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"Grease" or "Sand" the Wheels of Economic Development: A Meta-Analysis of Corruption

Working Paper No. 2021-19

“Grease” or “Sand” the Wheels of Economic Development: A Meta-Analysis of Corruption

Ella Hugo^{1,2}, David A. Savage², and Benno Torgler³

Abstract

Corruption literature within economics has long returned ambiguous results with no concise cause or impact of corruption identified. This meta-analysis aims to find synergy within the corruption literature by assessing macroeconomic empirical studies that evaluate whether corruption ‘greases or sands’ the wheels of economic development. The meta-analysis provides an analysis of popular variables used within the corruption literature and assesses their significance when measuring corruption.

JEL Codes: E00 D73 O1 C19

Keywords: Meta-Analysis, Corruption, Macroeconomics, Publication Bias

1. INTRODUCTION

During the past three decades there have been numerous attempts find the true impact of corruption in economic development. This has produced a great divide within the literature, not only from a methodological standpoint but in regard to the cause, impact, and how to combat the issue. One of the first problems arising from the literature is the lack of agreement in the definition of corruption, which has resulted in all activities related to corruption being aggregated together to form a broad singular amorphous entity. Studies within economics that have typically focused on Mauro’s (1995) “grease or throw sand in the wheels” of economic development argument have caused further division within the literature. Recently within the field of economics, meta-analysis has become the accepted practice for evaluating the conflicting scientific evidence found in numerous studies (Stanley, 2001). Such meta-analyses

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within the social and medical sciences have been used to bring order to areas previously filled with controversy. A meta-analysis is a statistical method used to summarise, evaluate, and analyse empirical economic research (Stanley, 2001). This type of analysis is useful for evaluating and reviewing independent studies that have been conducted on a particular subject with different data sets and methods, as it combines the results and provides insights and greater explanatory power than what is found in individual studies (Stanley, 2001). As this statistical tool has proven to be an effective technique to synthesise literature mired in controversy, a meta-analysis will be employed to find synergy within the economic corruption literature.

For this study we will purely focus on the area of corruption and economic growth, more specifically on studies that have shown corruption can either “grease” or “sand” the wheels of economic development (Campos, Dimova, & Saleh, 2010). This meta-analytical review and analysis of the corruption literature will aim to assess whether there is a relationship between corruption and economic growth and re-categorise the original studies of corruption as systemic or rent seeking activities. Using the variables listed within the studies, the meta-analysis will be used to examine the literature, accumulating findings to build a stable model of corruption. This meta-analysis utilises the research found in Campos, Dimova, and Saleh, (2010) and then updates the literature from 2011-2020. It is important to note that some of the original papers were deemed inappropriate upon further investigation into the results of the original 2010 meta-analysis. This paper reassesses the shortcomings of Campos et al. (2010) and provides new evidence on the relationship between corruption and economic growth.

This paper will be split into four sections and aims to find a synthesis within the economic literature. Section 2 reviews the literature surrounding corruption and meta-analysis within economics; Section 3 discusses the methodology to be used in the study, the stages by which the methodology was implemented, and the justification for the method; Section 4 summarizes the results of the meta-analysis; and, finally, Section 5 outlines the considerations of the research and its potential limitations, and what it means for corruption literature.

2. CONSENSUS ISSUES IN THE CORRUPTION LITERATURE

While the literature struggles to find consensus on what causes corruption and how it effects economic growth, there has been synergy in regard to the areas of the economy that corruption can affect. Typical econometric studies of corruption can be broken down into three main research areas; each field is concerned with one or more aspects of corruption and

economic growth which may lead to errors within each study due to the broad view of corruption. These studies can be grouped by economic growth (Huang, 2016; Leff, 1964; Mauro, 1995; Meon & Sekkat, 2005; Meon & Weill, 2008), national sectors such as the financial sector (Cooray & Schneider, 2018; D'Agostino, Dunne, & Pieroni, 2016; Pieroni & Agostino, 2008) and public policy, and government and structure (Aidt, 2009; La Porta, Lopez-de-Silanes, Shleifer, & Vishny, 1999; Rose-Ackerman, 1999). The main divide within the literature centres on the grease or sand argument. Studies that support the 'grease the wheels' hypothesis believe that corruption facilitates trade and creates efficiency in areas of government filled with bureaucratic red tape (De Soto, 1990; Leff, 1964; Lui, 1985). These studies show that in some developing nations, corruption – more specifically bribery – facilitates trade and foreign direct investment that would not occur otherwise (Lui, 1985). Corruption has also been shown to promote entrepreneurial innovation and allow residents to access services not previously available due to ineffective policy (Cooray & Schneider, 2018). Others believe that corruption is the lesser of two evils in an ill functioning bureaucracy; if the government moves in the wrong direction, corruption provides insurance that it may be redirected (Cooray & Schneider, 2018; Leff, 1964). The literature surrounding the 'grease the wheels' hypothesis argues that corruption and bribery promote the avoidance of inefficient policies, leading to investment, trade, and economic growth in countries with weak institutions (Cooray & Schneider, 2018; De Soto, 1990; Dreher & Gassenbner, 2013; Leff, 1964).

On the other side of the coin, there are numerous academic studies, theoretical and ethical arguments, government policies, and anti-corruption campaigns that portray corruption as an insidious plague that destroys governments and hinders economic development (Rose-Ackerman, 1999). These opposing views have provided evidence that corruption can reduce investment in most developing countries and have detrimental effects on human capital accumulation (Reinikka & Svensson, 2005; Rock & Bonnett, 2004). Corruption plays a significant role in generating poverty traps, making it a notable obstacle to economic development (Aidt, 2009; Saha & Ben Ali, 2017). It is in fact so notable that economic-policy-driven agencies such as the United Nations and World Bank have made it their goal to eradicate poverty by 2030, noting that corruption is one of the major obstacles to this sustainable development goal (United Nations, 2020). It has been estimated that a one percent rise in corruption leads to a three percent reduction in firm growth (Fisman & Svensson, 2007). While the 'sand in the wheels' body of evidence continues to inform key international policy institutions such as the World Bank, IMF, OECD, and United Nations (which promote ever-

growing anti-corruption campaigns), the evidence surrounding the impact of corruption is inconclusive (Campos et al., 2010).

While the World Bank loosely estimates that corruption costs the world economy up to one trillion US dollars a year, the actual impact is ambiguous at best, with empirical results differing from region to region (Fan, Lin, & Treisman, 2009; Treisman, 2000; World Bank, 2018). Within the corruption literature we begin to see evidence of a phenomenon known as the Asian Paradox, where there is a positive correlation between corruption and growth in a number of economies known as the Asian Tigers. This is supported by Huang (2016), who demonstrates that corruption enhances economic growth in certain regions. The inconclusive and ambiguous evidence of these studies can be explained by several factors. From an econometric perspective, regressions that infer a causal relationship between corruption and growth are often subject to reverse causality issues and omitted variable problems (Aidt, 2003; Campos et al., 2010). The use of perceptions-based indices has caused issues in the empirical literature as they are generally fraught with ideological bias and rank countries heavily on socio-political performance (Campos et al., 2010). The quality of data used within the studies is also a major issue within the literature. While every possible effort is made to ensure the variables used capture every aspect of growth, corruption, and inequality, the data generally hides the welfare implications of any economic phenomena as it is collected at an aggregate level (Campos et al., 2010).

While the current economic literature fails to find synergy and explain variation within the corruption literature, a meta-analysis is a statistical tool that can be used to find research synthesis (Cooper, 2017). It is important to understand that rigorous care is necessary when undertaking a meta-analysis within economics; unlike traditional studies in psychology or medicine, these empirical studies are non-stochastic and analyse publicly available data, with data and methods differing from study to study (Anderson & Kichkha, 2017). While a meta-analysis is not a true scientific technique as it requires some level of performative judgement in regard to what studies to include, it is a statistical technique with a goal of research synthesis (Anderson & Kichkha, 2017). When executing a meta-analysis within the field of economics it is important to remember that while a meta-analysis can be used to assess heterogeneity, it delivers correlation not causation, which indicates one should use caution when interpreting the results. In addition, all meta-analyses should be replicated to ensure that the performative judgement within the data is audited for empirical economic studies (Anderson & Kichkha, 2017; Stanley, 2001). Meta-analyses have successfully been used in the fields of medicine and

science where conducting numerous clinical trials becomes too difficult or expensive (Stanley, 2001). The American Statistical Association has encouraged the use of meta-analysis with the inclusion of small studies, as this type of research synthesis has solved some major controversies within the medical science literature (Hunt, 1997; Stanley, 2001). Meta-analysis has successfully clarified numerous literature disputes including the connection between exposure to TV violence and aggressive behaviour (Paik & Comstock, 1994), the efficacy of coronary bypass surgery (Held, Yusuf, & Furberg, 1989), and the effectiveness of spending money on schools (Hedges, Laine, & Greenwald, 1994; Stanley, 2001). Many of the scientific findings currently reported by media on various clinical trials, drugs, and treatments are deduced from the latest meta-analysis conducted within medicine (Stanley, 2001). The following section will summarise the methodological approach by which this analysis will empirically define the differences within the literature that have not been explained in the section above.

3. METHOD

To identify relevant studies, we searched academic databases using keywords such as ‘corruption’, ‘economic development’, ‘grease the wheels’, and ‘sand in the wheels.’ The abstracts of these studies were then examined to ensure they were relevant to the meta-analysis. When necessary, the full article was examined to ensure the article was significant to the study. The selection criteria for inclusion in the meta-study were as follows: each paper needed to have conceptualised measures of corruption, which then econometrically investigated the relationship between corruption and economic growth at a macroeconomic level; as well as including multiple countries or multiple time periods. To assess the issue of publication bias, a number of working papers from international non-government organisations were included within the dataset. These studies were required to report the number of observations, degrees of freedom, regression coefficients, t-values, and standard errors. Where the standard errors were omitted from the results, it was calculated using the regression coefficients and observations¹. These statistics provide sufficient information to allow creation of explanatory variables. All reported regression results from each individual study were included in the data set to prevent representative or preferred results, based on the logic that very few authors single out a preferred set of results (Campos et al., 2010).

Theoretical models were excluded from the study as we were looking for variable stability and convergence within the literature. As part of the analysis, conclusions were read to sort the papers into ‘grease’ or ‘sand’ results: this led to the construction of three datasets for analysis. The first dataset contains all papers included in the meta-analysis, with the second and third containing papers that concluded that their results either ‘greased’ or ‘sanded’ economic development respectively. It is important to note that one study within the entire dataset (Mironov, 2005) noted that corruption could provide positive and negative effects on growth depending on whether the corruption was deemed as ‘good’ or ‘bad’ corruption. Due to this, the study was included in both the grease and sand datasets to ensure all effects were counted.

Before beginning the analysis, the data was summarised to provide the overall effect size and its precision, as well as assess the between-study heterogeneity and homogeneity. Using the Meta Summarize command in STATA, the study estimates the overall effect size, θ , and its precision. To estimate this, the combined studies effect size is computed as the weighted average of the study specific effect sizes (Raudenbush, 2009). Studies which have a larger weight are considered to be more precise studies. The formula is as follows:

$$\theta^* = \frac{\sum_{j=1}^K w_j^* \hat{\theta}_j}{\sum_{j=1}^K w_j^*} \quad [1]$$

Where $w_j^* = \frac{1}{(\sigma_j^2 \tau^2)}$ and the variance of θ^* is estimated by $\text{var}(\theta^*) = \frac{1}{w^*}$ where $w^* = \sum_{j=1}^K w_j^*$. Once the data has been summarized and weighted, heterogeneity is measured by Tau^2 and I^2 . Tau^2 measures the variance of the effect size across the population of studies, while I^2 represents the percentage of variability between the effect size estimates that is caused by heterogeneity (Deeks, Higgins & Altman, 2008; Joanna Briggs Institute, 2020a, 2020b). I^2 is the proportion of the observed dispersions of effect sizes from the population studies included within the meta-analysis; a lower value of I^2 represents no to little heterogeneity while a larger value represents increasing heterogeneity (Deeks et al., 2008; Joanna Briggs Institute, 2020a). Once heterogeneity has been assessed, a sensitivity analysis is conducted to ensure the robustness of the results at different levels of heterogeneity using I^2 . A typical level for sensitivity analysis using I^2 is to assess the meta-analysis at 0.25, 0.5 and 0.75 (Deeks et al., 2008; Raudenbush, 2009).

As bias and cross study heterogeneity have proven to be a significant issue within economic literature—especially macroeconomic literature addressing corruption—a funnel

plot with tests for funnel plot asymmetry, publication bias, and small study effects is employed. For example, the more pronounced the asymmetry, the more likely we chance that bias is substantial (Sterne & Harbord, 2004). Academic papers tend to lean towards statistically significant results, which can lead to some studies being omitted from publication; therefore, these three tests will be used to ensure that bias and heterogeneity are addressed within the study. A funnel plot or graph is a scatter plot which places the study-specific effect sizes (regression coefficients) on the x axis against the measure of study precessions (standard errors) on the y axis (Light & Pillemer, 1984). This plot measures the small study effects where it is assumed that the results from smaller studies differ systematically from those of larger ones. In the absence of small study effects, the funnel plot should be symmetric (inverted) (Light & Pillemer, 1984). Traditionally within a funnel plot, the effect size of smaller studies will be more variable than those from larger studies due to sampling error. Small study effects are commonly explained by between-study heterogeneity and publication bias. While the funnel plot provides a useful visual method to explore the data, a less subjective and more formal method is needed (Light & Pillemer, 1984). For the purpose of this study, a Funnel-plot Asymmetry Test (FAT) known as the Egger-based regression test will be used to assess publication bias. These tests determine whether there is a statistically significant association between effect sizes and standard errors (Campos et al., 2010). This test performs a weighted linear regression of the effect size, θ_j , on their standard errors, σ_j , weighted by their precision $\frac{1}{\sigma_j}$ (Campos et al., 2010; Egger, Smith, Schneider & Minder, 1997). The regression tests for a zero slope, which provides a formal analysis for small study effects: however, it is important to note that these tests must be interpreted with caution as non-detection does not mean the existence of small study effects should not be ruled out (Egger et al., 1997).

The Egger test for small study effects is based on a simple linear regression of the standard normal variate, which for the purpose of this study will be defined as the individual effect size divided by its standard error, against study precision which is defined as the reciprocal of the standard error (Egger et al., 1997; Sterne & Egger, 2005):

$$E\left(\frac{\hat{\theta}_j}{\hat{\sigma}_j}\right) = b_0 + b_1 \frac{1}{\hat{\sigma}_j} \quad [2]$$

To provide a more rigorous understanding of the relationship between corruption and growth and identify whether studies have unintentionally identified RS or systemic corruption, the next section will aim to test the quality of the message conveyed by the existing literature by constructing a database of Meta Regression Analysis (MRA) literature that will be used to explain the variances found within the estimates/effect of each study (Campos et al., 2010). Anomalies within the literature may be explained by differences in research methodology, real world factors such as regional and time differences, the variables used, and whether the paper was unintentionally assessing RS or systemic corruption (Campos et al., 2010).

The following variables were constructed to capture the differences between studies and are described in Table 1. To describe the differences in econometric methodology, dummy variables were constructed taking the value of 1 if the coefficients originated from a cross-sectional model (0 if time series or panel), if fixed effects were used (0 if not), if the study attempted to correct for endogeneity, and if the paper was published in a peer reviewed academic journal, is a working paper, or was published by a non-governmental organisation (NGO) such as the World Bank (WB) or International Monetary Fund (IMF) (Campos et al., 2010). We also included a dummy variable to assess whether the main authors had a background within academia. As most of the studies covered a specific group of countries or region, we created dummy variables to capture the geographical effects of corruption on growth. The coefficients were given a value of 1 (0 otherwise) if the study focused on numerous countries and regions (WORLD), Middle East and Northern Africa (MENA), Latin America (LAC), North America (NA), Asia (ASIA), Sub-Saharan Africa (AFR), Europe (EU), Organization of Islamic Cooperation (OIC), BRICS (Brazil Russia India China and South Africa), and Oceania (OC) (Campos et al., 2010). OECD Countries were also included within the study. Dummies were created with a value of 1 to capture whether trade or trade openness, government quality, political institutional variables such legal origins or democracy, government expenditures, and human capital such as education were present in the model (Campos et al., 2010). To measure the outcome of each study, variables were included into a grease or sand model to capture whether the study showed a positive or negative effect of corruption on economic growth, allowing us to test the two separate theories.

One of the main issues surrounding the MRA literature is the validity of a perceptions-based index on global corruption (Razafindrakoto & Roubaud, 2010). In order to assess whether the choice of corruption indicators had a significant effect on the relationship between corruption and growth, dummy variables were constructed to account for the differences in

each study. The most commonly used measure is the Transparency International Corruption Perceptions Index (CPI), which uses an “expert perception” from a survey of businesspeople and country-based analysts. This index has been available since 1995 and includes around 150 countries; measurements range from 10 (highly clean) to 0 (highly corrupt). Unfortunately, one of the main issues with this measure is that the methodology has changed frequently over time, which makes it difficult to compare results as a time series (Campos et al., 2010). Other commonly used measures of corruption include the International Countries Risk Guide (ICRG) by the Political Risk Group and the Control of Corruption (WBCOC) by the World Bank (WB). The ICRG is available from 1984 with a yearly frequency and gives a lower value to countries with higher levels of corruption. The WBCOC measures corruption from -2.5 (high corruption) to 2.5 (low corruption) (Kaufmann, Kraay & Mastruzzi, 2011). In line with Campos et al. (2010), a COMB variable will be constructed as a dummy to capture the use of different corruption measures between studies (ICRG, TI CPI, WBCOC, OTHER, COMB) and an OTHER variable was constructed where the authors used different measures of corruption not listed above. Another common issue faced within the literature is that most of the observations used are not statistically independent. This becomes an issue as empirical estimates within a meta-analysis are considered statistically independent if they are reported by different authors.

It is believed that the empirical literature on the effects of corruption on growth is inconclusive (Campos et al., 2010). To address this and further explore the presences of heterogeneity within the literature, a random effects meta-regression is used with moderators (dummy variables). For the purpose of this study, the moderators will be the methods, study specific variables, and corruption measures used. While there are two types of regressions that can be used for meta-analysis, this study will only employ random effects (RE) because a fixed effects (FE) Meta regression assumes that all heterogeneity between studies can be accounted for by the moderators. A RE meta-analysis has been used to account for any potential additional variability that cannot be explained by the moderators. A random effects meta regression is given by the following two stage model (Berkey, Hoaglin, Mosteller & Colditz, 1995; Columbia University Irving Medical Center, 2019):

$$y_i \sim N(\theta_i \hat{\sigma}_i^2) \quad [3]$$

$$\theta_i \sim N(x_i \beta, \tau^2) \quad [4]$$

Where y_i is the estimated effect size for the study population i , θ_i has a normal distribution with the mean representing the true effect size of the population and σ^2_i is the within study variance. In Equation 4, $x_i\beta$ is assumed to be the population specific realisation of the distribution's true impacts of all effects where its mean is parameterised as a function of the study level variables and τ^2 is the between study variance. Thus, combining these two-level distributions yields:

$$y_i \sim N(x_i\beta, \tau^2 + \sigma^2) \quad [5]$$

From Equation 5, a linear regression model can be specified under this distributional assumption:

$$y_i = x_i\beta_i + v_i + \varepsilon_i \quad [6]$$

Where $v_i \sim N(0, \tau^2)$ is a random effect describing the study specific deviation from the distribution mean, and $\varepsilon_i \sim N(0, \sigma^2)$ is a random error term describing the sample variability (Berkey et al., 1995; Columbia University Irving Medical Center, 2019). The random effects model assumes that all studies within the meta-analysis share a common τ^2 and the observed sampling variances are the true variances within each study (Columbia University Irving Medical Center, 2019). This meta-analysis employs the use of the Restricted Maximum Likelihood (REML) meta regression as this is the preferred and most common method to fit both multilevel models and meta regressions, due to its unbiased and efficient methods (Berkey et al., 1995; Columbia University Irving Medical Center, 2019). REML estimates parameters that maximise the likelihood of the error distribution while imposing restrictions to avoid overfitting the model. This allows for the model to obtain a more accurate balance between the fractions of variability captured in the fixed and random parts of the statistical models (Berkey et al., 1995; Columbia University Irving Medical Center, 2019).

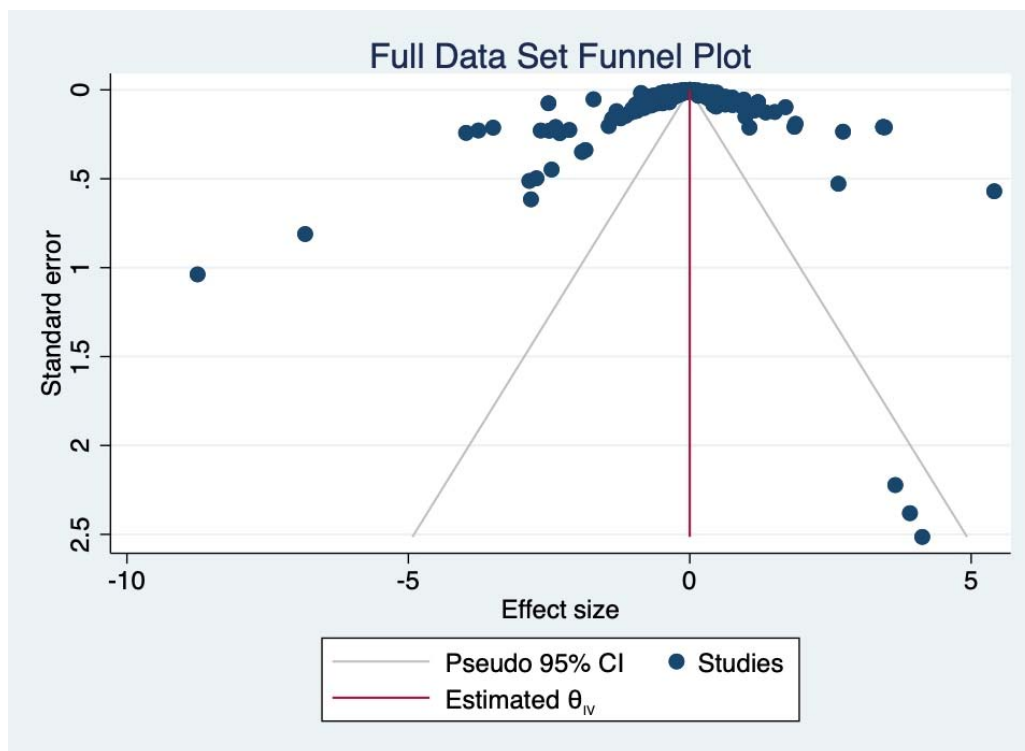
4 RESULTS

The purpose of this study was an attempt to narrow the findings and achieve synergy across the corruption literature. Instead, the meta-analysis demonstrates the chaos created from lack of clear definitions and empirical methodology. To aid our understanding of the variations found within the literature, we decided to split the meta-data into three separate data sets and analysed each. The first data set, which contained the full number of studies that reported grease and/or sand type effects, had 473 observations², with the grease and sand data sets having 247 and 268 observations respectively. Each meta-analysis conducted resulted in an I^2 of 100%, demonstrating that heterogeneity accounted for 100% of the variation in effect sizes between studies. This supports our claim that there is very little commonality across the studies. As a result, we did not conduct a sensitivity analysis as it was deemed inappropriate due to all data sets having an I^2 of 100%. To assess any publication bias, we constructed a Funnel plot for each of the data sets to illustrate the impact of bias in the literature. While visual inspection of funnel plots can lead to ambiguity within the analysis, it is extremely clear that all three data sets not only suffer from between-study heterogeneity but also publication bias. In the absence of publication bias and heterogeneity one would expect the majority of studies to be randomly scattered within the pseudo confidence interval region (grey lines), with the plot resembling an inverted V or funnel shape. Upon visual inspection we can see that the original meta-analysis that included all studies and the studies that identified corruption as greasing economic growth only have three data points, which sit inside the confidence interval; the rest of the studies are symmetrically scattered outside of this area with very few lining up with the computed overall effect size (red line). This suggests that there is a large amount of publication bias and heterogeneity. Exploring the sand funnel plot, we see a large presence of bias and again a lack of symmetry between studies, which is almost certainly a result of the heterogeneity. While the studies do seem to show the presence of a large amount of publication bias and heterogeneity, we find little evidence of small study effects within the data. As demonstrated in Table A4 the full data set and sand data set, when tested for small study effects through the random effect's Egger-based regression test showed no sign of small study effects, while the grease data set indicated a small presence of study effects with a beta of 0.86, which was statistically significant at 10% level. This effect is minor as it had no effect on the combined data set, which is expected from macroeconomic studies due to the nature of the data used.

To assess heterogeneity and attempt to find synergy between variables in an average corruption study, a Meta regression was conducted with dummy variables as moderators. These

moderators are explanatory variables which may influence the effect size, and should be interpreted in the same way as a simple linear regression, though it is important to note that larger studies have more influence as they are given heavier weights than smaller studies (Raudenbush, 2009). To evaluate the impact of moderators, we first assessed the measurement method of corruption as this is typically where most issues arise in the literature due to the use of perception-based indices. Upon investigation of the data sets we see that, not surprisingly, the only method that is statistically significant is the combined method at 5% level; although, due to heterogeneity it has a Tau^2 of 43.58% (See Table A5). Breaking the data sets we see that Table A10 (the grease data set) is similar to the whole full meta-analysis, but results start to become more significant in Table A15 when we assess corruption measurements as a moderator for the sand data set.

Figure 1: Full Meta-Analysis Funnel Plot



While the combined method is no longer significant, we observe that the CPI and the WBCOC have significance at 5% with a Tau^2 score of 27.73% and 28.07% respectively. This suggests that when it comes to the perception of corruption, the public tend to notice corrupt activities that we would expect to sand the wheels of economic development. We also observe that while the CPI increases the effect size within the analysis, the WBCOC significantly

reduces the effect size. This relationship could be one of the numerous reasons that there is so much heterogeneity within the literature. While the methods were different across the studies, there are six variables commonly found in a study of corruption and economic development, and these were adopted as moderators within this study. The meta-regression of the full data set (see Table A5, A6, A7, A8 and A9) shows that the only variables that have a statistically significant impact on the effect size are the political variable and trade-based variables. Throughout all three meta-regressions, trade has a significantly negative effect on the effect size, with political variables only having a significant effect on the full data set and the grease data set. The lack of significance in these moderators could explain the differing results we see within the literature.

Figure 2: Grease Meta-Analysis Funnel Plot

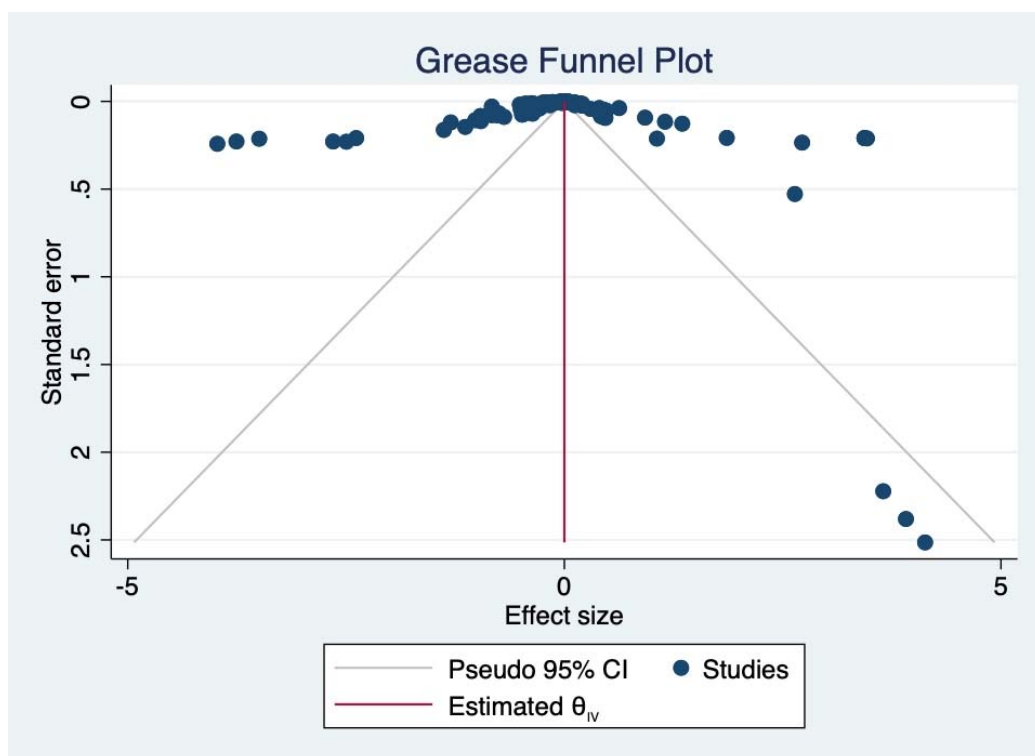
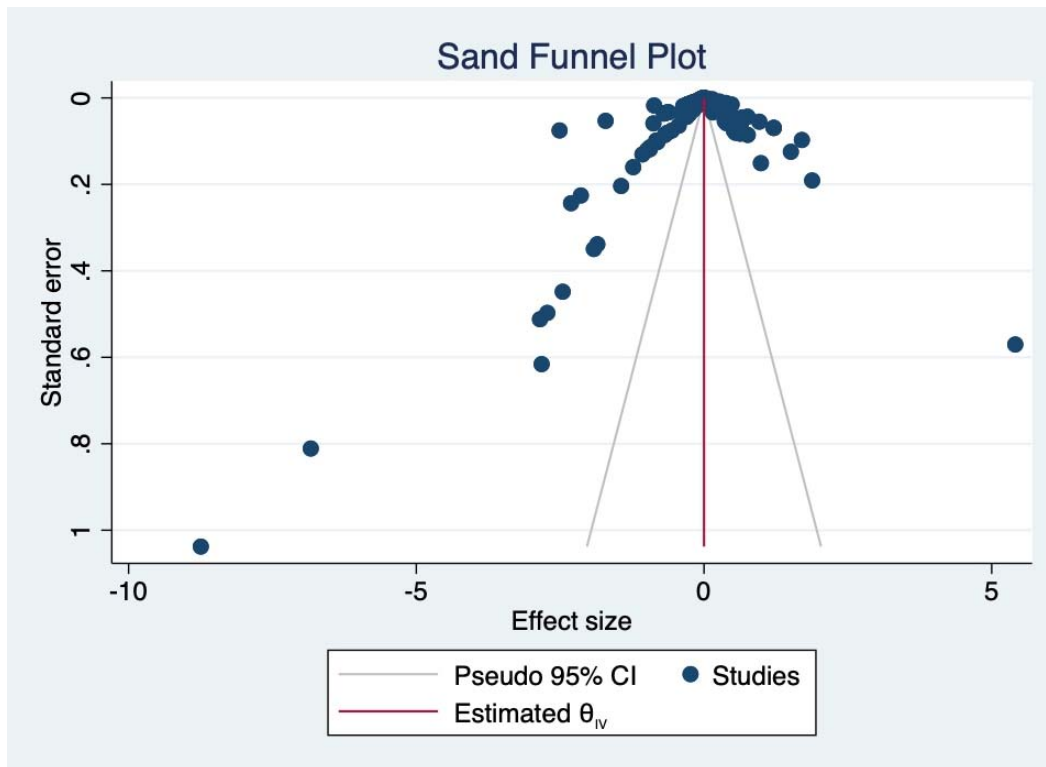


Figure 3: Sand Meta-Analysis Funnel Plot



While not statistically significant, it is interesting to note the relationship between the sand and grease dummy variables included in Table A6. Studies that were deemed to sand the wheels of economic development actually have a negative relationship with the effect size, while studies that concluded that corruption greases the wheels of economic development seem to have a positive relationship with the effect size.

Academics are thought to report results that are more rigorous and thorough than reports published by NGOs due to the strenuous peer review process to which they are subjected before publication. To test this, we used moderators for studies by university affiliated authors and for reports published by NGOs. We also included a dummy to control for studies which accounted for potential endogeneity within the model. We found that academic papers had a significant negative effect on the full dataset and the grease in the wheels data set, while studies coming from NGOs had a significant positive effect on all data sets, this is demonstrated in Tables A7, A12 and A17. This positive and negative relationship between NGOs and academic papers could explain the variance and heterogeneity within the literature. It may also be expected, as academics tend to face a lot of scrutiny for publishing articles that say corruption sands the wheels of economic development, while NGOs are generally more driven by attempting to push their political agenda (Campos et al., 2010). Endogeneity only

had a significant effect within the full and sand data sets, where it was seen to positively impact the effect size. This could suggest studies that account for endogeneity may reveal results closer to the true impact of corruption.

Within all of the 473 studies included in this meta-analysis, we encountered 14 different econometric methods with Ordinary Least Squares (OLS), accounting for 53.70% of models used. General Method of Moments (GMM) accounted for 17.55% of all studies, with Fixed Effects (FE) representing 10.15% of the population. When regressing these moderators, we find only two of these methods were significant. Within the full and sand data sets, the only methods that had a significant impact on the effect size throughout all studies were Fully Modified Least Squares (FM-OLS) and Generalised Least Squares (GLS). There was no significance within the grease data set, as studies included did not use FM-OLS or GLS. GLS, unlike OLS, is used to deal with situations in which the data is not BLUE (Best Linear Unbiased Estimator), where there is the presence of homoscedasticity and serial correlation. Through controlling for these things, studies may end up with a more accurate measure of the impact of corruption. FM-OLS is similar to GLS, but this model allows for optimal estimates of co-integrating regression (Phillips, 1995). This method modifies OLS to account for the effects of endogeneity and serial correlation within the model. It is important to note that while significant, these two moderators move in opposite directions around the effect size, which could be due to the different variables, countries, and time periods assessed. The lack of significance and convergence within the literature could be caused by the use of inappropriate models or broken assumptions, causing the results to be skewed.

One of the many factors thought to impact corruption is culture, and while many macroeconomic studies on corruption attempt to measure this, they seem to forget that culture is a unique singularity confined to individual nations. As culture differs across regions and economists rely heavily on panel data, we used country-based moderators to test the effectiveness of the data. We also included a few studies that did single country time series to compare the results with panel studies. Throughout the meta-regressions, the panel studies that included numerous countries (WORLD), OECD, MENA, and EUROPE were insignificant but single country studies or studies that included countries from Africa were significant throughout all three regressions. This suggests that regions such as Africa with similar economic situations and cultural backgrounds are easily comparable and more likely to give significant results in regard to the effect of corruption. We also see that studies which included transition economies (Abed & Davoodi, 2000; Åslund & Jenish, 2006) have significance

throughout the regressions. This could be due to economies transitioning through economic development sharing similar conditions and cultural backgrounds.

One important thing to note is the direction of the effect sizes within these regressions. Single time series studies had a negative effect on the direction of the effect size, while pooled panel studies (countries like transition countries and Africa) had a positive effect on the effect size. This could suggest that by focusing on single countries we obtain a more representative effect, and in pooling them together we cancel out the true impact. It could also suggest that these countries are experiencing either grease corruption or sand in the wheel's corruption depending on the variables used.

5 CONCLUSIONS

The original purpose of this study was an attempt to find synergy within the economic corruption literature and find its true 'effect' on economic development. Upon completion of this study, we came away with more questions than answers. The results, while showing no small study effects, did show a large amount of publication bias, variance, and heterogeneity. While the results from the meta-analyses show more correlation than causation it is clear that there is little synthesis within the economic literature. Additionally, we saw a very small number of significant variables and methods throughout the studies, suggesting that there is no clearly significant method which may be used to assess corruption and economic development. While traditional econometric models are appropriate for examining less complex phenomena, these results have demonstrated that it may be time to consider different econometric methods such as Structural Equation Modelling (SEM), which has traditionally been used to examine unobservable activities such as those conducted in the shadow economy (Fan et al., 2009; Lambsdorff, 2002; Schneider, Buehn & Montengro, 2010). Along with this, the differing results between studies that were deemed to grease or sand economic development may also suggest that we have been looking at corruption incorrectly all this time. These results suggest that corruption possibly may either be two separate activities acting together at once or appearing separately in different time periods and stages of a country's development.

If this is true, then these findings have shown us that the ambiguity within the corruption literature is warranted and that there is no precedent set for a methodological base to study corruption. Furthermore, we have shown that the use of multiple country and region panel data has no effect on determining the effect size of corruption on economic development. With

current economic trends and our history of borrowing from other disciplines, perhaps these results have paved the way not only for a new macroeconomic model of corruption, but also a model that strongly considers cultural and historical differences when determining the effect of corruption and steps away from using perceptions-based data. The findings of this meta-analysis can be used as the starting point to resolve some of the ambiguity within the current corruption literature and hopefully produce a sound model that addresses the phenomenon directly.

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Appendix A: Studies from the Meta-Analysis

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Appendix B: Results from the Meta-Analysis

Table A1: Descriptive Statistics for Full Meta-Analysis

Variable	Obs	Mean	Std. Dev.	Min	Max
Effect Size	473	-0.07	0.95	-8.74	5.41
Standard Error	473	0.05	0.20	9.64E-06	2.51
Government expenditure	473	0.55	0.50	0	1
Quality	473	0.36	0.48	0	1
Political	473	0.52	0.50	0	1
Human	473	0.93	0.25	0	1
Investment	473	0.69	0.46	0	1
Trade	473	0.48	0.50	0	1
Combined	473	0.12	0.32	0	1
CPI	473	0.21	0.41	0	1
ICRG	473	0.30	0.46	0	1
Other	473	0.30	0.46	0	1
WBCoC	473	0.06	0.24	0	1
Endogeneity	473	0.69	0.46	0	1
NGO	473	0.09	0.29	0	1
Academic	473	0.92	0.26	0	1
World	473	0.66	0.47	0	1
Vietnam	473	0.03	0.15	0	1
USA	473	0.02	0.14	0	1
OECD	473	0.02	0.16	0	1
Italy	473	0.02	0.16	0	1
Nigeria	473	0.01	0.09	0	1
Africa	473	0.04	0.20	0	1
Transition	473	0.03	0.20	0	1
BRICS	473	0.002	0.04	0	1
MENA	473	0.09	0.27	0	1
OIC	473	0.03	0.17	0	1
Europe	473	0.01	0.12	0	1
FMOLS	473	0.01	0.10	0	1
Random Effects	473	0.01	0.12	0	1
CSARDL	473	0.03	0.17	0	1
DP	473	0.02	0.13	0	1
SUR	473	0.01	0.13	0	1
3SLS	473	0.02	0.14	0	1
2SLS	473	0.01	0.11	0	1
SGMM	473	0.02	0.14	0	1
Fixed Effects	473	0.10	0.30	0	1
GLS	473	0.02	0.13	0	1
GMM	473	0.16	0.38	0	1
OLS	473	0.54	0.50	0	1
MLE	473	0.02	0.13	0	1
Instrument Variable	473	0.01	0.10	0	1

Table A2: Descriptive Statistics for Grease Meta-Analysis

Variable	Obs	Mean	Std. Dev.	Min	Max
Effect Size	247	-0.005	0.87	-3.97	4.13
Standard Error	247	0.06	0.27	9.64E-06	2.51
Government Expenditure	247	0.35	0.48	0	1
Quality	247	0.28	0.45	0	1
Political	247	0.57	0.49	0	1
Human	247	0.90	0.30	0	1
Investment	247	0.65	0.48	0	1
Trade	247	0.55	0.50	0	1
Combined	247	0.04	0.21	0	1
CPI	247	0.16	0.37	0	1
ICRG	247	0.50	0.50	0	1
Other	247	0.25	0.43	0	1
WBCoC	247	0.03	0.19	0	1
Endogeneity	247	0.71	0.45	0	1
NGO	247	0.06	0.25	0	1
Academic	247	0.93	0.25	0	1
BRICS	247	0.004	0.06	0	1
MENA	247	0.15	0.36	0	1
OIC	247	0.06	0.24	0	1
World	247	0.74	0.44	0	1
Transition	247	0.05	0.21	0	1
2SLS	247	0.01	0.13	0	1
SGMM	247	0.04	0.20	0	1
OLS	247	0.52	0.50	0	1
GMM	247	0.14	0.34	0	1
Fixed Effects	247	0.17	0.37	0	1
CSARDL	247	0.06	0.24	0	1
Random Effects	247	0.03	0.17	0	1

Table A3: Descriptive Statistics for Sand Meta-Analysis

Variable	Obs	Mean	Std. Dev.	Min	Max
Effect Size	268	-0.13	0.95	-8.74	5.41
Standard Error	268	0.04	0.11	0.00001	1.04
Government Expenditure	268	0.71	0.45	0	1
Quality	268	0.46	0.50	0	1
Political	268	0.54	0.50	0	1
Human	268	0.88	0.33	0	1
Investment	268	0.77	0.42	0	1
Trade	268	0.40	0.49	0	1
Combined	268	0.16	0.37	0	1
CPI	268	0.23	0.42	0	1
ICRG	268	0.12	0.32	0	1
Other	268	0.41	0.49	0	1
WBCoC	268	0.08	0.27	0	1
Endogeneity	268	0.62	0.48	0	1
NGO	268	0.10	0.30	0	1
Academic	268	0.93	0.26	0	1
World	268	0.65	0.48	0	1
Vietnam	268	0.04	0.21	0	1
USA	268	0.04	0.19	0	1
OECD	268	0.04	0.21	0	1
Italy	268	0.04	0.21	0	1
Nigeria	268	0.01	0.12	0	1
Africa	268	0.07	0.26	0	1
Transition	268	0.007	0.08	0	1
Europe	268	0.02	0.16	0	1
FMOLS	268	0.02	0.13	0	1
DP	268	0.03	0.17	0	1
SUR	268	0.02	0.15	0	1
3SLS	268	0.04	0.19	0	1
2SLS	268	0.007	0.08	0	1
SGMM	268	0.03	0.19	0	1
Fixed Effects	268	0.04	0.20	0	1
GLS	268	0.03	0.17	0	1
GMM	268	0.18	0.39	0	1
OLS	268	0.57	0.49	0	1
Instrument Variable	268	0.02	0.13	0	1

Table A4: Regression-based Egger Test for small study effects (Random Effects)H0: $\beta_1 = 0$; no small-study effects

Method:			
REML			
	Full Meta Data Set	Grease Data Set	Sand Data Set
Beta1	-1.76	0.86	-4.21
SE of Beta	0.33	0.48	0.40
z	-5.26	1.80	-10.46
Prob > z	0.00	0.07	0.00

Table A5: Meta Regression of full data set – Corruption Dummies

Meta Effect Size					
Method: REML					
Corruption Dummies					
CPI	0.11 (0.08)				
ICRG		-0.04 (0.07)			
WBCOC			-0.20 (0.13)		
Combined				0.17** (.096)	
Other					-.07 (0.07)
Observations	473	473	473	473	473
R ²	0.0035	0.00	0.007	0.0023	0.0022
Tau ²	.4353	.4381	.4365	.4358	.4359
Wald Chi ²	2.24	0.28	2.45	2.97	1.34
H ²	2.9e+07	2.9e+07	3.0e+07	2.9e+07	2.9e+07
I ² (%)	100	100	100	100	100

Note: Standard Errors in parentheses; *, **, *** denote 10%, 5% and 1% level of significance respectively.

Table A6: Meta Regression of full data set – Variable Dummies

Meta Effect Size								
Method: REML								
Variable Dummies								
Human	-0.05 (0.12)							
Political		-0.10* (0.06)						
Investment			-0.03 (0 .07)					
Quality				0.08 (0.06)				
Government Expenditure					0.03 (0.06)			
Sand						-0.02 (0.06)		
Grease							0.04 (0.06)	
Trade								-0.18*** (0.06)
Observations	473	473	473	473	473	473	473	473
R ²	0.0039	0.00	0.00	0.004	0.00	0.00	0.00	0.0207
Tau ²	.4351	.4381	.4384	.4367	.4377	.4384	.4384	.4278
Wald Chi ²	2.77	0.16	0.19	1.72	0.18	0.08	0.36	8.75
H ²	2.9e+07	2.9e+07	3.0e+07	2.6e+07	2.9e+07	2.6e+07	2.9e+07	2.8e+07
I ² (%)	100	100	100	100	100	100	100	100

Note: Standard Errors in parentheses; *, **, *** denote 10%, 5%, and 1% level of significance respectively.

Table A7: Meta Regression of full data set – Academic Dummies

Meta Effect Size			
Method: REML			
Academic Dummies			
Academic	-0.27**		
	(0.12)		
Non-Governmental Organisation		0.24**	
		(0.11)	
Endogeneity			0.13**
			(0.07)
Observations	473	473	473
R ²	0.0084	0.0079	0.0083
Tau ²	.4332	.4334	0.4332
Wald Chi ²	5.30	5.07	4.07
H ²	2.9e+07	2.9e+07	2.9e+07
I ² (%)	100	100	100

Note: Standard Errors in parentheses; *, **, *** denote 10%, 5%, and 1% level of significance respectively.

Meta Effect Size	
Method: REML	
Method	Dummies
2SLS	0.06 (0.27)
CS- ARDL	-0.24 (0.17)
Fixed Effects	0.001 (0.10)
GMM	0.03 (0.08)
MLE	0.09 (0.24)
OLS	-0.03 (0.06)
Random Effects	0.12 (0.25)
SGMM	0.05 (0.21)
3SLS	0.11 (0.21)
DP	0.06 (0.24)
FM-OLS	1.24* **

GLS											(0.29)	-0.82***		
IV Models												(0.24)	-0.02	
SUR													(0.30)	0.19
														(0.28)
Observations	473	473	473	473	473	473	473	473	473	473	473	473	472	473
R ²	0.00	0.0032	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.049	0.0330	0.00	0.00
Tau ²	.4381	.4354	.4382	.4382	.438	.4383	.4379	.4381	.4379	.4381	.4154	.4224	.4382	.4376
Wald Chi ²	0.05	1.90	0.00	0.11	0.16	0.21	0.22	0.07	0.28	0.06	18.37	12.17	0.00	0.50
H ²	3.0e+07	2.9e+07	3.0e+07	2.6e+07	3.0e+07	2.9e+07	3.0e+07	2.6e+07	3.0e+07	2.9e+07	2.8e+07	2.93+07	3.0e+07	3.0e+07
I ² (%)	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Note: Standard Errors in parentheses; *, **, *** denote 10%, 5%, and 1% level of significance respectively.

Table 9: Meta Regression of full data set – Country Dummies

Meta Effect Size					
Method: REML					
Method Dummies					
World	-0.09 (0.06)				
Vietnam	-0.33** (0.19)				
USA		0.01 (0.21)			
Transition Economy			0.78*** (0.18)		
OIC			-0.23 (0.17)		
OECD				-0.06 (0.19)	
Nigeria				-2.15*** (0.38)	
MENA					-0.02 (0.12)
Italy					0.07 (0.19)
Europe					0.12 (0.25)
BRICS					0.08

											(0.66)	
Africa												0.61*** (0.15)
Observations	473	473	473	473	473	473	473	473	473	473	473	473
R ²	0.0019	0.0302	0.00	0.0416	0.0032	0.00	0.0627	0.00	0.00	0.00	0.00	0.0481
Tau ²	.436	.4339	.4382	.4187	.4354	.438	.4095	.438	.4381	.4379	.4382	.4158
Wald Chi ²	1.86	3.02	0.00	18.58	1.90	0.11	31.84	0.02	0.12	0.21	0.01	15.94
H ²	2.9e+07	2.9e+07	3.0e+07	2.8e+07	2.9e+07	3.0e+07	2.8e+07	3.0e+07	3.0e+07	3.0e+07	3.0e+07	2.83+07
I ² (%)	100	100	100	100	100	100	100	100	100	100	100	100

Note: Standard Errors in parentheses; *, **, *** denote 10%, 5%, and 1% level of significance respectively.

Table A10: Meta Regression ‘grease meta-analysis’ – Corruption Dummies

Meta Effect Size					
Method: REML					
Corruption Dummies					
CPI	0.01 (0.12)				
ICRG		0.004 (0.09)			
WBCOC			0.05 (0.23)		
Combined				0.90*** (0.20)	
Other					-.23 (0.10)
Observations	247	247	247	247	247
R ²	0.00	0.00	0.00	0.0752	0.0191
Tau ²	.4756	.4756	.4755	.4377	.4643
Wald Chi ²	0.01	0.00	0.06	20.02	5.57
H ²	5.8e+07	5.8e+07	6.0e+07	5.5e+07	5.8e+07
I ² (%)	100	100	100	100	100

Note: Standard Errors in parentheses; *, **, *** denote 10%, 5%, and 1% level of significance respectively.

Table A11: Meta Regression ‘grease meta-analysis’ – Variable Dummies

Meta Effect Size						
Method: REML						
Variable Dummies						
Human	-0.06					
	(0.15)					
Political		-0.19**				
		(0.09)				
Investment			-0.07			
			(0 .09)			
Quality				0.05		
				(0.10)		
Government Expenditure					0.01	
					(0.09)	
Trade						-0.22**
						(0.08)
Observations	247	247	247	247	247	247
R ²	0.00	0.0158	0.00	0.00	0.00	0.0239
Tau ²	.4352	.4658	.475	.4747	.4756	.462
Wald Chi ²	0.18	4.60	0.59	0.32	0.02	6.30
H ²	6.0e+07	5.7e+07	6.0e+07	5.3e+07	6.0e+07	5.7e+07
I ² (%)	100	100	100	100	100	100

Note: Standard Errors in parentheses; *, **, *** denote 10%, 5%, and 1% level of significance respectively.

Table A12: Meta Regression ‘grease meta-analysis’ – Academic Dummies

Meta Effect Size			
Method: REML			
Academic Dummies			
Academic	-0.72***		
	(0.18)		
Non-Governmental Organisation		0.72***	
		(0.18)	
Endogeneity			0.06
			(0.10)
Observations	247	247	247
R ²	.0626	.0626	.00
Tau ²	.4437	.4437	.4747
Wald Chi ²	16.65	16.65	0.36
H ²	5.6e+07	5.6e+07	6.0e+07
I ² (%)	100	100	100

Note: Standard Errors in parentheses; *, **, *** denote 10%, 5%, and 1% level of significance respectively.

Table A13: Meta Regression ‘grease meta-analysis’ – Method Dummies

Meta Effect Size								
Method: REML								
Method Dummies								
2SLS	0.03 (0.35)							
CS- ARDL		-0.26 (0.18)						
Fixed Effects			-0.03 (0.12)					
GMM				0.08 (0.13)				
MLE					0.08 (0.25)			
OLS						0.008 (0.09)		
Random Effects							0.10 (0.26)	
SGMM								0.04 (0.22)
Observations	247	247	247	247	247	247	247	247
R ²	0.00	0.0051	0.007	0.00	0.00	0.00	0.00	0.00
Tau ²	.4756	.4709	.4753	.4745	.4754	.4756	.4753	.4756
Wald Chi ²	0.01	2.10	0.07	0.44	0.10	0.01	0.15	0.03
H ²	6.0e+0 7	6.0e+0 7	6.0e+0 7	5.3e+0 7	6.0e+0 7	5.8e+0 7	6.0e+ 07	5.3e+0 7
I ² (%)	100	100	100	100	100	100	100	100

Note: Standard Errors in parentheses; *, **, *** denote 10%, 5%, and 1% level of significance respectively

Table A14: Meta Regression ‘grease meta-analysis’ – Country Dummies

Meta Effect Size					
Method: REML					
Country Dummies					
World	-0.11				
	(0 .10)				
Transition Economy		0.90***			
		(0.20)			
OIC			-0.26		
			(0.18)		
MENA				-0.04	
				(0.13)	
BRICS					0.06
					(0.69)
Observations	247	247	247	247	247
R ²	0.00	0.0752	0.0051	0.00	0.00
Tau ²	.4741	.4377	.4709	.4753	.4756
Wald Chi ²	1.18	20.02	2.10	0.08	0.01
H ²	6.0e+07	5.5e+07	6.0e+07	6.0e+07	6.0e+07
I ² (%)	100	100	100	100	100

Note: Standard Errors in parentheses; *, **, *** denote 10%, 5%, and 1% level of significance respectively.

Table A15: Meta Regression Sand Meta-Analysis – Corruption Dummies

Meta Effect Size					
Method: REML					
Corruption Dummies					
CPI	0.17**				
	(0.08)				
ICRG		-0.17			
		(0.10)			
WBCOC			-0.29**		
			(0.12)		
Combined				-0.06	
				(0.09)	
Other					0.06
					(0.07)
Observations	268	268	268	268	268
R ²	0.0213	0.00	0.0092	0.00	0.00
Tau ²	.2773	.2854	.2807	.2835	.2856
Wald Chi ²	4.89	2.31	5.40	0.49	0.76
H ²	2.6e+06	2.0e+06	3.1e+06	3.0e+06	2.7e+06
I ² (%)	100	100	100	100	100

Note: Standard Errors in parentheses; *, **, *** denote 10%, 5%, and 1% level of significance respectively.

Table A16: Meta Regression Sand Meta-Analysis – Variable Dummies

Meta Effect Size						
Method: REML						
Variable Dummies						
Human	-0.05					
	(0.10)					
Political		0.007				
		(0.07)				
Investment			0.06			
			(0.08)			
Quality				0.09		
				(0.07)		
Government Expenditure					0.06	
					(0.07)	
Trade						-0.13*
						(0.07)
Observations	268	268	268	268	268	268
R ²	0.00	0.00	0.0016	0.00	0.00	0.0122
Tau ²	.2852	.2851	.2829	.2844	.2842	.2798
Wald Chi ²	0.24	0.01	0.64	2.06	0.60	3.53
H ²	2.8e+06	3.1e+06	3.1e+06	2.4e+06	2.7e+06	2.6e+06
I ² (%)	100	100	100	100	100	100

Note: Standard Errors in parentheses; *, **, *** denote 10%, 5%, and 1% level of significance respectively.

Table A17: Meta Regression Sand Meta-Analysis – Academic Dummies

Meta Effect Size			
Method: REML			
Academic Dummies			
Academic	0.11 (0.13)		
Non-Governmental Organisation		-0.05 (0.11)	
Endogeneity			0.14** (0.07)
Observations	268	268	268
R ²	0.0006	0.00	0.0172
Tau ²	.2831	.2844	.2784
Wald Chi ²	0.81	0.23	4.36
H ²	3.2e+06	3.2e+0.6	2.7e+06
I ² (%)	100	100	100
Note: Standard Errors in parentheses; *, **, *** denote 10%, 5%, and 1% level of significance respectively.			

Table A18: Meta Regression Sand Meta-Analysis – Method Dummies

[illegible]

Observations	268	268	268	268	268	268	268	268	268	268	268
R ²	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1664	0.1177	0.00	0.00
Tau ²	.2851	.2852	.2844	.2857	.2852	.2847	.2852	.2361	.25	.2852	.2842
Wald Chi ²	0.05	0.10	0.16	0.28	0.10	0.43	0.09	31.96	11.77	0.01	0.73
H ²	3.2e+06	3.2e+06	3.0e+06	2.7e+06	2.3e+06	3.2e+06	2.9e+06	2.7e+06	2.8e+06	3.2e+06	3.2e+06
I ² (%)	100	100	100	100	100	100	100	100	100	100	100

Note: Standard Errors in parentheses; *, **, *** denote 10%, 5%, and 1% level of significance respectively Meta results: Sand

Table A19: Meta Regression Sand Meta-Analysis – Country Dummies

Meta Effect Size									
Method: REML									
Country Dummies									
World	-0.07								
	(0 .07)								
Vietnam		-0.34**							
		(0.15)							
USA			0.01						
			(0.17)						
Transition Economy				0.08					
				(0.38)					
OECD					-0.07				
					(0.16)				
Nigeria						-2.14***			
						(0.32)			
Italy							0.06		
							(0.16)		
Europe								0.11	
								(0.20)	
Africa									0.65***
									(0.12)
Observations	268	268	268	268	268	268	268	268	268
R ²	0.0018	0.0293	0.00	0.00	0.00	0.1519	0.00	0.00	0.1758
Tau ²	.2828	.275	.2852	.2852	.2846	.2403	.2851	.2848	.2335
Wald Chi ²	0.95	4.92	0.00	0.04	0.18	45.06	0.17	0.32	30.84
H ²	3.1e+07	3.1e+06	3.2e+06	3.2e+06	3.2e+06	2.7e+06	3.1e+06	3.2e+06	2.6e+06
I ² (%)	100	100	100	100	100	100	100	100	100

Note: Standard Errors in parentheses; *, **, *** denote 10%, 5%, and 1% level of significance respective

Notes:

1. The formula for calculating an absolute standard error is $\frac{\sigma}{\sqrt{n}}$ where σ is the regression coefficient and \sqrt{n} is the square root of the observations.
2. 473 observations or studies is the number of regression results that were taken from the individual studies, some studies conducted numerous regressions hence all observations were included.