The shift of focus to the macroeconomic level began with Mauro (1995), which is cited as the first attempt at estimating the impact of corruption on economic growth empirically. Although he did not find a significant relationship between corruption and growth, he did find a significant relationship between bureaucratic efficiency and growth. Using a larger data set, Mauro (1997) concluded that the effect of corruption on investment and per capita income growth rates was negative and statistically significant. A one-standard-deviation in improvement in the control of corruption is found to be associated with a 4 percentage point increase in investment rate and a 0.5 percentage point increase in per capita income growth per annum. Mauro's results were later confirmed by Mo (2001), Méon and Sekkat (2005) and Podobnik (2008), who report consistently that corruption is detrimental to economic growth.

Although theoretical work on the relationship between corruption and economic performance dates back to the 1960s, only a few reviews of the literature exist – of which Bardhan (1997) is the first attempt. Bardhan classifies the literature into a number of thematic areas, including: (i) the static effects of corruption on efficiency; (ii) the types of corruption (centralised versus decentralised) and their differential impacts on efficiency; (iii) differences in levels and persistence of corruption; (iv) corruption and growth; and (v) policy options for tackling corruption. This review is very useful for identifying the theoretical/analytical issues in the study of corruption – and for understanding the dynamics that may explain the level, persistence and variation of corruption across countries and over time. However, Bardhan (1997) provides only a limited review of the empirical work on the relationship between corruption and growth. This limitation, however, is a reflection of the fact the empirical research was still in its early stages – and not of an oversight by the author.

Indeed, the newly emerging work has been captured by Wei (1999), who reviews the empirical work and provides new evidence on the relationship between corruption and growth. The conclusion to be derived from Wei's study is that countries with high levels of corruption tend to record poor economic performance. The adverse effects of corruption on growth and development are reported to result from reduced domestic investment, discouraged foreign direct investment, overspending in government and distorted composition of government spending. Wei (1999) then discusses various policy options, including reforming the government's role in the economy; merit-based recruitment and promotion of civil servants; paying civil servants a competitive salary in relation to similar jobs in the private sector; and international pressure on countries with high levels of corruption.

Aidt et al. (2006) have come up with a more nuanced finding on the corruption-growth relationship. They report that corruption has a regime-specific impact on growth in that it has the most harmful effects in countries with good quality institutions but little impact in countries with weak institutions. Similarly, Méon and Weill (2010) estimate the effect of corruption on output per employee (a measure of efficiency rather than growth per se) and find a similar result to that of Aidt et al. (2006): corruption is less detrimental to efficiency in countries where institutions are weak, but more detrimental to efficiency in countries with good institutions.

Finally, Aidt (2009) takes a critical look at categorising the literature into two rival camps: the 'sanders', who argue that corruption is detrimental to growth, and the 'greasers', who argue that corruption may aid growth by enabling economic actors to circumvent bureaucratic hold-ups. He concludes that the evidence supporting the 'greasing the wheels hypothesis' is very weak and shows that there is no correlation between a new measure of managers' actual experience with corruption and GDP growth. Instead, he reports a strong negative relationship

between growth in per capita wealth (not per capita GDP) and corruption – suggesting that corruption may be associated with unsustainable wealth generation even if its effect on GDP is not certain.

The brief review above enables us to make three observations. First, empirical evidence on the corruption-growth relationship tends to indicate that corruption has a negative effect on growth. Secondly, although the majority of the studies summarised here report a negative relationship between corruption and growth, some estimates are statistically insignificant. Thirdly, when non-linear models of estimation are used, the effect of corruption tends to be regime- or country-specific, with higher negative effects in developed countries with good institutions and lower or insignificant effects in less-developed countries with weak institutions. These observations indicate the need to conduct a systematic review in order to synthesise the findings on the basis of models used for estimation, country groups and effect channels. This review addresses this need by providing random-effect estimates (weighted averages) of corruption's direct and indirect effects on growth. The random effect estimates take account of between- and within-study variation; and are subjected to a precision-effect test to establish whether they reflect genuine effect beyond bias. As such, the synthesised evidence is verifiable and generalisable, and can be used as input into an evidence-based policy-making process.

1.4.2 The analytical framework informing this review

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 in many developing countries. 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 neo-classical economic theory. This 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 its 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 et al., 2004).

The importance of governance institutions had been recognised since Adam Smith (1976 [1876]: 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 continued but largely marginalised interest in the role of governance institutions, the incorporation of the latter into mainstream economic analysis did not materialise until the early 1990s, when Douglass North published his work on institutions and economic performance. In this 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).

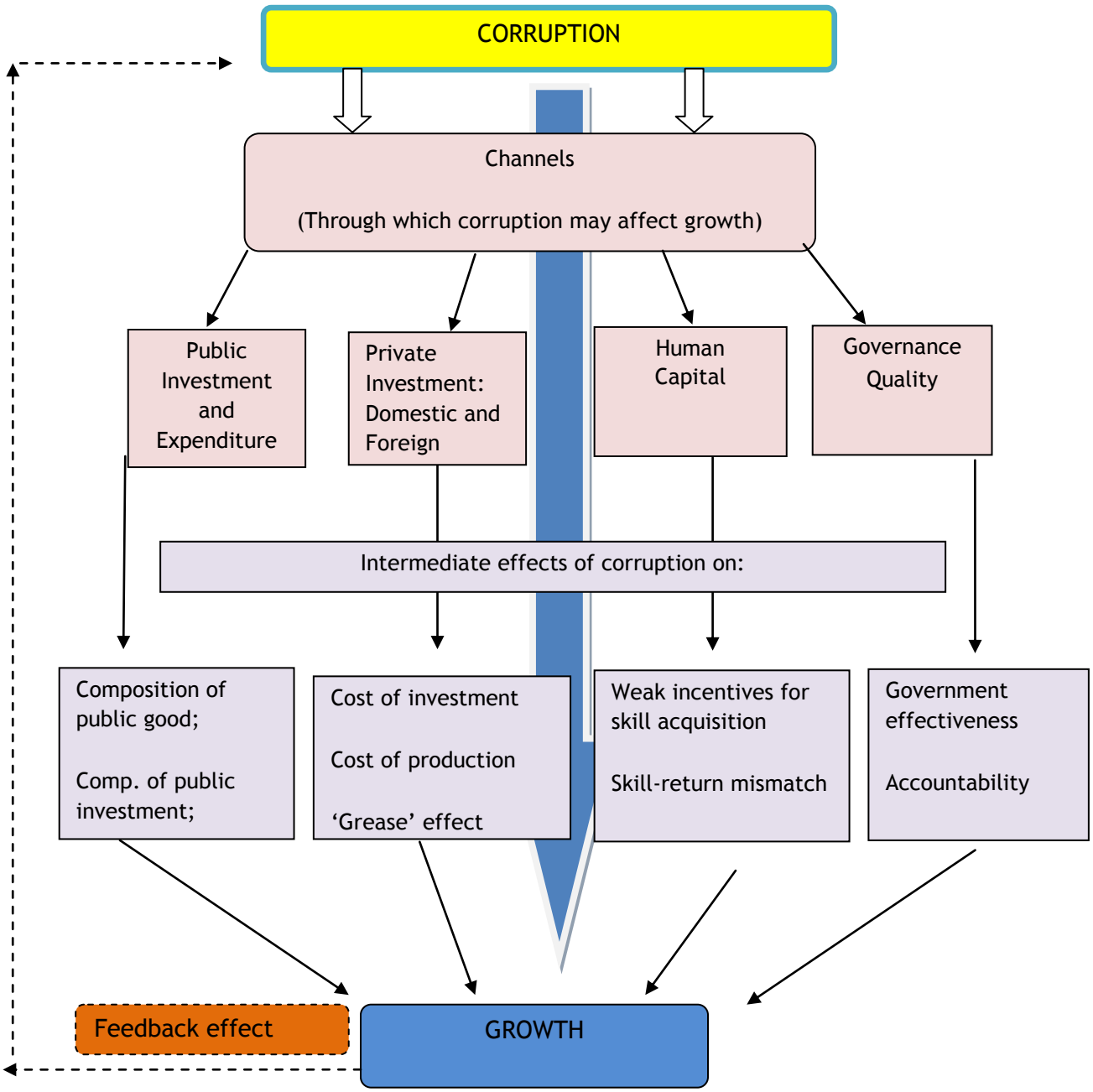
Institutions can be conceptualised as either 'rules of the game' that govern private-private interactions in a society, or as 'governance structures' that frame public-private and private-private interactions. Institutions as 'rules of the game' affect private-private transaction costs and investment decisions, whereas institutions as 'governance structures' affect the set of opportunities for private-private and private-public contracting. Eventually, both types of institutions affect economic performance in a country through their market-creating or market-deepening effects.

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 a 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 1.1.

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.

Figure 1.1: Corruption-growth relationship: channels causal mechanisms



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 materialise 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.

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 the 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 the empirical and the 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 choice of reported estimates for synthesis.

Detailed explanation of the growth model and its variations used in the original studies is presented in Appendix 2.2. Suffice it to indicate here that model specification in the original studies follows a well-established method for cross-country or panel-data estimation of growth. Introduced by Barro (1991), the model regresses per capita income on 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. Mankiw et al. (1992) have extended the model to account for endogenous growth. Formally, the model can be stated as follows:

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

where *Corr* is the corruption variable and CV_k is the kx1 vector of control variables that are derived from the growth theory or are expected to influence growth; and *u* is the error term. The coefficients are defined as follows: β_0 = constant term; β_1 = the partial effect of corruption on growth; and β_k = the kx1 vector of coefficients representing the partial effects of the control variables on growth. (For issues that may arise in estimating this type of models and the ways in which the original studies address these issues, please refer to Appendix 2.2).

In this review, we included all reported estimates of corruption's effect on growth, irrespective of the econometric method through which the estimates were obtained. However, each estimate is coded systematically to indicate the kind of estimation method used in the original studies. We have also coded each reported estimate as either a 'direct' or an '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, per capita 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. Therefore, we are able to control for various factors so that the meta-synthesis results are consistent and generalisable (for further elaboration on the choice of estimates, see Appendix 2.2).

1.5 Objectives, focus, and state/outcome variables

The systematic review question requires us to focus on low-income countries (LICs) as the main 'population' of interest. We have adopted the low-income-country definition of the World Bank, which classifies a country as an LIC if the per capita GDP in that country is $995 or less. At the time of conducting this review, the number of low-income countries that met this criterion was 43 (see Appendix 2.1). 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). We report the meta-analysis for these three groups of countries in order to provide further evidence against which the LIC evidence can be evaluated. The other reason for this 'multi-population' presentation is that the number of countries (the sample size) and the number of reported estimates in the original studies increase as one moves from 'LICs' to 'Mixed' and then to 'All ' countries. This increase in sample size and number of estimates enables us to verify whether the precision-effect test results remain robust across country groups.

This systematic review is about the impact of an institutional weakness (corruption) on economic performance (growth) in low-income countries. Here, corruption is considered as a 'state' variable that affects economic growth as the 'outcome' variable; full details are given in Section 1.2 above.

The outcome variable in this systematic review is 'growth', which is measured as per capita GDP growth rates, per capital GDP levels or GDP growth rates in the original studies. Given this heterogeneity in the measure of growth, we nested (clustered) the original studies within three different nests when we analysed the direct effect of corruption on growth, and within a further set of three nests when we analysed its indirect effects. We have maintained this level of disaggregation when we controlled for corruption measures or country groups.

2. Methods used in the review

2.1 User involvement

Our starting point in the process of identifying potential users of the review has been the review specifications drafted by the Department for International Development (DFID) of the UK government. DFID is a major actor in international development in general and international aid in particular. The Department considers the production and dissemination of systematic reviews as an important means for strengthening the international community's capacity for evidence-based policy making. The DFID is also of the view that better informed decisions increase the impact of and provide better returns on policy interventions.[5]

This systematic review has been conducted in response to the objectives identified by the DFID in its programme for systematic reviews, one of which is to support the 'creation and dissemination of systematic reviews as public goods'. To develop a better understanding of The DFID's goals and benefit from the insights of policy-makers in the field, we have also consulted with the policy leads of the relevant policy units at the DFID. These consultations have led to formulation of three specific goals for the review: (i) providing an evidence base for policy development; (ii) identifying possible gaps in the theoretical and empirical literature; and (iii) identifying new research questions that may inform both new research and/or new systematic reviews of the existing research.

During the review process, we also consulted with two academics involved in systematic reviews in the context of low-income countries (Randolph Luca Bruno of University of Birmingham and Nauro Ferreira Campos of Brunel University) to discuss methodological issues concerning the organisation of evidence on low-income countries. We have also consulted a major contributor to the empirical work on the corruption-growth relationship – Dr Toke Aidt of the University of Cambridge. We discussed with Dr Aidt the evidence base for the corruption-growth relationship, the role of systematic reviews, and the complementarities/differences between systematic reviews and extreme bound analysis.

We aim to expand the scope for user involvement by following a two-pronged strategy. On the one hand, we will draw on the University of Greenwich's research and publicity infrastructure to disseminate the review findings through press releases, Greenwich-based workshop presentations and web presence on the University of Greenwich website. On the other hand, we will liaise with the University of Greenwich Director for International Partnerships, who works closely

[5] http://www.dfid.gov.uk/R4D//SystematicReviewFeature.asp

with higher education institutions in developing countries, including Bangladesh and Ethiopia. The aim here is to present the findings of the review and elicit debate through workshops open to the faculty of partner institutions, civil society organisations and local/national policy-makers in the host country. We aim to organise two overseas workshops – one in Bangladesh and one in Ethiopia. The systematic review will be revised, if necessary, in the light of comments and feedback we receive in the workshops or through other means.

We also aim to make the review accessible for the research community. To this end, we will deposit the review with the EPPI-Centre and with on-line research repositories such as MRPA (Munich RePec Personal Archive) and SSRN (Social Science Research Network), used heavily by researchers in economics and social sciences. Finally, we will revise and update the review in the light of the feedback we receive and submit it to economics journals that recently began to publish systematic reviews (e.g., *Journal of Economic Surveys*, *Journal of Economic Perspectives*, *Journal of Economic Literature* etc.). We expect the journal publication to contribute to the debate on the role of systematic reviews in economics in general and development economics in particular.

2.2 Identifying and evaluating studies

2.2.1 Identifying the research base, key concepts and databases

As we have indicated in Section 1.4.1 above, the expansion of the literature on the economic consequences of corruption began in the mid-1990s even though earlier work dates back to the 1960s. Before the review process and in preparation for the protocol, we examined both the earlier and post-1990 work in order to construct an inventory of the seminal contributions to the debate; identify the existing literature reviews and the cross-cutting themes/issues in the debate; and identify the key words to be used in electronic searches. In Section 1.4 above, we presented the results of this stock-taking exercise with respect to causal mechanisms in the corruption-growth relationship, the predicted effects of corruption on growth, the factors/channels through which this effect is mediated, and the estimation strategies used in the original studies. This stock-taking exercise has also enabled us to develop a general view of the wider literature – especially with respect to the evolution of the research output over time, the distribution of the work between empirical and theoretical/analytical studies, and the kind of research design and estimation methods used.

The stock-taking exercise before the review process also enabled us to identify some of the key search terms to be used in order to maximise the number of studies to be included. Our set of keywords has been refined in the light of the feedback we received in workshops held by the systematic review team of the EPPI-Centre, through consultations with information specialists at the University of Greenwich library, and through recommendations made by the reviewers of the

protocol for this review. As a result of this process, we identified 32 key search terms as follows:

14 concepts/keywords for corruption (the 'state' variable);

9 concepts/keywords for growth (the 'outcome' variable); and

9 concepts/keywords for low-income countries (the 'population' variable).

The list of concepts/keywords we used in the search is given in Appendix 2.4.

In addition, and as much as the search facility of each database allowed, we also used 43 country names included in the World Bank list of low-income countries (see Appendix 2.1).

We searched 20 databases, selected on the basis of our research experience, advice from librarians at the University of Greenwich, and referee comments/recommendations received on the draft protocol. The databases can be grouped under three categories, reflecting three publication types: journal article databases, working paper and report databases, and databases for PhD theses. The list of databases is reported in Appendix 2.5.

2.2.2 Search strategy

We interrogated each of the 20 databases with the 32 concepts/keywords listed in Appendix 2.4. In addition, we also included the 43 country names for low-income countries if the database search fields did not restrict the number of search terms that could be used. When the search fields were restrictive, we proceeded in two stages. In stage 1, we carried out title, abstract and text search for 32 main concepts/keywords specified in the protocol. In stage 2, we replaced the nine main concepts/keywords for low-income countries with country names listed in the World Bank table. When the database had only a limited number of search fields, we used the main concepts in the review question (corruption and growth). This was the case mainly with working paper and report databases such as SSRN, World Bank, NBER, ADB etc.

The search was conducted by research assistants and supervised by the reviewers as indicated in the protocol. Appendix 2.6 documents the search process and the number of 'hits' in each database search. Carrying out the search in all databases, we obtained 1,330 studies, of which 288 were identical duplicates and these were eliminated automatically in EndNote. We uploaded the set of 1,042 studies to EPPI-Reviewer – our study storage and management platform. A further examination of authors, titles and publication type on EPPI-Reviewer revealed 40 new duplicates that were not detected in EndNote due to slight differences in author names.

These were excluded as duplicates, leaving a net set of 1,002 studies for title/abstract screening.

2.2.3 Screening studies: PIOS criteria at the title and abstract stage

We carried out initial screening of the 1,002 studies on the basis of title and abstract information. Two reviewers (M. Ugur and N. Dasgupta) carried out the screening independently. However, before independent screening, we conducted a pilot of 10 studies to test whether the selection criteria were being interpreted reliably and consistently; and whether the criteria were effective in identifying the studies to be selected or rejected. There was 80 percent congruence between the decisions of the two reviewers. The discrepancy of 20 percent was due to incomplete information provided in the title and abstract. We agreed that it would be better to err on the inclusion side and decided to include a study for the next stage if the title/abstract information was not sufficient to score the study with respect to all criteria. In this, we were guided by recommendations in CRD (2009), which indicate that piloting and independent screening increase the chance of selecting all relevant studies.

The initial screening was carried out on the basis of PIOS (Population – Independent variable – Outcome – Study design) criteria. The choice of these criteria was informed by the PICOS framework recommended by CRD (2009). The PIOS criteria enabled us to interrogate each study with the following questions:

Population (low-income countries or synonyms)

Does the study include ‘low-income countries’ or its synonyms in the abstract or title?

Independent variable (corruption or synonyms)

Does the study include ‘corruption’ or its synonyms in the abstract or title?

Does the study abstract indicate that it analyses/estimates the corruption-growth relationship?

Outcome (growth or synonyms)

Does the study include ‘growth’ or its synonyms in the abstract or title?

Does the study abstract indicate that it analyses/estimates the corruption-growth relationship?

Study design

Is the study theoretical/analytical (TA)?

Is the study empirical (EM) or mixed (EM2)?

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, as specified in the protocol, was to include a study for the critical evaluation stage if it satisfies at least four of the seven criteria.

Using this decision rule and applying the PIOS criteria, both reviewers chose 294 studies in common for inclusion in the critical evaluation stage. However, there was discrepancy between the two reviewers with respect to 71 studies with potential for inclusion. We read the title/abstract information for each of these studies together and developed a consensus on the criteria they met. As a result, we agreed to include 44 of these studies for the next stage – arriving at a total number of 338 studies for inclusion. The number of studies satisfying each PIOS criterion and the selection decisions are given in Table 2.1.

Table 2.1: PIOS screening results for 1,002 studies

Criteria	Studies satisfying the criteria
Population	730
Independent variable 1 (IV1)	484
Independent variable 2 (IV2)	25
Outcome 1 (O1)	450
Outcome 2 (O2)	70
Study design TA	143
Study design EM/EM2	180
Decision:	Select if four criteria satisfied
Select for next stage	338
Reject	664[6]

[6] The list of studies excluded at the title/abstract stage is recorded and coded as such in EPPI-Reviewer. The authors are happy to provide this list on request.

2.2.4 Evaluating studies: VRA criteria at full-text stage

We uploaded the full text of the 338 studies into EPPI-Reviewer and conducted critical evaluation 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 reproducible; and applicability refers to the extent to which the findings are generalisable/applicable to low-income countries.

At the critical evaluation stage, we also conducted a hand search for studies that were referred to in evaluated studies but were not picked up by our search. In addition, we consulted one of the key contributors to the literature on the corruption-growth relationship – Dr Toke Aidt of Cambridge University – and sought his recommendations for studies that might not have been picked up by our search. As a result of this process, we identified 14 additional studies and included 9 of them for analysis.

The validity, reliability and applicability (VRA) of each study was assessed by using a new **PIOS** framework for critical evaluation. The criteria in the framework included the following and the scores for each criterion were:

applicability to low-income countries

corruption is a central variable that affects growth

growth impact of corruption is one of the main outcomes

the study provides original analysis/evidence

study design (including data quality) is verifiable and compatible with the growth regressions literature.

During critical evaluation, each study was coded as theoretical/analytical (TA) or empirical (EM/EM2). A TA study was defined as a study that analyses the impact of corruption on growth through mathematically or diagrammatically or verbally derived models. The main aim of TA studies is to develop models/explanations of the corruption-growth relationship rather than estimate the magnitude of the growth impact of corruption. An empirical study is either a purely empirical (EM) study that utilises a valid model for estimating the corruption-growth relationship, or a mixed (EM2) study that analyses the impact of corruption on growth through a mathematically derived model and uses empirical evidence to verify the model's predictive quality.

Table 2.2 summarises the inclusion/exclusion criteria we used at the critical evaluation stage and the decisions reached for each criterion and for each study type.

Table 2.2: Results of critical evaluation using VRA criteria

Screening criteria for TA studies	TA studies satisfying the criteria		Screening criteria for EM/EM2 studies	EM/EM2 studies satisfying the criteria
Population – is the analysis applicable to LICs?	88		Population – does the sample consist of LICs or does it include some LICs?	183
Independent variable – is corruption a central state variable?	71		Independent variable – does the corruption data come from a documented and recognised source?	122
Outcome – is the growth/corruption relationship the main outcome variable?	42		Outcome – does the study report findings on the growth impacts of corruption?	89
Study design – does the study have a valid construct combining theory and evidence?	50		Study design – does the study have a valid study design compatible with empirical growth literature?	146
			Study design 2 – does the study carry out a robustness check for endogeneity and model specification?	44
Decision – include if four criteria are satisfied			Decision – include if four criteria are satisfied	

Excluded[7]	113		Excluded	124
Included	39		Included	84

Note: Overlap between TA and EM/EM2: 8 studies
Net number of studies included: 39+84-8 = 115
Number of empirical studies included for data extraction: 84
Number of empirical studies included in meta-analysis: 67

2.2.5 Quality assurance process

Our search methodology was designed to be inclusive, transparent and unbiased. We exhausted all the search terms specified in the protocol, subject to constraints posed by the search facility of each database. We also carried out a hand search and consulted with our peers working in the area of corruption-growth relationship.

Our inclusion/exclusion methodology (at the initial screening and critical evaluation stages) is well documented. As indicated in Sections 2.2.3 and 2.2.4 above, we interrogated each study with a pre-specified list of questions to ascertain if: (i) the study is relevant to the population (LICs); (ii) the independent variable is corruption; (iii) the outcome variable is growth; and (iv) the study design satisfies validity, reliability and applicability (VRA) criteria. To ensure consistency in the application of the screening and inclusion/exclusion criteria, we ran pilots and discussed our decisions at length. This method has enabled us to ensure that the risk of study selection bias was minimised.

The protocol for this review was reviewed by the DFID and two external reviewers, all of whom provided helpful feedback that improved our tools and procedures. The EPPI-Centre of the Institute of Education provided training and technical support in the use of the EPPI-Reviewer software for document storage, coding and information retrieval. We also consulted qualified librarians at the University of Greenwich to ensure that we did not miss any relevant studies.

The critical evaluation of the theoretical/analytical (TA) studies was conducted by Dr Dasgupta and that of empirical studies by Dr Ugur. This was preceded by a pilot of ten studies (four theoretical/analytical and six empirical) to test whether the inclusion/exclusion criteria were being interpreted and implemented reliably and consistently, and whether the criteria were effective in identifying studies to be selected or rejected. There was full congruence between the decisions of both reviewers. Then, each reviewer evaluated his/her full set of studies independently.

[7] List of studies excluded at the full-text critical evaluation stage is recorded and coded as such in EPPI-Reviewer. It can be provided on request.

Finally, we examined each other's inclusion and exclusion decisions, going through each study and the scores coded in EPPI-Reviewer. Queries were raised about fifteen decisions (eight exclusion and seven inclusion); we read the contested studies together and arrived at a common decision for each, and as a result, three extra theoretical/analytical studies were included. The change in the decisions concerning these studies was based on the consensus that they had an empirical content, but they also had a significant theoretical/analytical content that could strengthen the narrative synthesis. The extra studies included at the end of this process were Aidt et al. (2005), Blackburn et al. (2008) and Pellegrini and Reyer (2004). Hence, the number overlaps between empirical and theoretical/analytical studies increased from 5 to 8.

2.3 Methods for synthesis

2.3.1 Assessing the quality of studies

We assessed the quality of included studies at the critical evaluation stage, as described in Section 2.2.4 above, on the basis of validity, reliability and applicability (VRA) criteria.

Validity determines whether a study has a valid 'construct' and a valid 'method'. The construct consists of concepts, notions and hypotheses that postulate the relationship between corruption and growth, whereas the method involves the kind of evidence and the kind of qualitative or quantitative analysis used to test the hypotheses for the corruption-growth relationship. An empirical or empirical and theoretical/analytical study was considered to satisfy the construct validity requirement if its construct was developed coherently (through verbal arguments and/or mathematical statements) and was related to existing literature. In the case of empirical studies, methodological validity was considered to hold if: (a) the study used empirical models informed by the 'empirics of growth' literature; (b) its estimation methodology consisted of one or more estimation methods used for analysing the potential determinants of growth, including corruption; (c) it used data from one or more of the corruption data sources we have identified; and (d) its growth and other control variable data was documented. In the case of theoretical/analytical studies, the validity requirement was considered to be satisfied if: (a) the study developed a coherent construct by engaging with the relevant literature; (b) it examined the causal mechanisms and channels through which corruption might affect growth; and (c) it drew on quantitative or qualitative evidence gathered as a result of original research that is documented.

The **Reliability** of a study is the extent to its results can be regarded as consistent over time and across countries, or they are open to be verified in the light of new evidence. The reliability criterion requires that the evidence used was collected on the basis of a clear methodology, and the results, given the method of analysis, can be replicated. We considered a study to satisfy the reliability criterion if its

evidence base was documented, relevant hypothesis tests were carried out, and the results it reported were related to the direct or indirect effects of corruption on growth.

Finally, **applicability** refers to the extent to which the findings of the study could be applied to low-income countries. In this review, a theoretical/analytical study is considered applicable to low-income countries if it is based on a construct that conceptualises corruption as a principal-agent problem that reflects an institutional weakness in any country. While the institutional weakness distorts the costs and incentives faced by economic agents in general, the severity of weakness and the principal-agent problem it generates may differ between countries and over time. A theoretical/analytical study is considered as applicable to low-income countries if it examines how the impact of corruption on growth differs between countries with different levels of corruption and different mediating factors. An empirical study, on the other hand, is considered as being strongly applicable to low-income countries if it is based on evidence from these countries only. If the study draws on evidence from a sample of countries that includes both low-income and other countries, we consider the study to have a weak level of applicability to low-income countries. Therefore, we first provide meta-analysis results for low-income countries only and then we supplement these results with evidence on mixed countries. The latter is provided as an additional check for the relevance of low-income evidence rather than as outcomes to be expected to hold in a low-income country context.

We tried to ensure that studies included in this review satisfied the validity, reliability and applicability criteria by interrogating each study with a set of questions – as indicated in Section 2.2.4 above. At the data extraction stage, we established that all theoretical/analytical studies included after the critical evaluation satisfied the validity, reliability and applicability criteria. With respect to empirical studies, however, we established that some studies elaborated on the direct and indirect effects of corruption on growth, but did not report empirical estimates of those effects. We did not exclude these studies from the review, but their reported estimates were not used for the meta-analysis. As a result, out of 84 empirical studies, 67 studies were included in the meta-analysis.

2.3.2 Selection of studies for meta-synthesis

We extracted data from all theoretical/analytical studies (39) and all the empirical studies (84). Data extracted from all theoretical/analytical studies were used for meta-synthesis. However, during the data extraction stage, we established that some empirical studies (4) reported only simulation results. These results were extracted, but were not used for synthesis. This is because simulation results are not reported with standard errors or confidence intervals and as such they are not suitable for meta-synthesis. Some other empirical studies (13 in total) reported estimates of corruption's effect on foreign direct investment (FDI) or net savings or

output per worker, etc., which might eventually affect growth. These studies, however, did not report estimates of corruption's direct or indirect effects on growth itself. Instead, they just pointed out that the effect of corruption on FDI, savings or efficiency (output per worker) would eventually percolate to growth. Therefore, estimates reported by these studies were extracted but not used for synthesis. As a result, 67 out of 84 empirical studies and 596 out of 815 empirical estimates were used for meta-analysis.

2.3.3 Selection of outcome data for synthesis

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 were obtained. However, each estimate was coded systematically to indicate whether the underlying estimation was instrumented and what kind of estimation method (OLS, 2SLS, 3SLS or GMM) was used in the original studies. We also coded each reported estimate as either a 'direct' or an 'indirect' effect. In addition, both direct and indirect effects were coded with respect to the outcome they related to, which could be per capita GDP growth, GDP growth, GDP levels or interaction terms between corruption and other income determinants that might act as transmission channels for the indirect effect of corruption on growth.

The alternative would have been to choose an aggregate statistic that summarised 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. Firstly, it prevents the use of all available information. Secondly, the selection criterion is highly likely to have a subjective dimension. Therefore, we used 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 minimise the risk of dependence between multiple estimates drawn from a single study, we nested the studies within clusters in order to: (i) reduce the number of multiple estimates drawn from each study; and (ii) minimise the effect of within-study dependence on the random-effect weighted means calculated for each cluster. This procedure minimised the risk of within-study dependence but might not eliminate it altogether.

2.3.4 Methods of synthesis: mapping the narrative synthesis with meta-analysis

In this systematic review, we combined a narrative synthesis of the theoretical/analytical findings with a meta-synthesis of the empirical evidence on the direct and indirect effects of corruption on growth. We then mapped the narrative synthesis with the meta-synthesis in order to derive policy conclusions and indicate potential avenues for further research.

The narrative synthesis has enabled us to derive a number of theoretical/analytical conclusions on the growth impact of corruption despite a high degree of between-study variation. On the other hand, the meta-analysis methodology has enabled us to calculate weighted averages of the original estimates at different levels of nesting/clustering and to verify the statistical significance of the latter through precision-effect tests conducted at the same level of nesting/clustering.

Our narrative synthesis methodology draws on research findings and practical guidelines in Popay et al. (2006) and CRD guidance (2009). The methodology is designed to enable reviewers to strike an optimal balance between the need for reflecting variations in terms of theorisation and explanation on the one hand and the need for deriving cross-cutting and generalisable conclusions on the other. To extract the necessary data for analysis, we identified eight key data identifiers – one of which relates to study title and seven of which relate to thematic (vertical) and content (horizontal) issues.

The thematic (vertical) issues consist of corruption type (bureaucratic or political corruption), organisation of corruption (centralised versus decentralised practice) and the level of institutional/bureaucratic quality. Our reporting of the narrative synthesis below follows a sequence determined by the thematic (vertical) issues. Using an analogy, we can state that the thematic (vertical) issues function as pillars around which the narrative synthesis is built.

The content (horizontal) issues, on the other hand, consist of the effects of corruption on growth (negative, positive, non-linear), the channels through which corruption affects growth (investment, public finance, human capital), and the causal mechanisms in the corruption-growth relationship (direct, indirect and feedback effects). The data/information on the content (horizontal) issues have enabled us to 'lay the bricks' around the thematic (vertical) issues.

Our narrative synthesis is conducted within a principal-agent theoretical framework, which accounts for Type I and Type II corruption. Type I corruption refers to the abuse of political office by an official who benefits from asymmetric information about or access to a public good or service, which may include licenses, permits, official approvals, admissions or service delivery. This type of corruption tends to affect growth through its effect on the cost of transactions between economic agents themselves and between the latter and the state. Type II corruption, on the other hand, refers to the abuse of public office by high-level political actors and policy-makers who have asymmetric information or decision-making powers with respect to public funds, assets and expenditures. This type of corruption leads to diversion of public funds for private benefits – which may be financial or political or both. It affects growth through its effect on misallocation of public funds and expenditures.

The narrative synthesis presented below indicates that the relationship between corruption and growth is not linear because it depends on political economy factors, type of corruption, political organisation of corruption, and the existing level of development itself. The robustness of the arguments presented in each paper was assessed by its methodological quality and appropriateness to this study. The assessment criteria were: cogency of theoretical arguments; the evidence base for the arguments; and whether the study focused on the principal question of this review, i.e. the impact of corruption on growth.

For meta-analysis, we first calculated fixed-effect and random-effect estimates as weighted means of the original estimates reported in empirical studies. The fixed effect estimate (FEE) has been shown to be efficient if the estimates reported in the original studies are drawn from the same population with a common mean (Cooper and Hedges, 1994; Stanley et al., 2009). We used the FEE to calculate weighted means of the estimates reported in each study for each measure of growth. The random-effect estimate (REE), on the other hand, is efficient when the original estimates are drawn from different populations. We used the REE to calculate weighted means for estimates reported in a group of studies nested on the basis of a unique combination of corruption and growth measures or growth measures and country types.

The FEE is a point estimate for the weighted mean of the estimates reported in each study. The weight is the inverse of precision-squared ($1/SE_i^2$) of each estimate, where SE_i is the standard error of each estimate reported in the study. The lower the precision (i.e., the higher is the standard error) of the original estimates, the lower the weighted mean calculated with this method will tend to be. On the other hand, the random effect estimate (REE) is a point estimate for the weighted mean of original estimates reported by a number of studies nested within a specific combination of corruption and growth measures or country type and growth measures. It accounts not only for within-study variation (as the FEE does) but also for between-study variation. It is calculated using $[(1/(SE_i^2 + \sigma^2)]$ as weight, where SE_i is the standard error of each original estimate and σ^2 is the variance of the original estimates reported by a group of studies included in a specific nest/cluster. (For further elaboration on the fixed- and random-effect estimates, see Appendix 4.1).

Although FEE and REE are efficient estimates, they cannot be taken as measures of genuine effects – i.e. as statistically significant measures of corruption's effect on growth. This is due to the risk of study selection bias or small number of original estimates from which they are derived. Therefore, we also provided confidence intervals and precision levels for FEE and conducted precision-effect tests (PETs) for each REE we reported.

The combination of confidence intervals and precision levels has enabled us to evaluate the statistical significance and precision of the weighted mean effects

calculated for each study. The study-based weighted means (the FEEs) provide useful information about similarities and differences between the findings reported by the original studies on a study-by-study basis. This is the common method used for reporting meta-analysis results of randomised controlled studies in healthcare or social interventions, where between-study heterogeneity is minimised through study design and random choice of intervention and control groups.

However, the observational nature of the corruption-growth research is associated with high levels of heterogeneity caused by differences in estimation methods, corruption and growth measures used and countries covered. Therefore, study-based meta-analysis results derived from observational studies cannot be taken as a sufficient evidence base for testing hypotheses or for policy design. To address this problem, we clustered the original study estimates within different nests, each of which is defined by a common metric (measure) for corruption and growth variables. This clustering led to 48 nests at the most disaggregated level – corresponding to 8 measures of corruption and 6 measures of growth.

Half of the corruption indices - coded as ICGR1, TI1, WGI1 and Other1 – refer to *less corruption* as the index increases. The other half – coded as ICGR2, TI2, WGI2 and Other2 – uses the same metric, but in reverse order. In other words, they refer to *more corruption* as the index increases. Given this property, we merged the two versions of each corruption data to obtain 4 corruption indices instead of 8. This merge has required multiplying the estimates derived from ICRG1, TI1, WGI1 or Other1 corruption data with minus one (-1). As a result, we were able to cluster the original estimates within 24 nests – corresponding to 4 corruption data indices and 6 measures of growth. As will be seen in Tables 4.3 and 4.4 below, the simple and weighted-average estimates calculated for these nests turn out to be similar in magnitude and sign. Therefore, we took the next step and clustered the original-study estimates within 18 nests - using a single corruption metric, but along 6 growth measures and 3 country types.

To establish whether the weighted average estimates of the effect size is statistically significant (i.e., it refers to genuine effect beyond bias), we conducted precision-effect tests (PETs) in two stages. In stage 1, we conducted PETs for each of the 24 nests based on 4 corruption and 6 growth measures. In stage 2, we repeated the procedure for each of 18 nests based on 3 country types (LICs, Mixed and All) and 6 growth measures (consisting of three direct effects on per capita GDP growth, per capita GDP level, GDP growth; and three indirect effects on per capita GDP growth through investment, public finance and human capital channels).

The precision-effect test (PET) is carried out by estimating a weighted-least-squares (WLS) model and testing for statistical significance of the slope coefficient. The model can be stated as follows:

$$t_i = \beta_1(1/SE_i) + \beta_0 + \varepsilon i \,.$$

Here (t_i) is the t-statistic and ($1/SE_i$) is the precision of the estimates reported in original studies; (εi) is the error term. This model 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). (For further elaboration on the PET and properties of the WLS model, see Appendix 4.2.)

Following this method, we present meta-analysis results for three country groups: (i) low-income countries (LICs); (ii) mixed-countries (Mixed) where the sample includes both LIC and non-LIC countries; and (iii) all countries (All), which is the total of LICs and Mixed**.** We have chosen to report the meta-analysis results for LICs and non-LIC countries in order to provide additional evidence with which the growth impact of corruption in LICs can be compared.

2.4 Deriving conclusions and implications

Our review has demonstrated that there is a rich literature on the effect of corruption on growth. The critical evaluation and data extraction process has provided us with an overview of the wide range of theoretical/analytical and empirical findings. Drawing on this overview, the review team met and discussed the narrative synthesis and meta-analysis methods again with a view to determining how we could strike a balance between synthesis and study heterogeneity.

With respect to theoretical/analytical findings, we concluded that it would be appropriate to identify thematic issues that cut across studies vertically and substantive issues that captured the contribution of each study to a given vertical theme. This conception has enabled us to design the narrative synthesis as a matrix of evidence cells containing two types of evidence: evidence on the type and organisation of corruption and the institutional factors through which its growth effect is mediated; and evidence on the direct and indirect effects of corruption and the channels through which these effects unfold.

With respect to the meta-analysis of empirical evidence, on the other hand, we decided to provide synthesised evidence at a disaggregated level first before proceeding to the aggregate level for LICs and non-LICs. This decision was informed by the need to account for the observational nature of the empirical studies and for between-study heterogeneity. This decision required precision-effect tests to be conducted at different levels of aggregation, and the results to be compared with respect to sign consistency – i.e., consistency about whether the effect was positive or negative. We proceeded to derive an aggregate-level synthesis after the findings at the disaggregated levels of nesting indicated that: (a) the majority of

the FEEs (i.e., study-based synthesis results) were observed to be negative and their confidence intervals did not include zero; (b) the sign of the majority of the REEs estimates remained negative as the level of aggregation increased.

Having completed the narrative synthesis and meta-analysis, the review team met to discuss how to map the findings. We decided to take the theoretical/analytical findings of the narrative synthesis as the benchmarks against which the findings of the meta-analysis should be compared. We established that the narrative synthesis led to three overall findings: (a) findings on the sign (negative or positive) of corruption's effect on growth; (b) findings on whether the sign and/or magnitude of the effect remained stable over time or across countries and why; and (c) findings on channels through which corruption affected growth. We also established that the findings of the meta-analysis were suitable for mapping with these theoretical/analytical findings.

Before drafting the report, the review team discussed the implications of mapped evidence for policy, practice and research. In that discussion, we established that the weight of the theoretical/analytical and empirical evidence pointed to a negative effect from corruption to growth. We also established that this finding remained robust to changes in corruption data sources and country groups. However, we also noted that the magnitude of the effect tended to change between countries (LICs versus non-LICs), effect types (direct versus indirect effects), and corruption data sources (with WGI data being associated with higher estimated effects). Therefore, we decided that the policy and practice conclusions should be stated with explicit reference to: (a) the context and channels through which corruption affects growth; and (b) differences in the synthesised estimates across country type and corruption data sources. We also decided that it was necessary and appropriate to qualify our policy recommendations with statements on the strengths and limitation of systematic reviews based on observational studies.

Finally, we sought comments/feedback from Dr Toke Aidt of the University of Cambridge on the draft systematic review report. Dr Aidt read the report and indicated that it provided an important and thorough summary of the evidence base for the corruption-growth relationship. However, he also indicated the potential limitations to systematic reviews based on observational data. He highlighted two issues: samples used by different studies might not be independent of each other; and 'data mining' might be taking place to obtain the 'desired' estimates. In addition, he also indicated that it was necessary to establish whether corruption was a cause in itself in the corruption-growth relationship, or whether it was a manifestation of weak institutions.

In this systematic review, we addressed the first comment indirectly by: (a) stating that the review is based on observational studies/data and therefore our synthesis results are not as robust as results derived from randomised controlled trials

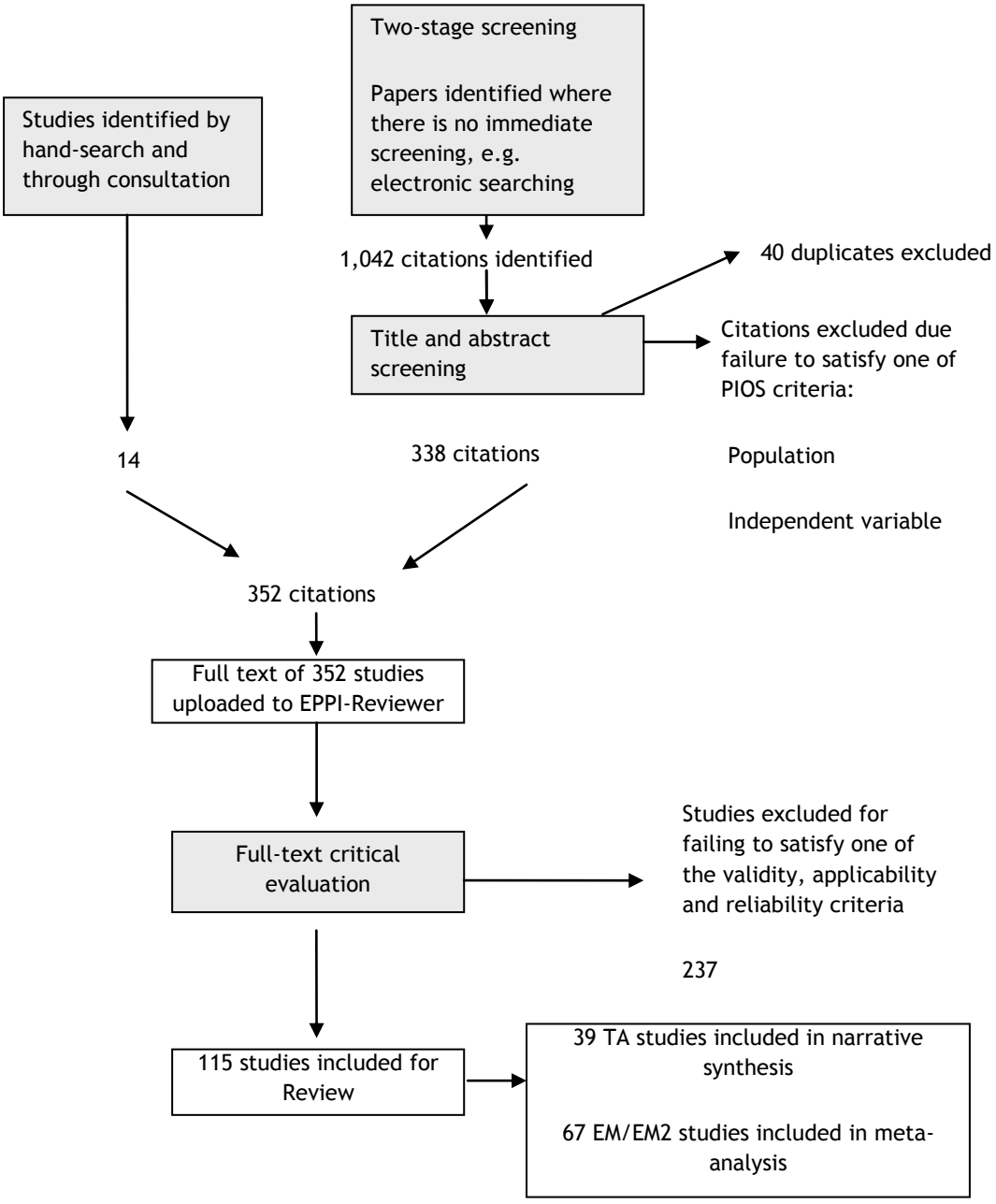
(RCTs); and (b) providing synthesis results for individual studies as well as study groups nested together. We concluded that the synthesis results could be taken as reflections of genuine effect only if there was evident consistency between the estimates obtained from individual and nested studies and if the nested results satisfied the precision-effect tests. We characterised this as an 'indirect' way of addressing the limitation of observational studies because there was no way of establishing sample dependence prior to meta-analysis. We addressed the second comment explicitly and directly in our narrative synthesis, where we indicated that corruption can be either an indication or result of institutional weakness. In addition, in our narrative synthesis as well as conclusions, we indicated that the interaction of corruption with institutional quality is a major issue for future research.

3. Search results

3.1 Studies included from searching and screening

The decision tree summarising the decisions at the title/abstract screening and critical evaluation stages is presented in Figure 3.1.

Figure 3.1: Decision tree for screening and critical evaluation stages



3.2 Details of the included studies

We have included 115 studies, 8 of which appear within both the empirical and theoretical/analytical study sets.

One characteristic of the included studies is that their frequency distribution over time is congruent with that of all studies captured our search. The distribution over time (see Appendix 3.1) reflects an increasing frequency for all studies as well as included studies (both empirical and theoretical/analytical studies).

The second characteristics relates to the distribution of studies with respect to publication type. Among theoretical/analytical studies, we have 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). As indicated above, 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 significance levels of confidence intervals; and as such they are not appropriate for meta-analysis. Suffice it to indicate here that the simulation-based estimates of corruption's effect on growth were much larger that regression-based estimates.

The empirical studies using regressions to estimate the impact of corruption on growth used a wide range of estimation methods, ranging from ordinary least squares (OLS) through two-stage and three-stage least squares (2SLS and 3SLS) to generalised method of movements (GMM). Most studies in this category also used multiple model specifications. In fact, it was generally the case that studies first reported OLS estimation results as upper-bound estimates followed by 2SLS or 3SLS estimates and eventually GMM estimates to check the robustness of the results to estimation method and instrumentation.

Despite this variation, however, all empirical studies estimated a growth model that was compatible with growth regressions discussed and tested in the empirical growth literature (Barro, 1991; Levine and Renelt, 1991; Mankiw et al., 1992; and Sachs and Warner, 1997.

Similarly, the theoretical/analytical studies examined different types of corruption and transmission channels, and provided different explanations as to why corruption might have a negative, positive or variable effect on growth. Despite this variation, however, all theoretical/analytical studies included in this review either adhered to an explicitly-stated principal-agent approach to corruption, or their account was closely related to that approach. The only variation here

concerns the type of 'agent' involved, with 60 percent of the studies examining bureaucratic corruption, where the agent consists of civil servants/bureaucrats, and about 40 percent examining political corruption, where the agent is an elected or appointed high-level government official or decision maker.

Finally, the empirical studies used different data sources for corruption, and some studies used corruption data from more than one source. We controlled for variation in data sources by calculating random-effect estimates (REE) for groups of studies that used the same corruption data source. The REE is a point-estimate of the weighted mean of the original estimates, where the weights are the inverse of within-study and between-study variation $[(1/(SE_i^2 + \sigma^2)]$. Tables 4.4 and 4.5 indicate that the REEs of the weighted means differed in magnitude between corruption data sources. However, the REEs remain negative in more than 90 percent of the findings when 8 corruption indices were used and in all of the findings when the corruption indices were merged to obtain 4 measures.

We entered theoretical/analytical studies as rows in an Excel sheet that contained six columns designed to house the data input for narrative synthesis. The column headings were: textual/mathematical analysis; channels through which corruption affects growth; types of corruption; degree of centralisation in corruption; causal relationship between corruption and growth/development; and causes of corruption. These data have been used to identify convergence/divergence among the studies with respect to: type of analysis; impacts of corruption and their channels; impacts of corruption and degree of centralisation in corruption as an institution; and whether the causes and consequences of corruption were similar or different in different settings.

We also entered EM/EM2 studies into a separate Excel sheet, where each row contained one observation (i.e., reported estimate) from a given study. If the study reported N estimates, the study appears in N rows. Then we identified 35 codes to control for publication type (journal article, book, working paper, report, thesis etc.); type of reported estimate (direct or indirect effect of corruption on growth); type of estimation method (OLS, 2SLS, 3SLS, GMM, simulation etc.); type of corruption data used (ICRG, TI, WGI, other), and type of countries in the sample (LICs and Mixed). A summary of the code categories and the number of code headings in each category is presented in Appendix 3.2.

Each reported estimate was entered into a column coded 'direct effect' or 'indirect effect'. For example, if the reported 'direct effect' referred to the direct effect of corruption on per capita GDP growth, the relevant cell was coded with '1' and all other cells were coded with '0'. If the reported effect was 'indirect' and referred to the interaction between corruption and public finance, the cell of the column coded 'corruption and public finance' was coded with '1' and all other cells for interaction terms were coded with '0'. Then, we controlled for corruption data source, estimation method, publication type, etc. in the same manner. When all

codes were entered for a given reported estimate all relevant code headings would be coded with '1' and all others would be coded with '0'. When this procedures was repeated for all reported effects in the included studies, we obtained a data matrix consisting of 815 rows x 52 columns = 42,380 data entries. We used this data set to conduct meta-analysis at different (aggregated, semi-aggregated and disaggregated) levels of nesting. This hierarchical approach enabled us to control for relevant factors and to pool studies together on the basis of explicitly defined criteria derived from the control code categories specified in Appendix 3.2**.** We conducted repeated quality checks to ensure that all data entries were correct.

4. Synthesis results

In this systematic review, we conducted two types of synthesis (narrative synthesis and meta-synthesis) and mapped the results of the two in our conclusions. In this section, we summarise the methods we used. The results are presented in sections 4.1–4.2 (narrative synthesis) and sections 4.3–4.4 (meta-analysis).

Our narrative synthesis methodology draws on research findings and practical guidelines referred to in Popay et al. (2006) and CRD guidance (2009) for systematic reviews. The methodology recommended in these sources suggests that we need to strike an optimal balance between the need to reflect variations in terms of methodology and explanation on the one hand and the need to derive generalisable conclusions on the other. To achieve this balance, we extracted and tabulated data from the theoretical/analytical (TA) studies in a way that enabled us to capture information about six key theme and content identifiers. A sample of extracted data is presented in Appendix 4.3. We conducted the narrative synthesis in the light of the principal-agent theory of corruption, described in section 2.3.4.

The aim of meta-analysis is to derive synthesised empirical evidence concerning the magnitude and sign of corruption's effect on growth. In this review, we followed well-established methods of calculating fixed-effect and random-effect estimates from evidence in the original studies and conducted a widely-used precision-effect test (PET) to verify whether these estimates can be taken as indicators of genuine effect beyond publication or small-study bias. The meta-analysis is described in more detail in section 4.3 below.

4.1 Narrative synthesis – summary results

The theoretical/analytical studies examined corruption as a principal-agent problem under high monitoring costs; Table 4.1 gives details of the relevant studies. The principal-agent problem occurs when a bureaucrat or an 'agent' uses his/her public authority and access to information about a public good or a scarce commodity to extract rent from the 'principal' by whom the agent is employed to deliver a public service or good. The principal-agent theory argues that it is the monitoring costs that allow the agent, who is entrusted with a particular public duty, to engage in malfeasance (Bardhan, 1997). Monitoring costs leads to two types of corruption.

An agent may be entrusted with the allocation of a public good or service (licence, permit, official approval, public property etc.) demanded by the principal. If the principal is constrained in his/her capacity to hold the agent accountable (i.e., if monitoring the agent is costly), the latter can extract rents, leading to higher transaction costs, inefficiencies in the allocation of resources, and higher risks for innovators and investors. This corresponds to bureaucratic corruption (Type I).

Studies analysing bureaucratic corruption identify three possible corruption effects on growth.

The majority of studies (18 out 28) report/predict a negative effect due to distorted incentives, higher costs of transactions and inefficiencies in the allocation of resources. This can be referred to as the 'sand in the wheel' effect.

A sizeable number of studies (6 out of 28) report that the relationship between corruption and growth is non-linear. Corruption affects growth differently, depending on the country's institutional quality, whether corruption is organised/centralised, and the level of development.

A small number (2 out of 28) report that corruption may have a positive impact on economic growth if the costs of distortions, inefficiencies or high transaction costs are outweighed by the benefits of overcoming excessive government regulations and bureaucratic barriers. This can be referred to as 'greasing the wheel' effect.

On the other hand, an agent may hold a decision-making power with respect to allocation of public expenditure funds or sale of public assets. If monitoring costs are high, this position enables the agent to manipulate the allocation of public funds and sale of public assets in a way that produces political rents or unlawful economic rents. This can be defined as political corruption (Type II). As Tanzi (1998) has indicated, this kind of corruption distorts the decision making processes connected with public investment and expenditures. All theoretical/analytical studies (14) examining political corruption reported a negative effect on growth.

Table 4.1: Matrix summary of theoretical/analytical studies

Vertical issues and reporting studies	Reported impacts and transmission channels	Causal mechanisms
Bureaucratic corruption		
1.Negative effects		
Murphy, Shleifer and Vishny (1993) Acemoglu and Verdier (2001) Ehrlich and Lui	Corruption causes misallocation of talent and skills away from productive activities towards non-productive (rent-seeking) activities. Rent seekers are likely to target the innovation sector, which requires more public goods than	Under corruption, investment in innovations incurs higher transaction costs; lower profitability and greater inefficiencies. Corruption reduces the incentives for investments in development of human capital and diverts resources to unproductive investments.

(1999) Blackburn and Forgues-Puccio (2009)	established industries. Reduced innovation and capital accumulation.	
Mijiyawa (2008) Fosu, Bates and Hoeffler (2006)	Corruption undermines protection of property rights, creates obstacles to doing business and impedes innovation and technological transfer.	Property and contract laws are essential for growth. When corruption undermines these legal assurances, it can slow down private investment and technological transfers and drag down the growth rate.
Drury, Krieckhaus and Lusztig (2006) Aidt et al. (2005 and 2008)	Dysfunctional political institutions enable corrupt politicians to extract unpredictable rents, inducing a shift from the formal to the informal sector. Corruption functions like an free entry into the formal sector. In response, economic actors leave the formal sector and seek refuge in the informal sector, leading to low growth or stagnation.	Corruption responds to the quality of political institutions and the level of political accountability. As political institutions become increasingly dysfunctional, the tendency to shift from the growth-enhancing formal sector to the growth-reducing informal sector increases.
Fosu, Bates and Hoeffler (2006) Kimenyi (2007)	Corruption through patronage of special interest groups reduces the effectiveness of competitive elections and impedes economic growth. Sub-Saharan Africa.	Ethnic loyalty is won through patronage and dispensing of favours. This results in a trade-off between economically efficient public good provision and the ethnically driven pattern of provision.
Gyimah-Brempong (2002) Pellegrini and	Corruption affects growth through investment, schooling, trade openness and political stability. African countries.	Corruption deters investment, including foreign direct investment (FDI) but the effect is mediated through wider institutions.

Gerlagh (2004) Breslin and Samanta (2008)		
2. Non-linear effects		
Aidt et al. (2008)	In regimes with high institutional quality, corruption has substantial negative effects on growth, whereas in regimes with weak institutions, corruption has no	Corruption, institutions and growth are related through a complex web. Hence there are feedback effects, threshold effects and other sources of non-linear relationship between corruption and
Bardhan (1997) Larsson (2006) 2 reports	Oligarchic setting combined with disorganised rent is economically inefficient. Russia	The oligarchic setting and disorganised corruption means reduced incentives for owners of capital to invest. Negative impact on capital accumulation and economic growth.
Larsson (2006) Wedeman (2004)	Centralised authority combined with Schumpeterian rent may be efficient.	Strong leadership combined with growth performance targets in China and has induced government agents to derive rents from investment in productive activities. This 'Schumpeterian rent' awards innovation and entrepreneurship. However, as the economy grows, the number of rent seekers increases. This could push up transaction costs and have a negative impact on growth.
Larsson (2006) Wedeman (2004)	Dividend-sharing corruption may be compatible with economic growth.	Dividend-sharing corruption means the agents are keen to enhance the economic base of the rent revenue – leading to economic growth. However, as the number of rent-seekers increases, distortions increase and reduce growth.
Chang (1998) Dellepiane-Avellaneda (2010)	Rent-seeking undermines growth, but its eventual effect is mediated through institutions.	Institutions differ across countries. Hence, interaction of corruption with institutions determines the eventual effect on growth.

3. Positive effects		
Bardhan (1997) Heckelman and Powell (2010)	Corruption enables economic actors to overcome bureaucratic barriers. In a queuing model, the size of the bribe is decided by the briber to reflect the waiting cost associated with the queue. This would reduce the inefficiency in public administration – leading to growth.	Corruption can be beneficial in the early stages when economic freedom is limited and access to information is tightly controlled. However, this positive effect may be reduced by 3 mechanisms: (i) the size of bribes and the number of transactions may increase so as to produce an overall net loss in efficiency; (ii) the distortions that bribes are meant to mitigate may be the result of previous corrupt practices; and (iii) because corruption 'contracts' are not enforceable, the bribe may be higher than the waiting cost.
Political corruption		
Mauro (2004) Hillman (2004) De la Croix and Delavallade (2009)	Corruption may compromise human development through deterioration in the quality of public health and education programmes. Corruption is associated with	The controlling power of high officials over information on public expenditure funds leads to diversion of resources away from socially productive and growth-enhancing investments. Education and quality of health
Tanzi and Davoodi (1997) Hillman (2004) Mauro (2004)	Corruption may cause a general misallocation of public expenditures as certain areas of spending (e.g., military spending) are targeted more for their capacity to generate bribes than their potential to improve living standards.	Diversion of funds into military expenditure makes extraction of rent easier and allows the authoritarian regime greater domestic control and repression. This exacerbates institutional weakness and leads to lower growth rates.
Tanzi and Davoodi (1997) 1 report	Corruption leads to higher cost for a specified project than would be the case in the absence of corruption and makes capital spending much less productive.	The 'commission' or bribe paid is often a percentage of the total project cost. Hence, officials who receive payment for helping enterprises to win the bid will have a vested interest in increasing the size of the project. Capital spending becomes less

		productive and much less of a contributor to growth.
Tanzi and Davoodi (1997)	Corruption results in bias against spending on operations and maintenance of physical projects, which reduces productivity of past investments. Lack of commitment to maintenance results in poor conditions of roads and other infrastructure which is necessary for growth.	Lack of maintenance of past projects depresses returns on past investments. In addition, corruption creates perverse incentives for investment in new projects mainly for political rents
Tanzi and Davoodi (1997)	Corruption leads to poorer quality of infrastructure and reduces the productivity of current investments.	When public infrastructure, such as roads, power plants and irrigation canals, can be used only at a fraction of its full capacity, it retards growth more than the new capital projects add to growth.
Hillman (2004)	Corruption can reduce the effectiveness of public finance.	The tax revenue which does not reach the government is spent in unproductive ways or is privately appropriated before it reaches the intended public expenditure.
Tanzi and Davoodi (1997) Adam and Bevan (2005) Bose et al (2007) Blackburn et al. (2008).	Corruption can lead to loss of revenue collection, which requires the government to seek other sources of income to fund public expenditure. When it resorts to seigniorage (printing money), the consequent inflation leads to lower levels of capital accumulation and reduces the growth rate.	The looting of public resources means that for any given levels of tax and expenditures the government must rely more on the revenue from seigniorage in order to satisfy its budgetary constraints. A higher level of seigniorage implies a higher rate of inflation, which induces a portfolio reallocation away from capital towards money. Growth is reduced as a result.

Irrespective of the corruption type, the theoretical/analytical studies identify two institutional/political economy factors that mediate the impact of corruption on

growth: (1) how corruption is organised in a country (organised/disorganised; centralised/decentralised); and (2) and the level of institutional and bureaucratic quality.

Organisation or structure of corruption: When corruption is decentralised, bureaucrats at different levels of government attempt to maximise their own bribe income without taking into account the negative effect of this on the bribe-taking capacity of others (Shleifer and Vishny, 1993). For the briber, this means that the size of the bribe is unpredictable, and this uncertainty increases transaction costs. Centralised or organised collection of bribes is when there is a single point for the collection of bribes. This has less adverse consequences for efficiency than decentralised bribe taking, because it can internalise some of the effects of corruption by assuming power to determine the overall rent in the system. A centralised network of collusive corruption can lead to lower levels of bribe payment, relatively better provision of public goods/services and a smaller scale of distortions compared to decentralised corruption (Bardhan, 1997; Blackburn and Forgues-Puccio, 2009).

Blackburn and Forgues-Puccio (2009) demonstrate how an organised syndicate of corrupt bureaucrats would maximise its illegal income by limiting the number of corrupt transactions, a situation that does not arise in a disorganised network of rent-seeking officials. Bardhan agrees that centralised corruption, akin to Olson's 'stationary bandit', has an encompassing interest in the domain over which rent-exacting power is exercised. However, he also indicates that centralised corruption is more distortionary than taxation because of the need to keep corruption a secret. Therefore, corruption may not be associated with higher growth even if it is centralised/co-ordinated.

Institutional/bureaucratic quality: A large body of political economy research into the 'East Asian paradox' identifies this as a mediating factor in the corruption-growth linkage. Whether corruption is growth-enhancing or growth-reducing depends on the relationship between polity and the elite bureaucrats who will together facilitate the generation of rent most beneficial to them. Corruption is a response to situations where rents already exists and is an incentive for state officials to create new rents (Larsson, 2006). Hence, different types of rent have different implications for economic efficiency and growth. Larsson (2006: 274) distinguish between growth-reducing monopoly rent (which creates a deadweight welfare loss) and growth-enhancing Schumpeterian rent (which creates incentives for efficient use of scarce resources). Corruption is of Schumpeterian nature if it requires ability to find and use existing information or generate entirely new information. Monopoly rent is economically inefficient; whereas Schumpeterian rent may be growth-enhancing.

In what follows, we present the detailed narrative synthesis of the findings with respect to direct and indirect effects of corruption on growth. In doing this, we will

demonstrate how corruption type (bureaucratic and political corruption) interacts with mediating political economy factors to generate a wide-ranging array of direct and indirect effects on growth. We will control for corruption type and provide a synthesis of the evidence on direct and indirect impacts of corruption.

4.2 Narrative synthesis – detailed results

4.2.1 Bureaucratic corruption and impacts on growth

As indicated above, studies of bureaucratic corruption predict three possible effects of corruption on growth: (1) a negative effect due to distorted incentives and higher transaction costs; (2) a non-linear effect, which may be negative or positive depending on political economy factors or institutional quality; and (3) a positive effect due to centralised organisation of corruption.

4.2.1.1 Negative impact of bureaucratic corruption on growth

Bureaucratic corruption may cause a misallocation of talent and skills away from productive (entrepreneurial) activities towards non-productive (rent-seeking) activities. Therefore, Murphy et al. (1991) demonstrate that rent-seeking by government officials is likely to hurt innovative activities more than everyday production. This is because rent-seeking is likely to target the innovation sector, which is more vulnerable than already established producers. The latter group do not need as many 'government goods', as they have already bought them. Innovators, however, need government-supplied goods such as permits, licences, import quotas etc. Since innovation drives economic growth, rent seeking hampers growth severely even if it leaves the established producers untouched. This argument finds support in Rivera-Batiz (2001), who concludes that corruption undermines the profitability of innovations, lowers the rate of return to capital and reduces the rate of technological change.

Acemoglu and Verdier's study (2001) is located in the context of reward structure and the allocation of talent. The entrepreneur can allocate his activities into productive entrepreneurship and unproductive rent seeking. The reward structure determines the relative rewards of the agents engaged in these alternative activities. The returns to productive activities depend on the amount of rent seeking in the economy, which is determined by the reward structure. Furthermore, more rent seeking reduces the marginal productivity of investment and the relative return to entrepreneurship. Thus, the reward structure would divert entrepreneurial talent from productive to unproductive rent-seeking activities, with indirect negative impact on economic growth.

Ehrlich and Lui (1999) also draw on the human capital channel that transmits the impact of corruption on growth. Their argument is that if bureaucratic power holds promise of economic rents through corruption, then individuals have an incentive

to compete over the privilege of becoming a bureaucrat. This would divert capital to the accumulation of political capital, reducing the capital that could otherwise be used for production or investment. In this approach, the relationship between corruption and growth is analysed as an endogenous outcome of competition between growth-enhancing and socially unproductive investment.

Corruption may also have a negative effect on growth, due to its adverse effects on the enforcement of property rights, leading to obstacles to doing business, to innovation and to technology transfer. Secure property and contract laws ensure lower costs for investors and allow the private sector to retain their profits, leading to sustainable economic growth (Mijiyawa, 2008). Legal assurances increase private investment, which brings in new technology, and also increases the total factor productivity. These in turn increase the economic competitiveness necessary for economic growth. When corruption undermines these legal assurances, it can slow down private investment and technological transfers and drag down the growth rate.

Botswana provides an interesting case where provision of secure property rights has been a crucial factor in its steady growth rate. The policy enabled the integration of minority tribal groups and the elite, with substantial investment in landed assets; and provided a strong incentive to promote the development of rational-state institutions with well delineated protection of property rights (Fosu, Bates and Hoeffler, 2006).

Another direct negative effect of corruption is due to patronage, which reduces the effectiveness of competitive elections and impedes economic growth. The research on this causal mechanism has focused primarily on Africa and its persisting low economic growth rates. In the context of Kenya, Burundi and sub-Saharan Africa, multi-ethnicity has had a negative impact on growth policies as ethnic loyalty is won through patronage and dispensing of favours. This results in a trade-off between economically efficient public good provision and the ethnically driven pattern of provision (Fosu, Bates and Hoeffler, 2006; Kimenyi, 2007).

Finally, corruption may limit the extent of a country's trade openness and reduce inflows of foreign direct investment (FDI), leading to lower growth rates. Pellegrini and Gerlagh (2004) examine the effects of corruption on investment, schooling, trade policy and political stability, and estimate the contribution of the various channels to the overall negative effects of corruption on growth. They conclude that the effects of corruption on growth are both direct and indirect through its impact on investment, schooling, trade openness and political stability.

A government's intention to tackle corruption can have an impact on FDI and domestic capital formation. In the context of African countries, Breslin and Samanta (2008) examine the effect of corruption on FDI flows. Their study shows that level of corruption is not a significant factor for investment, capital formation

or growth of the economy. However, the decision of these countries to be more transparent (they signed a treaty in which they agreed to make legal and administrative changes to reduce corruption) has a positive impact on foreign direct investment and capital formation. The fact that the government is taking action to tackle corruption has a more important effect on foreign direct and domestic capital formation. Corruption in Africa is systemic and involves high-level political leadership. Therefore, the decision by the leadership to tackle corruption has an impact on the decision making of the investors (Gyimah-Brempong, 2002: 185)

4.2.1.2 Non-linear relationship between corruption and growth

Three principal theses in institutional economics have helped to clarify the links between corruption and economic development: (i) that formal rules, informal norms, political institutions and enforcement characteristics shape actor expectations and behaviour; (ii) that actors make choices using subjective mental models, and thus individuals from different backgrounds may interpret the same evidence differently; and (iii) that institutions are endogenous. These insights have had significant influence on the research that examines how corruption interacts with the wider institutional set-up and actor choices to generate non-linear (differentiated) impacts on growth.

Analysing the impacts of corruption as a dysfunctional institution, several studies examine the impact of corruption in the context of endogenous growth and corruption with non-benevolent principals (Aidt et al, 2005; Méon and Sekkat, 2005; Aidt et al., 2008).

Aidt *et al.* (2008) focus on incentives for political leaders and political accountability. They demonstrate that politician's pursuit of rent is designed to respond to the quality of political institutions and the level of political accountability. Elected politicians or dictators extract rent from citizens by charging a fee for entry into the formal sector of the economy under conditions of asymmetric information. At one end, political institutions are so dysfunctional that political leaders are effectively free to extract as much rent as they like from the economy. In response to this, citizens leave the formal sector of the economy and seek refuge in the informal sector. The net result is low growth or stagnation. This result ties in with other findings on the negative effects of corruption summarised above.

At the other end of the spectrum, however, political institutions – like voting - allow the citizens of the formal sector to reduce corruption by threatening to replace the incumbent who extracts rent too greedily. The politicians/rulers are willing to reduce current corruption to avoid being replaced and loss of future rent. Therefore, such political institutions have a disciplining effect on political behaviour and allow the formal economy to grow, which means that the resource

base from which politicians can extract rents expands over time. Therefore, institutions that reduce monitoring costs (i.e. cost of 'firing' the political leaders when bureaucratic corruption is high) create a benign feedback loop between economic growth and corruption: high growth reduces corruption, which in turn increases growth. Hence, the existing level of development mediates the impact of corruption on growth.

Drury, Krieckhaus and Lusztig (2006) also highlight the role that institutional quality plays in mediating the effects of corruption on growth. Their study covers 100 countries over a 16-year period and concludes that non-democracies suffer significant economic harm from corruption. The ability in a democracy for the electorate to remove leaders from office seems to mitigate the stunting effect corruption has on economic growth. This finding is similar to that of Méon and Sekkat (2005), who tested the 'greasing the wheel' hypothesis using indicators of institutional quality and corruption. They conclude that corruption is most harmful when governance is weak. In this perspective, democracy and good governance reduce the 'monitoring costs' that prevent the 'principal' from holding the 'agent' accountable.

However, the relationship between governance quality (including democracy) and corruption may be more complicated than the causal explanation provided by these studies. For example, Mendez and Sepulveda (2006) demonstrate that the impact of corruption on growth varies with the level of corruption when the quality of democracy (proxied by political freedoms) is constantly high across a sample of countries. In this approach, corruption may have a negligible effect on growth if its incidence is low, but its effect becomes substantially adverse after a certain minimal threshold – even if the degree of political freedom remains high. Furthermore, democracy may in fact exacerbate both the level of corruption and its adverse effects on economic growth if other dimensions of governance quality are weak. This is generally the case when conflict resolution institutions are weak due to ethnic or religious fragmentation, distributive institutions are politicised and regulatory institutions are more likely to be captured.

Another mediating factor is the degree of centralisation in rent-seeking activities. Bribery in communist Russia was centralised to collect bribes and it was effectively monitored. In the post-communist era, officials in different ministries, agencies and levels of government attempted to maximise their own revenue. This combined with weak government and made inefficiency particularly acute (Bardhan, 1997). These officials may consist of strong elements from the Soviet era who continue to play a pivotal role in the co-ordination of economic and political transactions. Further, some of these networks have been used to exclude new entrants to markets and maintain monopoly rent. In the new regime, rent seeking allowed these power brokers to (i) create growth-retarding monopoly rents through control of natural resources and heavy industry; and (ii) extract rent-like transfers through privatisation. The result is reduced incentives for owners (domestic and

overseas) of capital to invest or to enhance productivity of firms under their control. This would have a direct negative impact on capital accumulation and economic growth rate (Larsson, 2006).

However, when the rent-seeking activities are centralised, the impact of corruption could be positive. This is shown to be the case in China, where the reform introduced by Deng Xiaoping had an important bearing on the centralisation of policy as well as rent-seeking activities. Deng Xiaoping's reforms retracted power from local cells and built a more centralised polity, centred on market-based exchanges. Hence, under strong central leadership focused on growth, corrupt Chinese officials had to create rent compatible with efficiency and long-term growth (Larsson, 2006).

4.2.1.3 Positive impact of corruption on growth

In contrast to studies examining the non-linear nature of the corruption-growth relationship, the work on positive growth impacts of corruption is linear and highlights the ways in which corruption may foster growth by enabling the principal to overcome bureaucratic barriers. This work draws on pioneering work by Leff (1964) and Huntington (1968). The latter had argued that corruption could improve efficiency and promote growth as it allowed businesses to overcome bureaucratic impediments.

Bardhan (1997) indicates one way through which this 'greasing the wheel' effect may materialise. In the case of competitive bidding, if the contract is awarded to the highest bidders, then allocation efficiency is maintained because only the lowest-cost firm can afford the largest bribe. In this model, the bureaucrat practices price discrimination among clients with different time preferences. Then the size of the bribe is determined by the briber to reflect the waiting cost associated with the queue. This could reduce inefficiency in public administration.

However, this remains a minority view. For example, Shleifer and Vishny (1993) demonstrate that in a highly regulated system, corrupt officials use arbitrary barriers to create delays. In other words, they are not necessarily engaged in matching the bribe level with the time preference of the principals. Also, Blackburn and Forgues-Puccio (2009) identifies other shortcomings in the 'greasing the wheel' argument. First, bribery may speed up individual transactions with bureaucrats, but both the size of the bribes and the number of transactions may increase so as to produce an overall net loss in efficiency. Secondly, the distortions that bribes are meant to mitigate are often the result of corrupt practices to begin with and therefore should be treated as endogenous, rather than exogenous to the bureaucratic process.

The narrative synthesis above demonstrates that the impact of bureaucratic corruption on growth is likely to be negative or at least more distortionary than the

impact of an equivalent tax. However, this may not be a linear relationship which can be estimated accurately by linear models. Hence, controlling for the wider institutional set-up, the degree of centralisation in rent-seeking activities and the level of development is necessary. In addition, the 'greasing the wheel' thesis on the corruption-growth relationship may draw attention to the causal mechanisms that sustain corruption as a remedy for institutional shortcomings or governance failures. However, its conclusion concerning a positive corruption effect on growth is too far-fetched because corruption may enable economic agents to circumvent existing barriers, but it creates new distortions whose negative effects are highly likely to outweigh the positive effect of the 'grease'.

4.2.2 Political corruption and impacts on growth

De la Croix and Delavallade (2009) define the ease with which rent seekers can capture part of the public spending, which they describe as predatory corruption technology. This distorts the allocation of public investment in favour of specific sectors, i.e., those that can be subject to corruption and where rent is generated more easily and better concealed. In this strand of the literature, political corruption is found to have a negative impact on growth. Therefore, we will synthesise its findings without sub-headings reflecting variable effects.

For Mauro (1997), Tanzi (1998), and De la Croix and Delavallade (2009), political corruption has a negative impact on economic growth because it prioritises investment in construction and physical capital at the expense of health and education. Additionally, lowering the provisions in education and health has a negative effect on future income and reinforces economic inequality. This occurs when auditing and institutional controls are weak (Tanzi, 1998).

Political corruption works through different channels but all these go to reducing growth (Hillman, 2004). In this tradition, Mauro (2004) provides evidence that corruption changes the composition of government spending through biases that provide more lucrative opportunities for personal gains through corruption. His empirical findings confirm that corruption is associated with biases against spending on education and health care. Education and quality of health determine the quality of human capital, which is fundamental for economic growth. Hillman (2004) cites evidence indicating that high levels of corruption have adverse effects on a country's child and infant mortality rates; on percentage of low birth-weight babies in total birth; and dropout rates in primary schools'.

Political corruption may also cause a general misallocation of public expenditures in favour of military spending, which has the capacity to generate bribes. In addition, Hillman (2004), Mauro (2004) and Tanzi and Davoodi (1997) demonstrate that corruption leads to higher public spending on goods whose value is difficult to establish and monitor. Procurement of high technology and military equipment is therefore favoured by corrupt officials because it is easier to extract rent. This

type of distortion is likely to be higher in less competitive markets because of the higher profits available to be shared between the supplier and the public official (Mauro, 2004).

Political corruption also leads to higher cost for a given public project than would be the case in the absence of corruption and makes government's capital spending much less productive. Tanzi and Davoodi (1997) note that there are various stages in project design and in the approval process. Decisions have to be made regarding the choice of specific projects, their location and size, and the design. When controlling and auditing systems are weak, some high-level individuals will influence the decision making for the project. Furthermore, domestic or foreign enterprises bidding for the project will be willing to pay a bribe if their profit margins in large projects are high. In fact, the 'commission' or bribe paid is often calculated as a percentage of the total cost of the project. And if commissions are a percentage of the project cost, the officials who receive payment for helping enterprises to win the bid will have a vested interest in increasing the size of the project. The authors therefore argue that when approval of investment projects come to be influenced by high-level corrupt officials, the return of projects as calculated by cost-benefit analysis ceases to be a criterion for project selection. Capital spending becomes much less productive and much less of a contributor to growth than expected. The impact on growth estimated through cross-country or panel data will then capture this distortion as a negative effect on cross-country growth rates.

Finally, political corruption can reduce growth through its impact on public finance. One way in which this may happen is when corruption siphons off tax revenues and reduces the funds for public expenditure (Hillman, 2004). This, in turn, may lead the government to extract seigniorage by printing money. When it resorts to this, the consequent inflation leads to a lower level of capital accumulation and reduces growth rate. Al-Marhubi (2000) reports that inflation due to seigniorage is positively correlated to incidence of corruption, while Adam and Bevan (2005) and Bose et al (2007) report that seigniorage has a negative effect on growth.

In conclusion, we can state that the theoretical/analytical work on political corruption tends to report a negative effect on growth. This effect can be due to misallocation of public funds, lower public revenue, and further distortions caused by the quest for alternative sources of public revenue – mainly seigniorage. Combining this with the findings of the literature on bureaucratic corruption, we conclude this narrative synthesis by indicating that corruption (of both types) is generally reported as an institutional weakness that hinders growth. However, the negative impact of corruption on growth is mediated through political economy factors in individual countries, the channels through which it is transmitted (investment, human capital, public finance, etc.), the extent of centralisation/co-ordination of rent-seeking activities, and the level of development. In the next

section, we will meta-analyse the empirical estimates of the impacts analysed in the theoretical/analytical studies. The nature of the reported empirical estimates does not allow for the factors through which corruption's impact on growth is mediated to be controlled for. However, we will control for some of these factors – particularly the country type (low-income, mixed and all countries), the corruption data sources (which reports perceived corruption), and the estimation method. This nested approach will enable us not only to address the systematic review question (which focuses on low-income countries), but also to provide a wider empirical setting within which the impact of corruption on low-income countries can be placed.

4.3 Meta-analysis – summary results

The meta-analysis to be presented below is based on 596 empirical estimates reported by the empirical studies. The meta-analysis is conducted in three stages:

In stage 1, we calculate summary statistics based on individual empirical studies. These summary statistics consist of simple means, fixed-effect estimates (FEE) for weighted means, confidence intervals, and average precision levels. We calculate these summary statistics for three direct effects of corruption on growth (direct effects on per capita GDP growth, per capita GDP levels, and GDP growth) and for three indirect effects (effects through investment, human capital and public finance channels). These summary measures will provide a quick overview of the study-based distribution of the point estimates for corruption's effects. In this overview, within-study variation captured by reported standard errors will be have been taken into account through the FEE – which is an efficient estimate if we assume that all estimates reported by a study come from a single population with constant mean. (Stanley, 2008).

In stage 2, we calculate simple and weighted means for estimates reported by a group of studies nested within a unique combination of growth and corruption measures or within a combination of growth measure and a group of countries. For weighted means in stage 2, we use the random effect estimator (REE) proposed by Stanley (2008), Stanley and Doucouliagos (2007), and de Dominicis et al. (2008). Because the REE is calculated across studies, the single population assumption is no longer valid. Therefore, each original estimate is weighted not only by within-study variation but also by between-study variation.

Note that the meta-analysis in stages 1 and 2 is conducted at different levels of nesting/aggregation. The aim here is twofold: (i) to establish how the weighted means compare to simple means at each level of nesting/aggregation; and (ii) to verify whether the sign (and preferably magnitude) of the REE remain consistent as the analysis is conducted at different levels of nesting/aggregation. Then, we proceed to stage 3 to conduct precision-effect tests (PETs) if the consistency requirement in (ii) is satisfied at different levels of nesting/aggregation.

In stage 3, we carry out precision-effect tests (PETs) for weighted means (REEs) calculated for groups of studies nested at different levels of aggregation. For this, we draw on the weighted least-square 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) regression of the t-value of the reported estimates on the precision of the estimate. This method is built on the original model proposed by Egger et al. (1997). If the test leads to rejection of the null hypothesis, the REEs can be taken as indicators of genuine effect beyond publication or small-study bias.

The PETs conducted in stage 3 are based on original estimates that are used to calculate the weighted means in stage 2. In other words, they are conducted at the same level of nesting/aggregation. Therefore, if the test result is conducive to the rejection of the null hypothesis, the PET would indicate that the given REE at the same level of nesting/aggregation can be taken as a measure of genuine effect beyond bias. Otherwise, the said REE cannot be taken as a statistically significant measure of genuine effect.

This procedure enables us to report the following:

67 percent of the studies we analyse in this review report estimates that yield negative simple and weighted means for direct and indirect effects of corruption on growth, and the average effect is statistically significant judging by associated confidence intervals.

When we nested the studies within 48 groups corresponding to 8 measures of corruption and 6 measures of growth, we obtained observations for 20 nests – i.e., original study estimates are concentrated in 20 nests. In 13 out of 20 nests (65 percent), the average effect within each nest is negative.

When we nested the studies within 24 groups corresponding to 4 measures of corruption and 6 measures of growth, we obtained observations for 14 nests. In 12 out of 14 nests (85 percent), the simple mean effect within each nest is negative.

Calculating weighted means (REEs) for the 14 nests defined in (3), we observe that all nests (100 percent) now contain negative estimates, suggesting that the 2 simple means with positive values in (3) must be associated either with high standard errors or with high levels of between-study variation.

Nesting studies within 3 country groups (LICs, Mixed and All) and 6 growth measures, we obtained observations for 18 nests. We observe that, with the exception of corruption's direct effect through investment, all weighted-mean estimates are negative for LICs, Mixed and All country groups.

Comparing the negative effects of corruption between countries, we report that the impact is usually smaller in magnitude in LICs – especially with respect to direct effect on per capita GDP and indirect effect through public finance.

We conducted precision-effect tests (PETs) to verify whether the weighted means (REEs) can be taken as measures of genuine effect from corruption to growth. The test results indicate that REEs indicates genuine negative effect on growth in: (i) 6 out of 14 nests defined in 3 and 4 above; (ii) 4 out of 6 growth measures for LICs; and (iii) 5 out of 6 growth measures for both Mixed and All country groups.

In the next section, we will present a detailed breakdown of the meta-analysis results.

4.4 Meta-analysis – detailed results

4.4.1 Meta-analysis of individual study findings

Table 4.2 presents the results of the meta-analysis for each study that reports estimates for one of the six effects of corruption on growth: three direct effects on per capita GDP growth rates, per capita GDP levels and GDP growth rates; and three indirect effects on per capita GDP growth through the public finance, investment and human capital channels. The table divides the studies into six groups, where each group consists of studies reporting estimates of corruption's effect on a particular measure of growth. The set of 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 68.5 percent of reported estimates (408 out 596) concern the impact of corruption on per capita GDP growth. This is followed by 75 estimates (12.5 percent) on the indirect effect through public finance and 44 estimates (7.4 percent) 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.

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 percent); and the sign remain stable when weighted means (FEES) are calculated. The preliminary conclusion is that about 85 percent of the studies report estimates that indicate a negative growth effect when the measure of corruption increases by one unit. 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, indicate a tendency towards a negative effect, which nevertheless has to be verified through the precision-effect test procedure.

Table 4.2: Meta-analysis of original study estimates, sorted by precision level

	No. of Estimates	Corruption Data Source	Simple Mean	Lower Conf. Limit	Upper Conf. Limit	Weighted Mean (FEE)	Average precision
Studies reporting effect on per capita GDP growth							
Mocan (2009)	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)	9	Other	−0.0078	−0.0206	0.0051	−0.0012	562.5
Mauro (1995)	9	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	17	ICRG	−0.0329	−0.0419	−0.0240	−0.0197	78.5

	No. of Estimates	Corruption Data Source	Simple Mean	Lower Conf. Limit	Upper Conf. Limit	Weighted Mean (FEE)	Average precision
Breuer (2006)							
Gupta et al. (2002)	11	ICRG	0.2330	−0.2163	0.6823	0.0233	73.1
Gyimah−Brempong and de Gyimah-Brempong (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)	13	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 and de Gyimah-Brempong (2006)	5	TI	−0.2333	−0.2806	−0.1860	−0.2357	12.9
Blackburn et al.	43	ICRG	0.0325	−0.1925	0.2575	0.0008	9.0

	No. of Estimates	Corruption Data Source	Simple Mean	Lower Conf. Limit	Upper Conf. Limit	Weighted Mean (FEE)	Average precision
(2008)							
Tanzi and Davoodi (2000)	11	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. (2002)	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

	No. of Estimates	Corruption Data Source	Simple Mean	Lower Conf. Limit	Upper Conf. Limit	Weighted Mean (FEE)	Average precision
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. (2000)	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
Méon 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
Subtotal	434						
Dzhumashev (2009)	10	WGI	−0.050	−0.075	−0.024	−0.001	200.6
Baliamoune-Lutz and Ndikumana (2007)	3	ICRG	−0.061	−0.331	0.209	0.001	137.3

	No. of Estimates	Corruption Data Source	Simple Mean	Lower Conf. Limit	Upper Conf. Limit	Weighted Mean (FEE)	Average precision
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
Pellegrini and Gerlagh (2004)	3	TI	−1.360	−4.918	2.198	−1.260	1.656
Subtotal	27						
Studies reporting effect on GDP growth							
Ehrlich and Lui (1999)	6	Other1	−0.056	−0.100	−0.012	0.035	1347.8
Gupta et al. (2002)	5	ICRG,WGI, Other	−0.008	−0.017	0.002	−0.002	617.2
Gyimah−Brempong (2002)	8	TI	−0.526	−0.611	−0.441	−0.549	11.2
Gyimah−Brempong (2006)	4	TI	−0.477	−0.582	−0.373	−0.486	10.5

	No. of Estimates	Corruption Data Source	Simple Mean	Lower Conf. Limit	Upper Conf. Limit	Weighted Mean (FEE)	Average precision
Mo (2001)	6	TI	−0.279	−0.471	−0.087	−0.262	4.6
Anoruo and Braha (2005)	5	TI	−1.169	−1.607	−0.730	−1.197	3.3
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
Subtotal	38						
Studies reporting effect on per capita GDP growth through public finance channel							
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
Subtotal	75						

	No. of Estimates	Corruption Data Source	Simple Mean	Lower Conf. Limit	Upper Conf. Limit	Weighted Mean (FEE)	Average precision
Studies reporting effect on per capita GDP growth through investment channel							
Dzhumashev (2009)	4	WGI	−0.017	−0.027	−0.008	−0.007	358.772
Guetat (2006)	6	TI	0.225	0.107	0.342	0.120	21.335
Subtotal	10						
Studies reporting effect on per capita GDP growth through human capital channel							
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
Subtotal	12						
Total number of reported estimates	596						

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) are as follows: 23 out 32 (72 percent) for corruption's effect on per capita GDP growth rates; 3 out 5 (60 percent) for the effect on per capita GDP level; 6 out 9 (67 percent) for the effect on GDP growth rates; 2 out of 3 (67 percent) for the indirect effect through public finance; 1 out 3 (33 percent) for the indirect effect through investment; and 0 out of 2 (0 percent) 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 percent) for the impact of corruption on per capita GDP have an average precision level of 10 or more. The proportions for other measures of growth are: 4 out 5 (80 percent) for per capita GDP levels; 4 out of 9 (44 percent) for GDP growth rates; 3 out 3 (100 percent) for the indirect effect through the public investment channel; 2 out 3 (67 percent) for the indirect effect through the public investment channel; and 1 out 2 (50 percent) for the indirect effect through the human capital channel. Overall, 32 out of 52 average estimates (58 percent) are associated with a precision levels that is greater than 10 – which is usually the desired level of precision in randomised control trials.

However, we do not propose to derive conclusions about the growth effect of corruption on the basis of individual study evidence for two reasons. Usually, when original observational studies of the type reviewed here report multiple estimates, they 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 4.2 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 4.2 should not be taken as indicators of genuine effect, which is the following: as a mirror image of the within-study dependence we referred to above, observational studies such as these are characterised by a high degree of heterogeneity with respect to measurement, data sources, estimation methods, and sample choices. Given this high degree of heterogeneity, it would be inappropriate to aggregate the findings

from each study in order to derive general conclusions. For this, we follow a nesting method that enables us to verify the extent to which the study findings still indicate a negative effect of corruption on growth when we nest studies at different levels of aggregation and within different country groupings.

4.4.2 Nested meta-analysis 1: simple means at different levels of aggregation

The empirical studies reviewed here use four 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 the remaining studies, we have coded the corruption measure as ICRG2, WGI2, TI1, and Other2. In total, there are eight measures of corruption with potential to be used in the original studies.

We began nesting the studies on the basis of disaggregated corruption data and growth measures used. Given that we have 8 possible corruption data types and 6 growth measures, the studies can be potentially nested within 48 nests. When we nested the studies in this way and calculated simple means for studies within each nest, we obtained the distribution in Table 4.3.

Table 4.3: Cross-study unweighted means for all countries, disaggregated by corruption data source and effect type

	ICRG1	ICRG2	WGI1	WGI2	TI1	TI2	Other1	Other2	Total N
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.E.	27
Corr*pubfin on Pcgdp_growth	N.E.	−0.8279 (75)	N.E.	N.E.	N.E.	N.E.	N.E.	N.E.	75
Corr*Investment on Pcgdp_growth	N.E.	N.E.	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)	N.E.	N.E.	12
Total N	58	182	48	23	198	34	8	45	596

(Number of reported estimates in parenthesis)

N.E. = No estimates reported in original studies

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.

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 1.0774 percentage points. If we take the cell that combines per capita GDP growth and TI2 data, the simple mean estimate 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 the 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 corruption's impact on per capita GDP level (row 3), 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 levels. The number of estimates on per-capita GDP growth rate is 434 and that for GDP growth is 38 – giving a total of 482 estimates for growth rates.

In the next step, we merged versions 1 and 2 of each corruption data source in order to obtain a single scale for each corruption data source. We did this 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 remains the same. This method is justified because the magnitude of the reported estimates would have been the same had the 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, Gyimah-Brempong, 2002; Egger and Winner, 2005; Ahlin and Pang, 2008; Aidt, 2009).

Table 4.4 presents unweighted means of the estimates when versions 1 and 2 of each corruption data source are merged.

An examination of Table 4.4 indicates that the unweighted average 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 4.4: Unweighted means for all countries: merged corruption data

	ICRG	WGI	TI	Other	Total N
Pcgdp_growth	−0.0612	−1.2280	−0.4230	−0.3561	434
Gdp_growth	−0.0078	−1.3000	−0.9448	N.E.	38
Pcgdp_level	0.0202	−0.3344	0.0445	N.E.	27
Corr*pubfin on	−0.8279	N.E.	N.E.	N.E.	75
Corr*Investment on	N.E.	−0.0243	−0.4603	N.E.	10
Corr*HumCap on	N.E.	N.E.	−0.1633	N.E.	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 it is 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 unweighted means reported at this level of nesting/aggregation should be considered only as simple yet un-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 Nested meta-analysis 2: weighted means and precision-effect tests by corruption data and growth measure

In this section, we report the weighted means of reported estimates for all countries, nested within four corruption data sources and 6 measures of growth. These weighted means have been calculated in accordance with the random-effect estimator discussed in section 2.3.4 above. As can be seen from Table 4.5, the weighted mean is consistently negative for all measures of growth and all corruption data sources. The exception we noted with respect to weighted means above (the positive unweighted mean for estimates nested within the ICRG data and per capita GDP level) no longer holds. A comparison with Table 4.4 also reveals that the magnitudes of the weighted means are smaller than those of the unweighted 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 synthesised effect if they pass the precision-effect test (PET).

Table 4.5: Weighted means of reported estimates for all countries: by aggregated corruption data source and effect type

	ICRG	WGI	TI	Other	Total N
Pcgdp_growth	−0.0233*	−0.8191	−0.2378*	−0.2242	434
Gdp_growth	−0.0060*	−1.0258	−0.8376*	N.E.	38
Pcgdp_level[a]	−0.0223	−0.2303	−0.1289	N.E.	27
Corr*pubfin on	−0.7259*	N.E.	N.E.	N.E.	75
Corr*Investment on	N.E.	−0.0213	−0.3023	N.E.	10
Corr*HumCap on	N.E.	N.E.	−0.1124*	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 conducted precision-effect tests on the original study estimates that populates each of the nests in Table 4.5. The bold entries in this table indicate that the null hypothesis of the precision-effect test (i.e., the hypothesis that there is no genuine effect) should be rejected at the 10 percent, 5 percent or 1 percent level. The results of WLS regressions for precision-effect effect and bias tests are presented in Appendix 4.3. Hence, at this level of nesting, it can be concluded that six out of fourteen nests return weighted mean estimates that satisfy the precision-effect test; and the remaining eight do not.

Four 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 two 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 to the 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, Tables 4.4 and 4.5 enable us to derive four conclusions. Firstly, random-effect estimates (REEs) provide synthesised results that are not only consistent with simple means, but are also more reliable as they take account of within- and between-study heterogeneity. Secondly, the weighted means for all nests in Table 4.5 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 a more aggregate level, and conduct precision-effect tests to verify if the weighted means calculated at that level represent genuine effects.

4.4.4 Meta-analysis 3: weighted means and precision-effect tests for LICs

At this stage of the meta-analysis, we pooled together studies that report estimates for LICs, irrespective of the estimation methods and corruption data sources they use. So far, we have provided four types of evidence that justifies the nesting at this level of aggregation:

The sign of the synthesised estimates remains the same (i.e., negative) as the level of aggregation increases (compare Tables 4.3 and 4.4).

The magnitude of the synthesised evidence remains comparable as the level of aggregation increases (compare Tables 4.3 and 4.4).

The weighted means (random-effect estimates) of corruption's effect are usually smaller than the simple means as they take account of heterogeneity (compare Tables 4.4 and 4.5).

The precision-effect tests (PETs) are effective in differentiating between REEs with respect to whether they represent a genuine effect or not.

Given this evidence, and in order to address the systematic review question directly, we have conducted meta-analysis of the empirical evidence from all studies that report estimates for corruption's effect on growth in low-income countries (LICs). Stated differently, we have conducted a meta-analysis by nesting studies at a higher level of aggregation. The results for weighted and simple means for LICs are given in Table 4.6.

We obtained 83 reported estimates from empirical studies that examine the impact of corruption on growth in low-income countries (LICs). This constitutes 13.9 percent of the total number of estimates we analyse in this review. The LIC-specific studies that report more than 2 estimates for corruption's growth effects in LICs consist of: Gupta et al. (2002); Gyimah-Brempong (2002); Anoruo and Braha (2005); Guetat (2006); Aixala and Fabro (2008); Baliamoune-Lutz and Ndikumana (2007); Blackburn et al. (2008); Breslin and Samanta (2008).

Table 4.6: Weighted and simple means of reported estimates for LICs

Growth indicator	Weighted	Simple
Pcgdp_growth	−0.0667 (N = 34)	−0.0049 (N = 34)
Gdp_growth	−0.6542 (N = 20)	−0.7572 (N = 20)
Pcgdp_level	−0.1910 (N = 13)	0.0224 (N = 13)
Corr*pubfin on pcgdp_growth	−0.2319 (N = 12)	−0.1630 (N = 12)
Corr*Investment on pcgdp_growth	0.1206 (N = 2)	0.1305 (N = 2)
Corr*HumCap on pcgdp_growth	−0.2890 (N = 2)	−0.3000 (N = 2)
Total original study estimates	83	83

The first point to be made here is that LICs have attracted a low number of studies compared to their percentage share (27.4 percent) of the total number of

countries for which corruption data exist.[8] Given the availability of corruption data for LICs, the relatively low number of LIC-specific studies must be due to lack of data for variables other than corruption – i.e., the control variables used in empirical models of growth. The second point to be made is that LICs tend to score high in terms of perceived corruption levels and low in terms of growth rates – as can be seen from the scatter plots in Appendix 4.3.

Given this combination, the relatively low number of studies on the growth impacts of corruption in LICs constitutes a significant gap in the literature that one hopes will be bridged in the future.

The weighted means reported in Table 4.6 indicate a systematically inverse relationship between the level of perceived corruption and various measures of growth in LICs – with the notable exception of the indirect effect through the investment channel. Compared to unweighted means, they are higher for three effects of corruption on growth: (i) the direct effect on per capita GDP growth; (ii) the direct effect on per capita GDP levels; and (iii) the indirect effect on per capita GDP growth through the public finance channel. They are lower than the unweighted means with respect to GDP growth and similar with respect to indirect effects through investment and human capital.

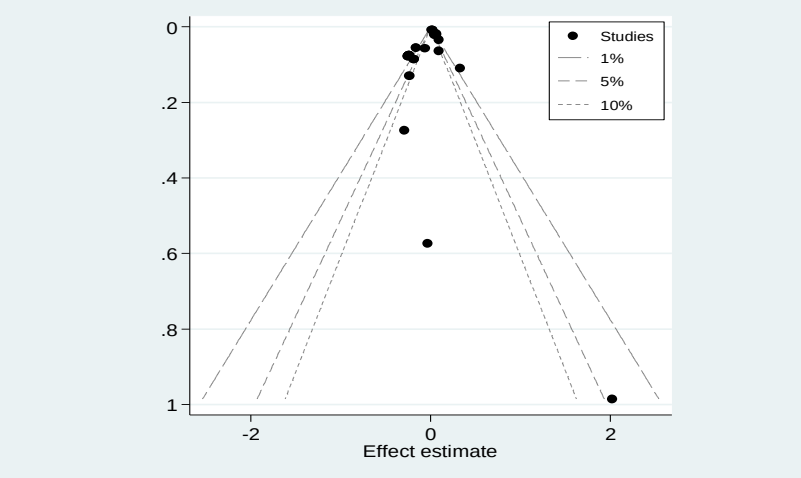
Recall that weighted means are corrected for both within- and between-study heterogeneity in accordance with equation 4 in the Appendix 4-1. Then, the evidence in Table 4.6 enables us to infer that corruption may be hindering growth in LICs. A one-unit increase in the level of perceived corruption is associated with a 0.06 percentage-point fall in per capita GDP growth, 0.65 percentage-point fall in GDP growth, and a 0.19 percentage-point fall in per capita GDP levels. The negative indirect effects on per capita GDP growth through transmission channels are: 0.23 percentage-point through the public finance/expenditure channel and 0.29 percentage-point through the human capital channel. Only the indirect effect through the investment channel is positive and equal to 0.12 percentage point.

In what follows, we conduct two tests to verify if these weighted mean estimates are associated with publication or study size bias and whether they indicate genuine effects. For the first task, we use funnel graphs, and for the second we use the precision-effect test (PET). Due to space constraints and given that per capita GDP growth rates are the most commonly used measures of growth in the relevant literature, we provide funnel graphs only for per capita GDP growth rates. However, we conducted PET for all measures of growth and the test results will be reflected in Table 4.7, where we highlight the estimates that satisfy the PET and compare LICs with non-LICs.

[8] The number of LICs in the World Bank definition is 43. The number of countries for which corruption data exist at least since mid-1990s is 157 in the WGI dataset.

A funnel graph plots the standard error against the non-standardised estimates as reported in the original study. Funnel graphs are highly effective in enabling the reader to identify the existence or absence of bias. To that end, they can be fitted with levels of significance (at 1 percent, 5 percent or 10 percent) to give a visual account of whether the reported estimates are statistically significant within the nest of studies that underpins the funnel. However, funnel plots do not provide a precise test of whether the original estimates or their synthesised summary thereof represent a genuine effect. This has to be verified through the precision-effect test (PET). Furthermore, funnel graphs should be interpreted with caution because they may be effective in indicating an absence of existence of bias, but they cannot capture all sources of bias. Because they are drawn as simple bi-variety graphs (against reported estimates and their standard errors) only, they can capture the bias that is attributable to the distribution of standard error only – the so-called study selection or small-study effect. (Egger et al., 1997; Sterne et al., 2001; Abreu et al. 2005).

Figure 4.1: Funnel plot for estimates of corruption's effect on per capita GDP growth rates



The funnel plot in Figure 4.1 indicates that the original estimates tend to have low standard errors (i.e. high precision). It also indicates that the large majority of the reported estimates lie within boundaries that delineate significance levels at 10 percent, 5 percent or 1 percent level. In other words, the large majority of the original estimates are statistically significant within each study. Finally, the funnel indicates that the reported estimates tend to be skewed to the left – implying that the majority of the reported estimates are negative. Therefore, the funnel suggests that there is a risk of publication-selection or small-study bias. We have run the Egger Test (or the Funnel Asymmetry Test in equation 2 in Appendix 4.2) to verify whether this is the case. The Egger test confirms that publication-selection or small-study bias cannot be rejected at 5 percent significance, but it can be rejected at 1 percent significance. In other words, publication bias cannot be ruled out, but it is marginal.

However, the existence of bias does not preclude the existence of a genuine effect from corruption to growth. To verify whether or not this is the case, we conducted the precision-effect test suggested by Stanley (2008) and Stanley et al. (2009). With the exception of corruption's direct effect on per capita GDP levels and the indirect effect through the investment channel, the PET results indicate that all synthesised estimates for LICs represent a genuine effect beyond bias. These statistically significant estimates include the direct effect on per capita GDP growth rates. The synthesised estimates (weighted means) that satisfy the PET are typed bold and marked with (*) in Table 4.7, which is a replica of column 2 in Table 4.6 with PET test results incorporated.

Table 4.7: Synthesised evidence for LICs – with precision-effect test results

Growth indicator	Weighted Mean Effects (REE)
Pcgdp_growth	**−0.0667*** (N = 34)
Gdp_growth	**−0.6542*** (N = 20)
Pcgdp_level	−0.1910 (N = 13)
Corr*pubfin on pcgdp_growth	**−0.2319*** (N = 12)
Corr*Investment on pcgdp_growth	0.1206 (N = 2)
Corr*HumCap on pcgdp_growth	**−0.2890*** (N = 2)
Total estimates	83

bold* = precision-effect test satisfied

Recalling that weighted means are corrected for both within- and between-study heterogeneity, the evidence in Table 4.7 enables us to infer that corruption has a negative and genuine effect on growth in LICs. This is the case when it is measured in terms of per capita GDP growth or GDP growth. The evidence also indicates that corruption has a negative and genuine effect on per capita GDP growth rates indirectly – through public finance/expenditures and human capital channels. Third, the evidence indicates that corruption's direct effect on per capita GDP levels is negative, but this cannot be considered as a genuine effect because the PET results do not allow the hypothesis that this estimate is not statistically significant to be rejected. Finally, the evidence indicates that corruption has a positive indirect effect on per capita GDP growth, but this effect is not statistically significant.

Adding corruption's statistically significant direct and indirect effects on per capita GDP growth (the most common measure in the growth literature), we can see that a one-unit increase in the corruption level is associated with a decrease of 0.5876 percentage-point in per capita GDP growth rates across LICs. The negative direct effect on GDP growth is similar: a one-unit increase in corruption level is associated with a decrease of 0.6542 percentage-point in GDP growth.

Focusing on per capita GDP growth, we can put the synthesised evidence into perspective as follows: suppose a hypothetical LIC had a per capita GDP of $500 in 1995 and has achieved an average of 3 percent growth from 1995 to 2010 (16 years). If the corruption level had remained the same in this hypothetical country, its per capita GDP would have been $802 in 2010. However, if this country had reduced the corruption level by one unit in 1995 and if it had kept the level of corruption constant in the following years, its per capita GDP would have been $879 in 2010. In other words, per capita GDP in this hypothetical country would have been 10 percent higher than the baseline figure if corruption had been reduced by one unit in 1995 and kept constant thereafter.[9]

4.4.5 Meta-analysis 4: weighted means and precision-effect tests for LICs and non-LICs

After pooling together the estimates for low-income countries, we followed the same procedure for Mixed countries (which include but are not exclusive to LICs) and All countries (LICs + Mixed). This procedure involved calculating weighted means (REEs) and conducting precision-effect tests (PETs) to verify whether the REEs can be taken as measures of genuine effect in statistical terms. The results are reported in Table 4.8.

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 in Mixed and All countries. Summing both direct and indirect effects, 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 or has no effect in countries below this threshold (Mendez and Sepulveda, 2006; Aidt et al.,

[9] We use the compound growth formula for this simple calculation, which is: $A_{tn} = A_{t1}(1 + r)^n$. Here, n is the number of years and r is the growth rate in percentage. A_{tn} is the level of per-capita GDP in 2010 and A_{t1} is the level of per-capita GDP in 1995. A more refined method for estimating the gain in per-capita GDP would have been to use a computable general equilibrium model, but this is not within the remit of this systematic review.

2008). 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; Heckelman and Powell, 2008; Dellepiane-Avellaneda, 2010).

Table 4.8: Weighted means of all reported estimates: by country group

	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

Another reason for the relatively smaller effect of corruption on per capita GDP in LICs may be the existence of excessive regulation and barriers that limit the number of economic transactions in the first place. This is in line with the '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 Powell, 2010).

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 emphasise the distortionary effects of corruption on the allocation of talents and investment in human capital – by the individual and by the government (Murphy, Shleifer and Vishny, 1993; Acemoglu and Verdier, 2001; Ehrlich and Lui, 1999; Rivera-Batiz, 2001; Blackburn and Forgues-Puccio, 2009). We do not wish to overemphasise the importance of this finding as it is based on two observations only, but the correlation between high levels of corruption and low levels of human capital in LICs merits special attention to corruption's indirect effect through the human capital channel.

5. Strengths and limitations

The original studies reviewed here draw on different observational data sources on corruption, use different estimation methods, and cover different country groups and time periods. This heterogeneity poses a serious challenge for systematic reviews. We addressed this challenge by: (a) calculating random effect estimates that take account of within- and between-study heterogeneity at different levels of nesting/aggregation; (b) conducting precision-effect tests to verify if the REEs can be taken as genuine (statistically significant effects; and (c) mapping the meta-synthesis of the empirical evidence with a narrative synthesis of the theoretical/analytical evidence.

This systematic review has provided verifiable evidence on the growth impacts of corruption in low-income countries and in wider sets of countries that include but are not limited to LICs. As such, it is the first systematic review that synthesises empirical as well as theoretical/analytical evidence on economic costs of corruption – a significant issue in international development.

The evidence synthesised in this review indicates that corruption has negative and statistically significant effects on economic growth in both low-income and other countries. This conclusion is based on a comprehensive set of empirical and theoretical studies that report the best-quality evidence on the corruption-growth relationship. It is also derived through a coherent methodology that is known to be efficient in detecting genuine effects. Therefore, we believe that the findings of this review are relevant for evidence-based policy making by national governments, international organisations and international donors of aid.

This systematic review can also support evidence-based policy with respect to activities informed by the UN Convention against Corruption, adopted in May 2004. The Convention obliges the 120 signatories to make corruption a criminal offence, to develop institutions that will prevent it, and to engage in collaboration and policy co-ordination aimed at reducing the incidence of corruption. The evidence presented in this review indicates that there is an economic case for investing both financial and political capital towards the attainment of these goals.

Nevertheless, no systematic review is better than the body of the empirical and theoretical/analytical work on which it is based. This reflects a significant improvement with respect to quantity and quality since the mid-1990s. The improvement in quality is evident with respect to: (a) estimation methodology that controls for endogeneity (or reverse causality) between corruption and growth; (b) examination of non-linearity in the corruption-growth relationship by controlling for country type or institutional quality differences; and (c) development of formal models that are embedded in growth theory and institutional economics.

Against these strengths, however, the existing literature poses some serious challenges for systematic reviews and reflects some idiosyncrasies that make evidence synthesis difficult. The major challenge for systematic reviews of

empirical evidence stems from the observational nature of the research and the risk of sample dependence between studies or between different samples used in the same study. In addition, researchers in the area of corruption-growth relationship, like other scholars working with observational data, are aware that a lot of data mining takes place in the research process. Therefore, samples used in empirical studies may not be independent or random.

Given this state of affairs, we are faced with two options: ruling out systematic reviews of observational studies, or striking a balance between precision and relevance. In this review, we exercised the second option by grouping studies within different nests and at different levels of aggregation. This approach does not resolve the issue of sample dependence, but it can minimise its adverse consequences by changing the composition of the study sets being analysed.

Following this method, we have established that the sign of the estimates for corruption's effects on growth tends to remain negative despite different levels of nesting and the changes in study composition that this entails. This finding suggests that the random-effect weighted means (REEs) obtained from different nests can be taken as reliable indicators of the direction of corruption's effect on growth.

However, the REEs are not necessarily precise indicators. They are efficient in controlling for heterogeneity as a source of imprecision; and as such they help in minimising the risk of imprecision. However, they are not efficient in controlling for within- and between-study dependence. This is especially the case if between-study variation (heterogeneity) is low and this is due to between-study dependence. However, if between-study variation is low for other reasons (e.g., similarity in estimation methods or model specification), the REEs remain efficient.

Given the underlying uncertainty about the true cause of between-study variation/dependence, the REEs can be considered only as weakly efficient in ensuring precision. Therefore, the findings of this systematic review should be qualified as follows: they can be relied upon to conclude that corruption has a negative impact on growth, but the magnitude of the synthesised impact may not necessarily be precise.

The second limitation that must be indicated relates to measurement and instrumentation issues associated with perceptions-based measures of corruption. The measures of corruption may be influenced by survey design as well as the composition of the respondents (i.e., by the sampling methodology). They may also be influenced by the effect of the economic performance of a country at the time of conducting the survey.

The existing literature reviewed in Chapter 1 (Background) indicates that there is a significant degree of convergence between different corruption measures despite differences with respect to sponsors of the surveys and the composition of the respondents. Therefore, we do not consider the risk of bias to be high enough to invalidate the empirical estimates reported in the original studies. However, it

must be acknowledged that the risk of measurement error in corruption data is higher than the risk associated with 'hard' data on growth measures or other economic variables used in the regressions for estimating corruption's effect on growth.

Specifically, we have observed that studies using WGI data tend to report higher estimates relative to studies using ICRG, TI or Other corruption data. This may be because the WGI data may suffer from higher levels of measurement error as it is derived from multiple corruption data sources. Nevertheless, the adverse effects of this potential source of measurement error have been reduced in two ways. Firstly, the REEs derived from studies using WGI data do not pass the precision-effect test. Secondly, the REEs we derive for country groups are weighted downwards by higher between-study variances when studies using WGI data are pooled together with those using other data sources. Having said that, however, the risk of measurement error is not (and cannot be) eliminated in this systematic review.

Finally, the perceptions-based nature of the corruption data requires instrumentation, and the choice of instruments must satisfy two conditions to ensure that the estimates in the original studies are fully comparable. Firstly, the instrument must be correlated with the corruption measure, but uncorrelated with the error term of the regressions. Secondly, it must be the same or comparable across studies.

The instrumentation techniques used in the empirical studies satisfy the first condition – i.e., they are used in the regression only after testing for that condition. However, they satisfy the second condition only partially. Instruments used in generalised methods of moments (GMM) estimations are fairly comparable as they consist of the lagged value of the dependent variable – i.e., growth. However, instruments used in other methods of estimation may not be comparable across studies. Although this risk exists, we can report with confidence that it is minimal because the large majority of the studies use a common 'ethnic fractionalisation index' as the instrument for corruption.

The remaining risk with respect to instrumentation stems from the small number of ordinary-least squares (OLS) estimation results that are not based on instruments. This review does not exclude the OLS estimation results and as such its findings may be influenced by the relatively higher estimate magnitudes reported by such studies.

However, this small risk of upward bias is mitigated in two ways. Firstly, the inclusion of OLS estimates increases between-study variation and as such is conducive to lower REEs when OLS studies are pooled together with other studies. Secondly, the absence of estimates for indirect effects of corruption in the large majority of studies implies that the direct-effect estimates in the original studies are actually biased downwards. This downward bias is significant enough to mitigate the upward bias introduced by the OLS estimates.

6. Conclusions and recommendations

Synthesis results

The narrative synthesis results from the theoretical/analytical literature can be listed as follows: (i) corruption has a negative impact on economic growth; (ii) however, the relationship between corruption and growth is not uniform between countries and over time; (iii) corruption's effects on growth are mediated through contextual factors such as the level of development, the degree of centralisation of corrupt activities and the quality of governance institutions; and (iv) the indirect adverse effects of corruption on growth are higher than its direct effects, and the highest indirect effect percolates through the public finance/expenditure channel, followed by the human capital channel.

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 point 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 two estimates for LICs and ten 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.

Conclusions and recommendations

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

Subject to limitations associated with the meta-analysis of observational study estimates, the evidence synthesised 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 other 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 the theoretical/analytical literature.

The second policy conclusion is that anti-corruption policy initiatives should prioritise corruption that distorts incentives and the 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. These 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 synthesise 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 their impact on growth simultaneously, with a view to injecting new information into growth regressions which include 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 of 596. Further analysis of the indirect effects of corruption on growth may be deterred by two factors: a 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), who propose new methods for addressing multicollinearity problems.

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Appendices

Appendix 1.1 Authorship of this report

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Acknowledgements

We would like to thank the Department for International Development (DFID) for financial support and the EPPI-Centre for methodological advice and technical support. We would also like to thank the reviewers of the protocol and the report for their valuable and

helpful comments. Finally, we would like to thank our research assistants, who have worked diligently and complied with quality assurance requirements in a professional manner. We have spared no effort to ensure that this report is free of errors or omissions, but we take full responsibility for any that may have escaped our attention.

Appendix 2.1: List of low-income countries as defined by the World Bank

Afghanistan	Guinea-Bissau	Rwanda
Bangladesh	Haiti	Senegal
Benin	Kenya	Sierra Leone
Burkina Faso	Korea, Dem Rep.	Somalia
Burundi	Kyrgyz Republic	Tajikistan
Cambodia	Lao PDR	Tanzania
Central African Republic	Liberia	Togo
Chad	Madagascar	Uganda
Comoros	Malawi	Uzbekistan
Congo, Dem. Rep	Mali	Vietnam
Eritrea	Mauritania	Yemen, Rep.
Ethiopia	Mozambique	Zambia
Gambia, The	Myanmar	Zimbabwe
Ghana	Nepal	
Guinea	Niger	

http://data.worldbank.org/about/country-classifications/country-and-lending-groups#Low_income

Appendix 2.2: Growth regressions in original studies and choice of reported estimates

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 this model, 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). This model was refined by Mankiw et al. (1992), who extended it to account for endogenous growth. Formally, the model can be stated as follows:

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

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 linearised for estimation as follows:

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

Where g = growth rate of per-capita income; k = investment rate; hl = change in the level of human capital; y_0 = initial level of income; o_p = change in the level of openness; gov = change in public finance indicators; ε = the error term; and subscripts 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), and Sachs and Warner (1997). 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 CV_k is the kx1 vector of control variables that include all or part of the variables in equation (1); and u is the error term. The coefficients are defined as follows: β_0 = constant term; β_1 = the partial effect of corruption on growth; and β_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 themselves 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 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 fractionalisation is used as an instrumental variable by Easterly et al. (2006), Aidt et al. (2005), 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 Arellano 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; Aidt et al. 2005; Baliamoune-Lutz and Ndikumana 2007; Aixala and Fabro 2008; Attila et al. 2009; Imai et al. 2010).

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 two-stage or three-stage least-squares (2SLS or 3SLS) 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., Mauro 1995; Li et al. 2000; Pellegrini and Gerlagh 2004; Ahlin and Pang 2008; Attila 2008; Blackburn et al. 2008; Haque and Kneller 2008)

The second problem 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 the addition

or inclusion of other variables that are hypothesised 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., $ß_1$) 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 transmit the indirect effects of corruption on growth, but retain them 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 multicollinearity 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 concerns which estimates of the original studies should be included in the systematic review. In this review, we included all reported estimates of corruption's effect on growth, irrespective of the econometric method through which the estimates were obtained. However, each estimate is coded systematically to indicate whether the underlying estimation is instrumented and what kind of estimation method (OLS, 2SLS, 3SLS or GMM) is used in the original studies. We have also coded each reported estimate as either a '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, per-capita 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. Therefore, we are able to control for various factors so that the meta-synthesis results are consistent and generalisable.

The alternative would have been to choose an aggregate statistic that summarises 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 aggregate statistics such as these has two major shortcomings. Firstly, it prevents the use of all available information. Secondly, the selection criterion is highly likely to have a subjective dimension. Therefore, the use of all reported estimates was preferred and this preference is justified when the reported estimates are weighted by a measure of within-study variation – e.g. the standard error associated with each estimate (de Dominicis, 2008: 668-669).

However, the case for including all reported estimates may be weakened by the so-called within-study dependence – i.e., correlation between the standard errors of the estimates that are used as weights for calculating within-study summary measures within each study.

Although the reported estimates (and their standard errors) within each study may differ depending on the model specification (i.e., the number of control variables used) or the method of estimation (e.g., instrumented v non-instrumented methods), there will still be a significant source of dependence because the study uses the same data set. Systematic reviews in healthcare and education address this problem by using multi-level linear models to estimate the degree of within-study dependence (Rosenthal, 1991; Frost et al. 1999; Goldstein, 1995; Goldstein et al., 2000; 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 et al. (2008); Bijmolt and Pieters (2001); and Bateman and Jones (2003).

We have followed a similar strategy in this review by nesting the studies within 'country types' (specified as low-income countries, mixed countries and all countries), estimation methods (specified as OLS, 2SLS, 3SLS, GMM, and instrumented), and corruption data sources (specified as ICRG, WGI, TI and Other). As a result, the risk of within-study dependence is minimised.

Appendix 2.3: Sources of corruption data used in original studies

Main sources

ICRG: International Country Risk Guide measure of corruption

http://www.prsgroup.com/ICRG.aspx

TI: Transparency International (TI) Corruption Perception Index

http://www.transparency.org/policy_research/surveys_indices/cpi

WGI: World Wide Governance Indicators (WGI) measure of corruption

http://info.worldbank.org/governance/wgi/sc_country.asp

Other sources

Business Environment Risk Intelligence: http://www.beri.com/

Dreher et al. (2007) index: http://129.3.20.41/eps/pe/papers/0406/0406004.pdf

Economist Intelligence Unit Country Risk Service and Democracy Index:

http://www.eiu.com/public/#

Sachs and Warner (1997) index:
http://jae.oxfordjournals.org/content/6/3/335.full.pdf+html

UN Inter-Regional Crime and Justice Research corruption measure:

http://www.unodc.org/unodc/en/corruption/index.html?ref=menuside

World Business Environment Survey (firm-level, World Bank):
http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:20699364~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html

Appendix 2.4: List of keywords used for study search

Keyword 1: Corruption

Synonyms: Misgovernance, rent-seeking, speed money, bribery, side-payment, institutions, institutional quality, grabbing hand, graft, fraud, sleaze, misconduct, malpractice

(For 'Title' 'Abstract' and 'Keyword' search)

Keyword 2: Growth

Synonyms: development, economic performance, income, output, investment, public finance, human capital, economic outcome

(For 'Title' 'Abstract' and 'Keyword' search)

Keyword 3: Low-income countries

Synonyms: Less developed countries, LDC, developing countries, Africa, Asia, Latin America, Middle East, World Bank list of low-income countries (43 low-income-country names from the World Bank list).

(For 'Keyword' and 'Text' search)

Time period

January 1990 – July 2010

Language

Open

Appendix 2.5: List of databases

For journal articles

IBSS - International Bibliography of the Social Sciences

EBSCO: Business and Economics Databases

Science Direct - All sciences and humanities

Web of Knowledge - All sciences and humanities

JSTOR - Social sciences

Econlit – Economics and allied disciplines

ISI – Social sciences

For working papers and reports

SSRN - Social Science Research Network:
http://papers.ssrn.com/sol3/DisplayAbstractSearch.cfm

NBER Working Papers: http://www.nber.org/papers

REPEC - Research Papers In Economics**:**
http://econpapers.repec.org/scripts/search/search.asp?pg=-1

Centre for International Development – Harvard University:
http://www.hks.harvard.edu/centers/cid/publications

World Bank : http://publications.worldbank.org/

IMF: http://www.imf.org/external/pubind.htm

Third World Network: http://www.twnside.org.sg/pos.htm

ADB – Asia Development Bank: http://www.adb.org/Statistics/publications.asp

AFDB – Africa Development Bank: http://www.afdb.org/en/documents/evaluation-reports/; http://www.afdb.org/en/documents/publications/working-paper-series/

EBRD – European Bank for Reconstruction and Development):
http://www.ebrd.com/pages/research/publications.shtml

Google Scholar: http://scholar.google.co.uk/schhp?hl=en&tab=ws

For PhD theses

Econlit - World-wide

Index to Theses – UK-wide: http://www.theses.com/

Appendix 2.6: Documentation of the search process

This section provides a detailed description of the search process as carried out on respective databases. The description will include the name of the database searched, the date the search was run, the years covered by the search and the specific search terms used. The specific keywords (and synonyms) used can be found in Appendices 2.1 and 2.4.

In some databases, the search had to be conducted in two stages because of restrictions to the number of search terms that could be entered in the search fields. In such cases, we exported both sets of search results and stored them in EndNote. In some other databases, the search fields were limited in number and allowed only a small number of search terms to be entered. In such cases (which were mainly working paper and report databases such as SSRN, World Bank, NBER, ADB) we used the key terms in the review question (corruption and growth). The results of the search process, the search strings, and the number of 'hits' with respect to each database are presented below.

The total number of 'hits' was 1,330. These results were exported to EndNote, where identical duplicates were eliminated automatically. The total number of results net of identical duplicates was 1,042 studies.

Database/Platform	Date	String	Uploaded Hits
EBSCO – Business/Economics Databases	7 October 2010	TI (corruption OR misgovernance OR rent-seeking OR speed money) or TI (side payment OR institutions OR fraud) or TI (institutional quality OR bribery OR misconduct) or TI (grabbing hand OR graft OR sleaze) (9,064) AB (corruption OR misgovernance OR rent-seeking OR speed money) or AB (side payment OR institutions OR fraud) or AB (institutional quality OR bribery OR misconduct) OR TI (grabbing hand OR graft OR sleaze) (138,940) TI (growth OR development OR economic performance) or TI (income OR output OR investment OR public finance) or TI (human capital OR economic outcome) (209,199)	109

		AB (growth OR development OR economic performance) or AB (income OR output OR investment OR public finance) or AB (human capital OR economic outcome (1,563,607) TX (low income countries OR LDC OR less developed countries) or TX (developing countries OR Africa OR Middle East) (506977) (TX low income countries OR LDC OR less developed countries or TX (developing countries OR Africa OR Middle East) and (S1 and S3 and S5) (137) ((TX low income countries OR LDC OR less developed countries) or TX (developing countries OR Africa OR Middle East) and (S1 or S2) and (S3 or S4) and S5	
EBSCO – Business/Economics Databases	7 October 2010	TI (corruption OR misgovernance OR rent-seeking OR speed money) or TI (side payment OR institutions OR fraud) or TI (institutional quality OR bribery OR misconduct) or TI (grabbing hand OR graft OR sleaze) (9,064) AB (corruption OR misgovernance OR rent-seeking OR speed money) or AB (side payment OR institutions OR fraud) or AB (institutional quality OR bribery OR misconduct) OR TI (grabbing hand OR graft OR sleaze) (138,940) TI (growth OR development OR economic performance) or TI (income OR output OR investment OR public finance) or TI (human capital OR economic outcome) (209,199) AB (growth OR development OR economic performance) or AB (income OR output OR investment OR public finance) or AB (human capital OR economic outcome (1,563,607)	92

		TX (Rwanda or Senegal or Sierra Leone or Somalia or Tajikistan or Tanzania or Togo or Uganda or Uzbekistan or Vietnam or Yemen Republic or Zambia or Zimbabwe) or (Guinea-Bissau or Haiti or Kenya or Korea or Kyrgyz Republic or Lao PDR or Liberia or Madagascar or Malawi or Mali or Mauritania or Mozambique or Myanmar or Nepal or Niger) or (Afghanistan or Bangladesh or Benin or Burkina Faso or Burundi or Cambodia or Central African Republic or Chad or Comoros or Congo DR or Eritrea or Ethiopia or Gambia or Ghana or Guinea) (1,357) (S1 OR S2) and (S3 and S4) and S5	
IBSS	9 October 2010	Search Query #16 (TI=(corruption or misgovernance or rent-seeking) or TI=((speed money) or bribery or side-payment) or TI=(institutions or (institutional quality) or fraud)) and(TI=(growth or development or (economic performance)) or TI=(income or output or investment) or TI=((public finance) or (human capital) or (economic outcome))) and(KW=((low income countries) or ldc or (less developed countries)) or KW=(Africa or Asia or (Latin america)) or KW= (Middle East)) Related to the Social Sciences/Humanities Date: 1990 to 2010	150

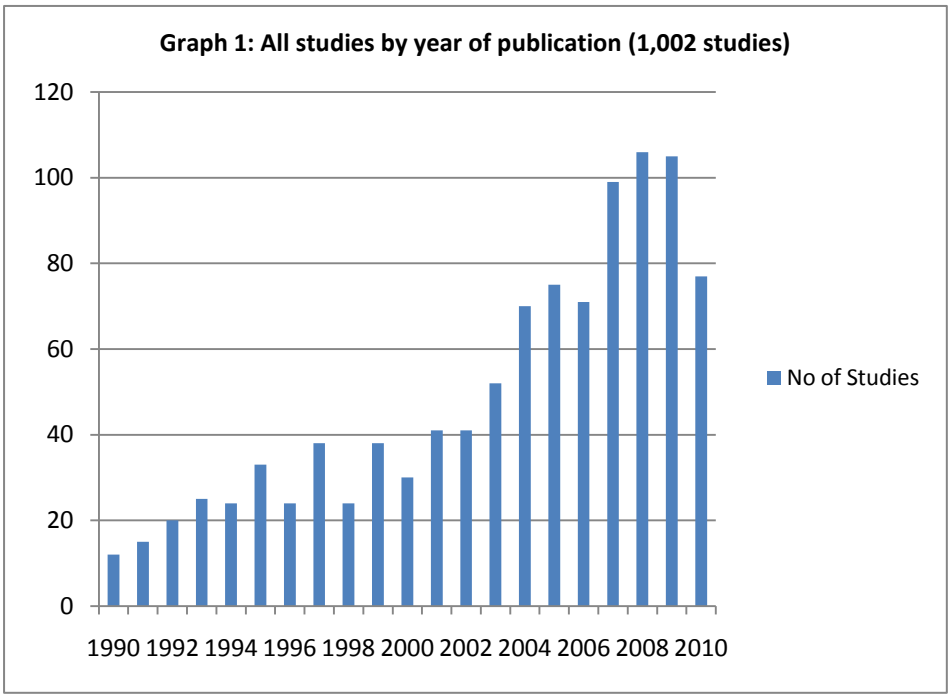
IBSS	16 October 2010	Search Query #1 TI=((corruption or misgovernance or rent-seeking or speed money or bribery) or (side-payment or institutions) or (institutional quality or grabbing hand or graft or fraud or sleaze or misconduct)) and TI=((growth or development or economic performance) or (income or output or investment or public finance) or (growth or development or economic performance or income or output or investment or public finance or human capital or economic outcome)) and ((Rwanda or Senegal or Sierra Leone or Somalia or Tajikistan or Tanzania or Togo or Uganda or Uzbekistan or Vietnam or Yemen Republic or Zambia Zimbabwe) or (Guinea-Bissau or Haiti or Kenya or Korea or Kyrgyz Republic or Lao PDR Liberia or Madagascar or Malawi or Mali or Mauritania or Mozambique or Myanmar or Nepal or Niger) or (Afghanistan or Bangladesh or Benin or Burkina Faso or Burundi or Cambodia or Central African Republic or Chad or Comoros or Congo DR or Eritrea or Ethiopia or Gambia or Ghana or Guinea)) Date: 1990 to 2010	54
JSTOR	9 October 2010	((ti:(corruption OR misgovernance OR rent-seeking OR speed money OR bribery OR side-payment OR institutions OR institutional quality OR grabbing hand OR graft OR fraud OR sleaze OR misconduct OR malpractice) AND ti:(growth OR development OR economic performance OR income OR output OR investment OR public finance OR human capital OR economic outcome)) AND (low income countries OR developing countries OR LDC OR Africa OR Asia OR Latin America OR Middle East)) AND (year:[1990 TO 2010])	247
Science Direct	9 October 2010	(pub-date > 1989 and TITLE-ABSTR-KEY(corruption OR misgovernance OR rent-seeking OR speed money OR bribery OR side-payment OR institutions OR	353

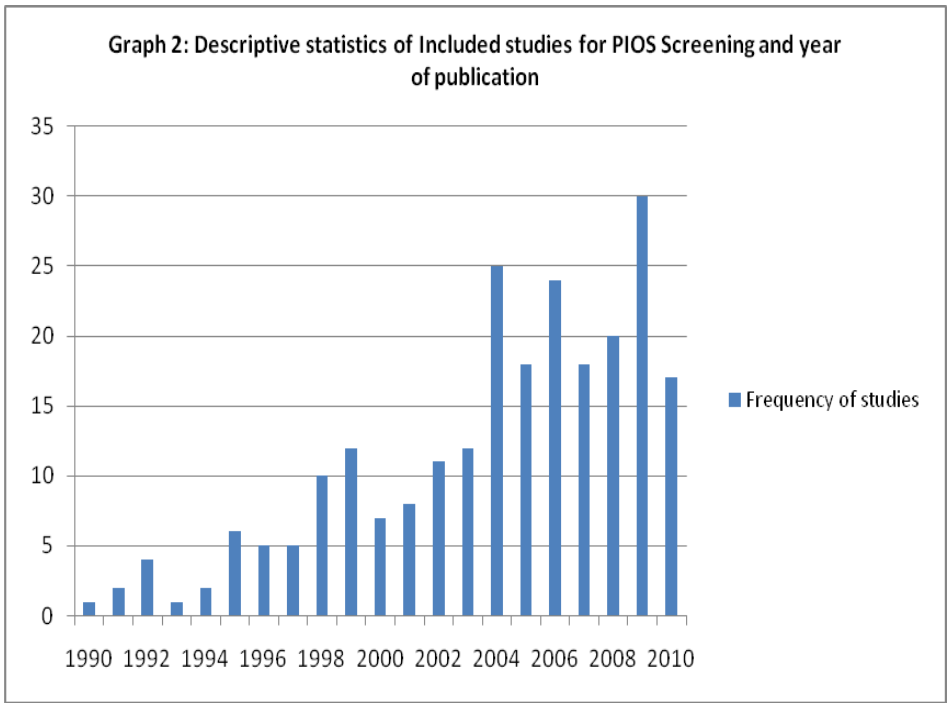
		institutional quality) or TITLE-ABSTR-KEY(grabbing hand OR graft OR fraud OR sleaze OR misconduct OR malpractice)) AND (pub-date > 1989 and TITLE-ABSTR-KEY(growth OR development OR economic performance OR income OR output OR investment) or TITLE-ABSTR-KEY(public finance OR human capital OR economic outcome)) AND (pub-date > 1989 and low income countries OR developing countries OR LDC OR Africa or Asia OR Latin America OR Middle East[All Sources(Economics, Econometrics and Finance)	
Web of Knowledge	7 October 2010	Title=(corruption OR misgovernance OR rent-seeking OR speed money OR bribery) OR Title=(side-payment OR institutions OR institutional quality OR fraud OR misconduct) OR Title=(grabbing hand OR graft OR fraud OR sleaze) *Timespan=1990 - 2010* > 88,046 Topic=(corruption OR misgovernance OR rent-seeking OR speed money OR bribery) OR Topic=(side-payment OR institutions OR institutional quality OR fraud OR misconduct) OR Topic=(grabbing hand OR graft OR fraud OR sleaze) *Timespan=1990 - 2010* >100,000 Title=(growth OR development OR economic performance OR income OR output) OR Title=(investment OR public finance OR human capital) OR Title=(economic outcome) *Timespan=1990 - 2010* >100,000 Title=(growth OR development OR economic performance OR income OR output) OR Topic=(investment OR public finance OR human capital) OR Topic=(economic outcome)	171

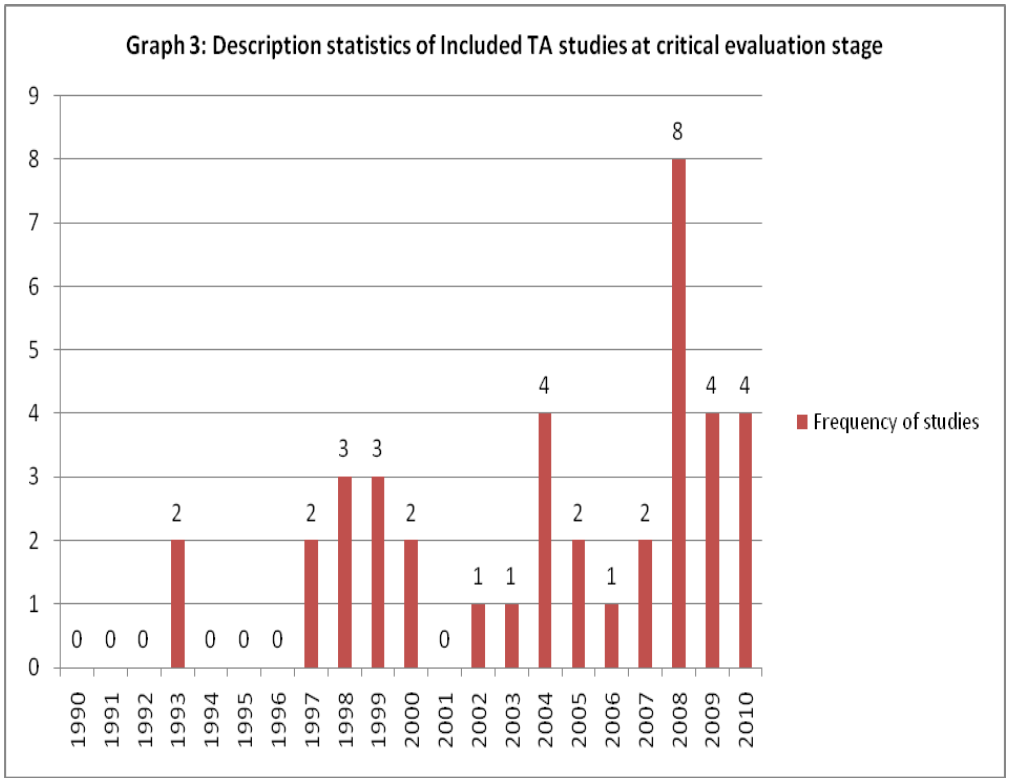
		Timespan=1990 - 2010 >100,000 Topic=(low income countries OR developing countries OR LDC) OR Topic=(Africa OR Asia OR Latin America OR Middle East) *Timespan=1990 - 2010* >100,000 #5 AND #3 AND #1 Timespan=1990 – 2010	
Econpapers	19 August 2010	corruption or misgovernance or rent-seeking or speed money or bribery or side-payment or institutions or institutional quality or grabbing hand or graft or fraud or sleaze or misconduct or malpractice among working papers and authors growth or development or economic performance or income or output or investment or public finance or human capital or economic outcome among working papers and authors low income countries or developing countries or LDC or Africa or Asia or Latin America or Middle East among working papers and authors Search #1 AND Search #3 AND Search #4 (83 hits of 200)	83
SSRN	14 October 2010	Searched for 'corruption'	35
NBER	14 October 2010	Searched for corruption and growth in low income countries	14
World Bank E-library	14 October 2010	(All Fields (including full text) contains 'corruption') **AND** (All Fields (including full text) contains 'growth') **AND** (All Fields (including full text) contains 'low income countries') **AND** (Content Type contains 'Books or Journals or Working Papers')	8

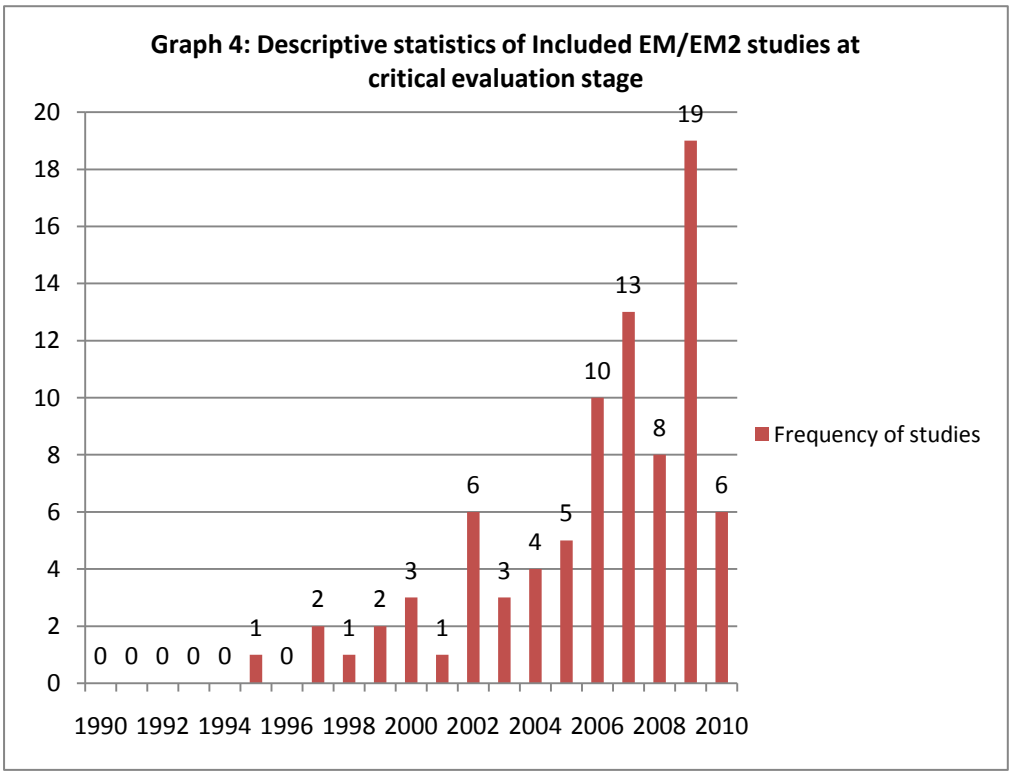
ADB	16 October 2010	ADB catalogue search and subject search for governance	1
IMF	16 October 2010	Search for 'corruption'	10
AFDB	16 October 2010	Search for corruption and growth in low income countries	0
EBRD	16 October 2010	Search for corruption and growth in low income countries	0
CID – Harvard	16/10/2010	Searched for 'corruption and growth'	3
Total hits			**1,330**

Appendix 3.1: Frequency distribution of studies over time






Graph 3: Description statistics of Included TA studies at critical evaluation stage
9
8
7
6
5
4
3
2
1
0
0 0 0 2 0 0 0 2 3 3 2 0 1 1 4 2 1 2 8 4 4
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Frequency of studies


Graph 4: Descriptive statistics of Included EM/EM2 studies at critical evaluation stage
20
18
16
14
12
10
8
6
4
2
0
0 0 0 0 0 1 0 2 1 2 3 1 6 3 4 5 10 13 8 19 6
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010
Frequency of studies

Appendix 3.2: Code categories and code headings used for extracted data

Code category	Codes headings used
Type of reported estimate	For estimates of direct effect of corruption: per-capita GDP growth, GDP growth, per-capita GDP level, GDP level, investment/GDP rate, human capital, public expenditures, FDI flows, FDI/GDP rates, public revenue, public investment growth For estimates of indirect effects of corruption: corruption and investment; corruption and public finance; and corruption and human capital
Type of estimation methods	Ordinary least squares (OLS), two-stage least squares (2SLS), three-stage least squares (3SLS), generalised method of movements (GMM), other estimation, instrumentation, control variables
Type of corruption data source	ICRG1, ICRG2, WGI1, WGI2, TI1, TI2, Other corruption data 1, Other corruption data2
Study characteristics	Journal article, working paper, report, book chapter, publication year
Empirical entries	Reported effect; standard error of reported effect; test statistic associated with reported effect

Appendix 4.1 Synthesising evidence through fixed-effect and random-effect estimators

We synthesised evidence from empirical studies in two stages.

In stage 1, we calculated the simple and weighted means of the reported estimates from each study. We also calculated confidence intervals and average precision levels for the mean estimates of each study.

For the 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:

$$\Omega = \frac{\sum w_i \theta_i}{\sum w_i} \qquad (1)$$

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 SE_i^2 is the square of the standard error associated with each estimate.

Hence, the FEE estimate is given by:

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

Then, the FEE is distributed normally around the population mean, subject to random disturbance from within-study variation. In this systematic review, we do not recommend the use of FEEs as measures of synthesised effect size because they do not account for dependence between multiple estimates reported within an individual study. The multiple estimates may be derived by different estimation methods or by changing the model specification, but these 'innovations' do not alter the fact that the multiple estimates are derived from the same data sample. This within-study dependence makes FEEs inappropriate generalisation. That is why we report the FEEs for individual studies only to provide information about the extent of convergence or divergence between the study-based summary measures of the size effect and the extent to which these study-based estimates are statistically significant.

In stage 2, we calculated simple and weighted means for estimates reported by a cluster of studies pooled together within a nest characterised by a unique combination of corruption and growth measures, or growth measure and country type.

For weighted means of reported effect sizes by a cluster of studies, 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:

$$\Psi = \frac{\sum w_i \theta_i}{\sum w_i} \qquad (3)$$

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 ($\boldsymbol{SE_i^2}$) 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, $wi = 1/(SE_i^{\,2} + \sigma^2)$.

With the weight thus specified, (3) can be rewritten as follows:

$$\Psi = \frac{\sum [1/(SE_i^{\,2} + \sigma^2)]\theta_i}{\sum [1/(SE_i^{\,2} + \sigma^2)]} \,. \qquad (4)$$

Then the REE is distributed normally around the population mean, subject to random disturbance from two sources: within-study variations ($\boldsymbol{SE_i^2}$) and between-study variations (σ^2).

The random-effect estimate of the effect size takes account of within- and between-study heterogeneity, but does not take account of dependence between estimates within a study or pooled together from a number of studies. Such dependence may arise from drawing on the same data sample within a study or on the same data source used by a number of studies. The risk of within- and/or between-study dependence is not eliminated by the use of REEs in this review. However it is minimised by: (i) distributing the multiple estimates reported by a single study across various nests; and (ii) pooling together estimates from different studies into a given nest. As such, this review trades off a residual risk of within- or between-study dependence against the informational gain obtained from including all estimates reported by each study rather than a subjectively determined representative estimate for that study.

Appendix 4.2: Verifying statistical significance of synthesised evidence: the precision-effect test

To establish whether the synthesised evidence is statistically significant, we carried out precision-effect tests (PETs) – 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 squares (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).

Egger et al. (1997) proposed the following model 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.

They demonstrated that there is evidence for publication bias if the coefficient β_0 is significantly different from 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 from 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 that model (1) is converted 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) has been defined. Equation (2) 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:

$$H_0: \quad \beta_0 = 0$$
$$H_1: \quad \beta_0 \neq 0 \qquad (3)$$

On the other hand, testing for genuine effect requires:

$$H_0: \quad \beta_1 = 0$$
$$H_1: \quad \beta_1 \neq 0 \qquad (4)$$

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 errors 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 β_1 to be tested for 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 carry out precision-effect tests (PETs) for estimates reported by a cluster of studies – not by 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 within 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 (Rosenthal, 1991; Goldstein, 1995; Frost et al. 1999; Goldstein et al., 2000; Rutter and Gatsonis, 2001). Some economics reviews that have used multi-level models include de Dominicis et al. (2008), Bijmolt and Pieters (2001) and Bateman and Jones (2003). The multi-level models (the meta-regression models) enable the reviewers to identify the sources of within-study dependence, but they can also help in correcting for within-study dependence only if they incorporate multivariate outcomes for which the correlation coefficient is known. Given that these coefficients of correlation are not reported in the original studies, we have decided to use PETs only.

This can be justified for two reasons. Firstly, we have benefited from the nesting methodology to address the issue of within-study dependence partially. We have clustered studies within nests characterised by similar corruption and growth measures or country types, and conducted PETs on that basis. This method reduces but does not eliminate the risk of within-study dependence. The risk is reduced as multiple estimates from the same study are distributed over different nests/clusters and these distributed estimates are pooled together with estimates from different studies. Secondly, multi-level regressions used to isolate within-study dependence usually lead to similar results on the statistical significance of the effect sizes and their random-effect estimates. The similarity of the

results applies to statistical significance, but not the size of synthesised estimates (i.e., REEs). Therefore, multi-level regression analysis may be desirable for identifying sources of dependence and heterogeneity that may impinge on the synthesised effect size, but they do not provide new information about its statistical significance. They may provide new information about the synthesised effect size, but this information will be a result of weighting based on correlations between multiple estimates within a study – at the expense of assuming that the quality of all studies reporting multiple estimates is the same. Under this assumption, a higher-quality study reporting highly-correlated multiple estimates will contribute less to the synthesised effect size compared to a lower-quality study that report mildly correlated multiple estimates.

For these reasons, we relied on PETs only to verify if the synthesised effect sizes (i.e., the REEs of corruption's effect on growth) were statistically significant beyond publication or small sample bias. As such, the size of the reported REEs may not be precise, but they can be taken as approximations to the genuine effect with a small risk of over-estimation due to the residual risk of within-study dependence. We have stated this caveat in the main report when and where necessary or relevant.

Appendix 4.3: Precision estimate and bias test results: Mixed countries by corruption data source

	coefficient	SE	t−value	p−value
Disaggregated corruption data sources				
WLS Reg for per capita GDP growth: Mixed countries, ICRG1 corruption data				
β_1 – genuine effect	0.0074***	0.0016	4.50	
β_0 – bias	0.4226	0.4487	0.94	
Egger Test of H_0: no bias				0.350
WLS Reg for per capita GDP growth: Mixed countries, ICRG2 corruption data				
β_1 – genuine effect	−0.0154***	0.0049	−3.16	
β_0 – bias	−0.1414	0.1808	−0.78	
Egger Test of H_0: no bias				0.436

	coefficient	SE	t−value	p−value
Aggregated corruption data sources				
WLS Reg for per capita GDP growth: Mixed countries, ICRG corruption data				
β_1 - genuine effect	−0.0080***	0.0010	−8.00	
β_0 – bias	−0.2778	0.1701	−1.63	
Egger Test of H0: no small−study effects				0.104
WLS Reg for per capita GDP growth: Mixed countries, WGI corruption data				
β_1 - genuine effect	0.0065	0.0052	1.25	
β_0 – bias	−1.7272***	0.2279	−7.58	
Egger Test of H_0: no bias				0

	coefficient	SE	t−value	p−value
WLS Reg for per capita GDP growth: Mixed countries, WGI1 corruption data				
$ß_1$ – genuine effect	−0.0068	0.0051	−1.33	
$ß_0$ – bias	1.8229	0.2577	7.07	
Egger Test of H_0: no bias				0.000
WLS Reg for per capita GDP growth: Mixed countries, TI1 corruption data				
$ß_1$ – genuine effect	−0.0010**	0.0004	−2.43	
$ß_0$ – bias	2.4655***	0.1593	15.47	
Egger Test of H_0: no bias				0.000
WLS Reg for per capita GDP growth: Mixed countries, TI2 corruption data				
$ß_1$ – genuine effect	−0.0160	0.0220	−0.73	

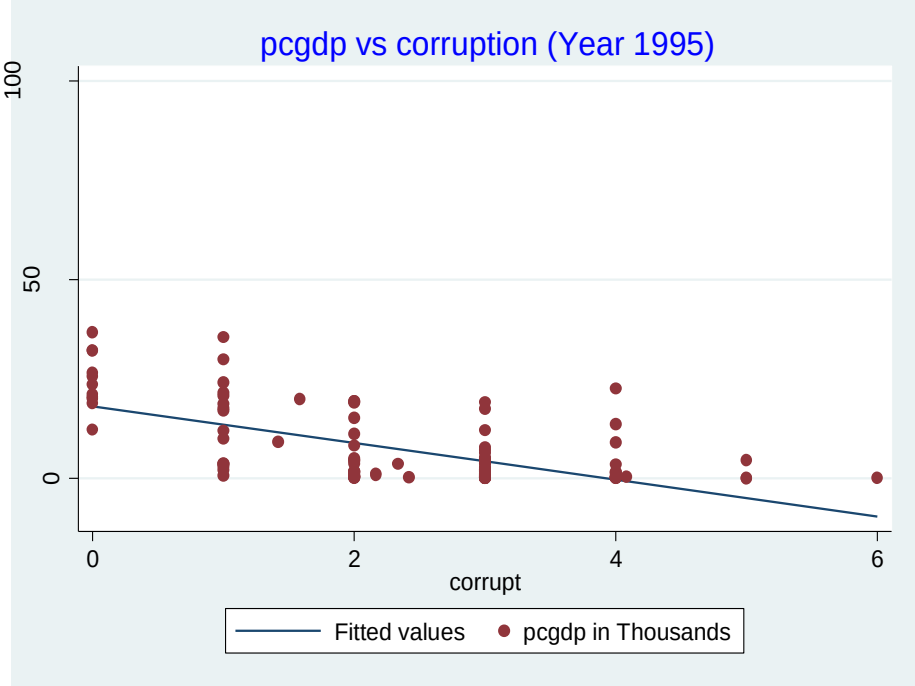
	coefficient	SE	t−value	p−value
WLS Reg for per capita GDP growth: Mixed countries, TI corruption data				
$ß_1$ – genuine effect	0.0007*	0.0004	1.85	
$ß_0$ – bias	−2.3024***	0.1480	−15.55	
Egger Test of H_0: no bias				0
WLS Reg for per capita GDP growth: Mixed countries, Other corruption data				
$ß_1$ – genuine effect	0.0004	0.0003	1.47	
$ß_0$ – bias	−1.4387***	0.1945	−7.40	
Egger Test of H_0: no bias				0
WLS Reg for GDP growth: Mixed countries, TI corruption data				
$ß_1$ – genuine effect	−0.3910***	0.1142	−3.42	

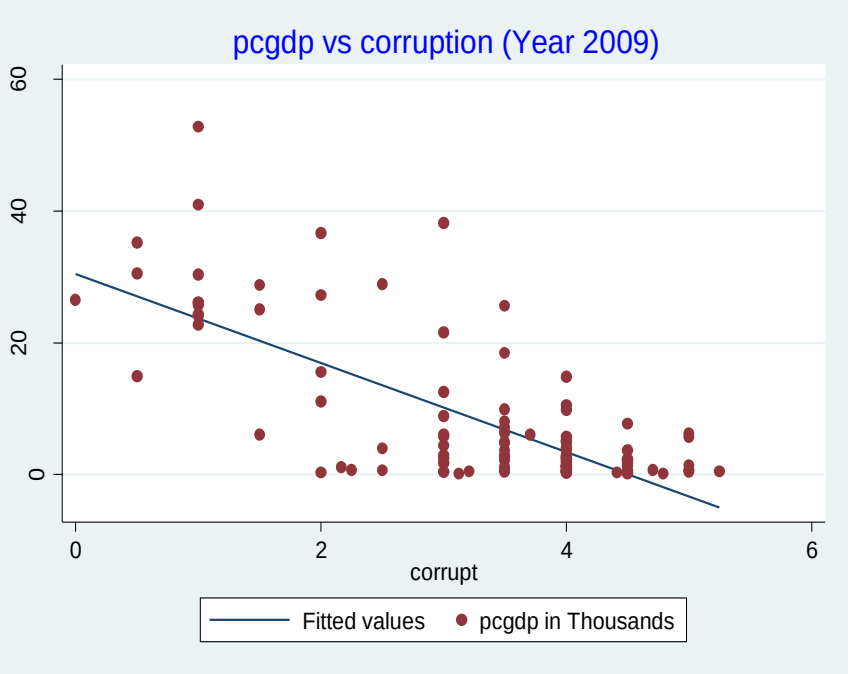
	coefficient	SE	t−value	p−value
$ß_0$ – bias	−1.3944	0.4043***	−3.45	
Egger Test of H_0: no bias				0.003
WLS Reg for per capita GDP growth: Mixed countries, Other2 corruption data				
$ß_1$ – genuine effect	0.0003	0.0002	1.21	
$ß_0$ – bias	−1.2023	0.1923	−6.25	
Egger Test of H_0: no bias				0.000
WLS Reg for GDP growth: Mixed countries, TI1 corruption data				
$ß_1$ – genuine effect	0.3910	0.1142***	3.42	
$ß_0$ – bias	1.7702	0.8633**	2.05	
Egger Test of H_0: no bias				0.049

	coefficient	SE	t−value	p−value
$ß_0$ – bias	−1.7702**	0.8633	−2.05	
Egger Test of H_0: no bias				0.049
WLS Reg for GDP growth: Mixed countries, ICRG corruption data				
$ß_1$ – genuine effect	0.0136***	0.0028	4.90	
$ß_0$ – bias	−2.4115***	0.4519	−5.34	
Egger Test of H_0: no bias				0.006
WLS Reg for GDP growth: Mixed countries, WGI corruption data				
$ß_1$ – genuine effect	0.0491*	0.0293	1.67	
$ß_0$ – bias	−4.7644***	1.0306	−4.62	
Egger Test of H_0: no bias				0.001

*, **, *** = statistically significant at 10%, 5% or 1% level

Appendix 4.4: Scatter plot for corruption and per-capita GDP: 1995 and 2009





Corruption data is from ICRG; per-capita GDP data is from the World Bank.

The scatter plot indicates a negative association between per-capita GDP and level of perceived corruption – at the beginning of the period (1995) when empirical studies on corruption and growth began to emerge, and at the latest year (2009) for which data is available. The negative association implies that countries with lower per-capita GDP tend to have high scores for perceived corruption.

Appendix 4.5: Data extraction record for theoretical/analytical (TA) studies

Channel of Transmission	Summary of Impacts		List of Authors	Assessment
	Direct Impacts	Indirect Impacts		
Type 1 Corruption Rent extracted for supply of public good like permits, licences, approvals, etc.				
Corruption has a negative impact on economic growth				
Corruption may cause a misallocation of talent and skills away from productive (entrepreneurial) activities towards non-productive (rent-seeking) activities.		Innovation drives economic growth. Rent seekers are likely to target the innovation sector which requires more public goods than established industries. This slows down innovation activities and capital accumulation.	Murphy, Shleifer and Vishny (1993: 409) Acemoglu and Verdier (2001:17-33) Ehrlich and Lui (1999) Rivera-Batiz (2001: 414) Blackburn and Forgues-Puccio	Under conditions of asymmetric information, investment in innovations will have to incur higher transaction costs, lower profitability and greater inefficiencies. Corruption reduces the incentives for investments in development of human capital and diverts resources to unproductive investments.

Channel of Transmission	Summary of Impacts		List of Authors	Assessment
	Direct Impacts	Indirect Impacts		
			(2009).	
Corruption may undermine the protection of property rights, create obstacles to doing business and impede innovation and technological transfer.		The legal assurances on property and contract laws increase private investment, which brings in new technology and also increases the total factor productivity. These in turn increase economic competitiveness necessary for economic growth.	Mijiyawa (2008) Fosu, Bates and Hoeffler (2006)	The fundamental condition for a country to be attractive for investors is the security of their investment. A governance system under which property and contract laws can be protected in court are essential. When corruption undermines these legal assurances, it can slow down private investment and technological transfers and drag down the growth rate.
Dysfunctional political institutions enable corrupt politicians to extract as much rent as they like, forcing firms and citizens to shift from the formal to the		Elected politicians or dictators extract rent from citizens by charging a fee for entry into the formal sector of the economy under conditions of	Aidt et al. (2008) Méon and Sekkat (2005) Mendez and	Politicians' pursuit of rent is designed to respond to the quality of political institutions and the level of political accountability. This means that as

Channel of Transmission	Summary of Impacts		List of Authors	Assessment
	Direct Impacts	Indirect Impacts		
informal sector.		asymmetric information. When the political institutions are dysfunctional, political leadership is effectively free to extract as much rent as they like from the economy. In response to this citizens leave the formal sector of the economy and seek refuge in the informal sector. The net result is low growth or stagnation.	Sepulveda (2006).[10] Drury, Krieckhaus and Lusztig (2006).	political institutions become increasingly dysfunctional, the tendency to shift from the growth-enhancing formal sector to the growth-reducing informal sector increases. The flip side of the argument is that strengthening political institutions can attract informal activities to the formal sector.
Corruption through patronage of special interest groups reduces the effectiveness of competitive elections and impedes economic growth.		Sub-Saharan Africa: multi-ethnicity has had a negative impact on the formulation of macro-economic growth policies. Ethnic loyalty is won through patronage and	Kimenyi (2007) Fosu, Bates and Hoeffler (2006)	Corruption through patronage and redistributive policies has longer-term impacts on the formulation of appropriate macro-economic policies.

[10] Cited in Aidt (2007).

Channel of Transmission	Summary of Impacts		List of Authors	Assessment
	Direct Impacts	Indirect Impacts		
		dispensing of favours. This results in a trade-off between economically efficient public good provision and the ethnically driven pattern of provision. The authors conclude that competitive elections may increase the scope of accountability and constrain rent-seeking behaviour, but they are unable to implement macro-economic policies necessary for growth. In the event that the elected leaders fail to integrate the pattern of patronage into new policies, it leads to political disorder.		This underscores the importance of the integration of ethnic groups into the polity in a manner that will not undermine growth.

The authors of this report were supported by the Evidence for Policy and Practice Information and Co-ordinating Centre (EPPI-Centre).

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This material has been funded by the Department for International Development. However the views expressed do not necessarily reflect the department's official policies. The report was first published in 2011 by:

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ISBN: 978-1-907345-21-0