European Research Centre for Anti-Corruption and State-Building

ERCAS Working Papers

Working Paper No. 46

Uncovering High-Level Corruption:

Cross-National Corruption Proxies Using Government Contracting Data

Mihály Fazekas[1,2]
Gábor Kocsis[2]

[1]University of Cambridge
[2] Government Transparency Institute

October 2015
www.againstcorruption.eu

Content

Tables and Figures

1. Abstract

Measuring high-level corruption and government favouritism has been the object of extensive scholarly and policy interest with relatively little progress in the last decade. In order to address the lack of reliable indicators, this article develops two objective proxy measures of high-level corruption in public procurement: single bidding in competitive markets and a composite score of tendering 'red flags'. Using publicly available official electronic records of over 2.8 million government contracts in 27 EU member states plus Norway in 2009-2014, it directly operationalizes a common definition of corruption: unjustified restriction of access to public contracts to favour a certain bidder. Corruption indicators are calculated at the level of contracts, but produce aggregate indices consistent with well-established country-level corruption indicators. Due to the common EU regulatory framework, indicators are consistent over time and across countries, while WTO regulations underpin global generalisability. Indicator validity is supported by correlations with well-established perception-based corruption indicators, and novel micro-indicators such as prices and supplier registration in tax havens. The utility of the novel indicators is demonstrated by using them to explain the effect of deregulation on corruption risks at the country level. In order to facilitate wide use of the data and indicators by researchers, journalists, NGOs, and governments, they are made publicly available at digiwhist.eu.

2. Introduction

Various corruption indices have received considerable academic, policy, and media attention, at least partially due to the central role the underlying phenomena play in the quality of democratic governance, the provision of public goods, economic growth, and equality. Some international organisations regularly monitor corruption in their member countries (European Commission, 2011) and even tie funding to performance on governance indicators including corruption (Andersson and Heywood, 2009; Radelet, 2002, 2003). Recognising the lack of reliable and actionable corruption indicators, repeated calls have been made to develop so-called second generation governance indicators better suited to aiding policy making and hypothesis testing. However only limited progress has been made (Knack, Kugler, & Manning, 2003; Sequeira, 2012).

In order to fill some of the gap between the demand for reliable and valid corruption indices and the state of indicators currently available, the goal of this paper is to develop a novel proxy measure of grand corruption or government favouritism in government contracting[1] which: 1) rests on a thorough understanding of the corrupt rent extraction process; 2) solely derives from objective data describing actor behaviour; 3) allows for consistent temporal comparisons within and across countries and; 4) can be calculated for many countries across long time-series.

We develop the measurement of grand corruption in public procurement following a definition widely used by practitioners and international organisations: “The aim of corruption [in public procurement] is to steer the contract to the favored bidder without detection. This is done in a number of ways, including avoiding competition through, e.g., unjustified sole sourcing or direct contracting awards; or favoring a certain bidder by tailoring specifications, sharing inside information, etc.” (World Bank, 2009, p. 7). This definition focuses attention on restricted and unfair access to public resources, i.e. particularism, in line with a wide set of academic sources (Mungiu-Pippidi, 2006; North, Wallis, & Weingast, 2009; Rothstein & Teorell, 2008).

Using this specific definition of corruption in the domain of government contracting and tailoring measurement to this context allows for a precise indicator building at the expense of capturing other types of corrupt behavior. As public procurement constitutes roughly one third of public spending in developed countries it is worth studying on its own merit while it may also indicate the broader quality of institutions in a country (OECD, 2013).

[1] Public procurement and government contracting are used interchangeably in this article.

3. Literature on Measuring Grand Corruption

3.1 Dominant Approaches to Measuring Corruption

Available indicators of corruption are either fundamentally flawed or too narrow for testing theories of grand corruption and developing effective solutions. By and large, corruption indicators derive from: (1) Surveys of attitudes, perceptions and experiences of corruption among different stakeholders (e.g. general population, firms, experts); (2) reviews of institutional features controlling corruption in countries or individual organisations; and (3) audits and investigations of individual cases.

Among perception and attitude surveys, the two most widely used are the World Bank's Control of Corruption (Kaufmann, Mastruzzi, and Kraay, 2010) and Transparency International's Corruption Perceptions Index (Transparency International, 2012a). Both of these have received extensive criticism applicable to any similar survey (Andersson & Heywood, 2009; Lambsdorff, 2006). Critics point out that perceptions may or may not be related to actual experience (Rose and Peiffer, 2012). They can be driven by general sentiment reflecting, for example, prior economic growth (Kurtz & Schrank, 2007a, 2007b) or media coverage of high profile corruption cases (Golden and Picci, 2005). Arguably, perceptions of grand corruption are even more unreliable than perceptions of everyday corruption since experts and citizens have almost no direct experience with it. Furthermore, these indicators are produced from non-representative surveys, therefore representativeness bias is likely to occur (i.e. capturing the views of a particular group rather than the whole population), in addition to reflexivity bias (i.e. respondents influenced by prior and future measurements) exaggerated by small samples (Golden and Picci, 2005). Furthermore, many such indices vary surprisingly little over time in spite of apparent large changes in the underlying governance structures suggesting that they are too insensitive to change (Arndt & Oman, 2006; Mungiu-Pippidi, 2011). Surveys of experiences with low-level bribery, such as the Quality of Government Institute's regional survey (Charron, Dijkstra, and Lapuente, 2010), address some of the weaknesses of perception surveys, but fall short of forming a sufficient data source. One major problem is non-response or false response to sensitive questions such as giving or receiving bribes. Most importantly, only a tiny fraction of the population has direct experience with grand corruption limiting the use of this method.

Reviews of institutions controlling corruption (e.g. OECD, 2009; Transparency International, 2012b), while crucial in understanding the determinants of corruption, are, by design, not measuring corruption directly. In the absence of a precisely measured outcome variable, they have to rely on untested and often implicit theories on which institutional features work. Scientific analyses and audits of individual cases are highly reliable in establishing both petty and grand corruption,

however, their narrow scope make them of only limited use for comparative purposes. In addition, data from courts and law enforcement agencies typically cannot be compiled to create indices of corruption because courts and law enforcement agencies have little capacity to investigate large number of cases and there is a high risk of capture in corrupt countries. An innovative exception to this general observation is Escresa & Picci (2015) who exploit the independence of US courts from foreign corrupt groups in enforcing the Foreign Corrupt Practices Act.

3.2 Objective Measures of Corruption

Some authors, recognising the deficiencies of the above indicators, have developed objective measures which rely on directly observable indicators of behaviour that likely indicate corrupt behaviour (for an overview see: Authors, 2016). These studies investigate corruption in various contexts such as elections and high-level politics or welfare services and redistributive programs. For example, Olken (2007) uses data generated by independent engineers to review road projects and calculates the amount and value of missing inputs to determine corruption. These indicators are very narrow, and would be extremely expensive to generate over time and across space.

More closely associated with our approach are those studies which focus on corruption in public procurement and bidding markets. For example, Golden and Picci (2005) propose a new measure of corruption based on the difference between the quantity of infrastructure and the related public spending among 20 regions in Italy. Our proxies are inspired by other authors that use red-flags in public procurement records as proxy measures for corruption. These include the use of exceptional procedure types (Auriol, Flochel, and Straub, 2011), single bidding (Klasnja, 2015), or unclear scoring rules (Hyytinen, Lundberg, and Toivanen, 2008).

4. Data

The public procurement database (PP database in short) derives from public procurement announcements in 2009-2014 in the EU27 (excluding Malta[2]) and Norway (EU27 plus Norway henceforth)[3]. Announcements appear in the so-called Tenders Electronic Daily (TED), which is the online version of the 'Supplement to the Official Journal of the EU', dedicated to European public procurement. (DG GROWTH, 2015). The data represent a complete database of all public procurement procedures conducted under the EU Public Procurement Directive by EU member states, countries in the European Economic Area, or the European Commission regardless of the

[2] Malta is excluded as it has too few contracts awarded in this period to conduct regression analysis.

[3] Awarded contracts are assigned to countries based on the location of the contracting bodies, hence international organisations such as the European Commission's contracting activities are assigned to the countries where they reside.

funding source (e.g. national, EU funded). The regulation of government contracting in WTO member states including the EU suggest that similar datasets can be constructed globally. The database was released by the European Commission - DG GROWTH[4] which also has conducted some data quality checks and enhancements. TED contains variables appearing in 1) calls for tenders, and 2) contract award notices. All the countries' public procurement legislation is within the framework of the EU Public Procurement Directives, hence the national datasets are therefore directly comparable (European Commission, 2014). The source TED database contains over 2.8 million contracts of which 2.3 million are used in the analysis due to the following exclusions: 1) countries with too few observations such as Malta, 2) contracts below mandatory reporting thresholds[5], and 3) contracts on non-competitive markets. The database used in this analysis, including corruption risk indicators can be downloaded from http://digiwhist.eu/resources/data/.

5. The Measurement Model

Our approach builds on prior work with similar datasets making use of a range of public procurement 'red flags' (Charron, Dahlström, Fazekas, & Lapuente, 2015; Authors, 2014; Authors, 2016; Klasnja, 2015). The measurement model exploits the fact that for grand corruption to work, government contracts have to be awarded recurrently to companies belonging to the corrupt network. This can only be achieved if legally prescribed rules of competition and open access are circumvented. By implication, it is possible to identify the output and input sides of the corruption process: lack of bidders for government contracts (output) and means of fixing the procedural rules for limiting competition (inputs). By measuring the degree of unjustified restriction of competition in public procurement, proxy indicators of corruption can be obtained.[6]

Such proxy indicators signal corruption risks only if competition is to be expected in the absence of corruption on the markets in question. This implies that markets which are non-competitive under non-corrupt circumstances have to be excluded. In the absence of reliable information about which markets are non-competitive by nature, we simply denoted markets with too few contracts awarded (i.e. less than 10 contracts in 2009-2014) as markets likely not able to sustain multiple competing firms even under non-corrupt circumstances. Markets are defined by a matrix of product groups

[4] Source data can be downloaded from: https://open-data.europa.eu/en/data/dataset/ted-csv

[5] http://www.ojec.com/threshholds.aspx

[6] Corruption can also be achieved in the post award phase which necessitates contract modification (e.g. increasing contract value) which is a more costly form of corruption as there are stringent rules on contract renegotiations all across Europe. This is to say that some forms of corruption are naturally not captured by our indicators, still the intention is that the biggest part is captured.

(CPV[7] categories at level 3) and geographical location of contract performance (NUTS[8] regions at level 2). This condition excluded 8% of all awarded contracts.

The simplest indication of restricted competition in line with our theoretical definition is when only one bid is submitted[9] in a tender on an otherwise competitive market. This typically allows the awarding of contracts above market prices and extracting corrupt rents (output side). Hence, the incidence of single bidder contracts awarded (i.e. contracts awarded in procurement tenders where only one bid was received by the contracting authority) is the most straightforward measure we use.

The more complex indication of high-level corruption also incorporates characteristics of the tendering process that are in the hands of public officials who conduct the tender and contribute to competition restriction (input side). This composite indicator, which we call the Corruption Risk Index (CRI), is defined as follows:

$$CRI^i = \Sigma_j w_j * CI_j{}^i \quad (1)$$

$$\Sigma_j w_j = 1 \quad (2)$$

$$0 \leq CRI^i \leq 1 \quad (3)$$

$$0 \leq CI_j^i \leq 1 \quad (4)$$

where CRI^i stands for the corruption risk index of contract *i*, $CI_j{}^i$ represents the *j*th elementary corruption indicator observed in the tender of contract *i*, and w_j represents the weight of elementary corruption indicator *j*. Elementary corruption indicators or 'red flags' can be either corruption inputs or outputs. CRI = 0 indicates minimum corruption risk while CRI=1 denotes maximum corruption risk observed.

Based on qualitative interviews with participants of public procurement tenders and a review of the academic and policy literature, we identified a long list of potential 'red flags' or corruption inputs (Chong, Klien, & Saussier, 2015; OECD, 2007; Pricewaterhouse Coopers, 2013; Sequeira, 2012; Transparency International, 2006; World Bank, 2009). 'Red flags' had to be reliably differentiated

[7] CPV=Common Procurement Vocabulary. For more info see: http://simap.europa.eu/codes-and-nomenclatures/codes-cpv/codes-cpv_en.htm

[8] NUTS=Nomenclature of territorial units for statistics. For more info see: http://epp.eurostat.ec.europa.eu/portal/page/portal/nuts_nomenclature/introduction

[9] According to correspondence with DG GROWTH officials, TED may contain the number of valid bids, that is after inadequate bids are rejected, rather than the number of submitted bids in some cases as the official guidance documents are not clear enough. Using the number of submitted bids rather than valid bids leads to an underestimation of corruption risks as excluding all but one bid on administrative grounds such as a missing stamp from one of the certificates, represents a corruption technique on its own (Authors, 2016).

from ‘green flags’ using statistical techniques to avoid the usual trap of ‘red flag’ approaches which are driven by a small number of known examples disregarding the diversity of public procurement markets. We implemented binary logistic regression models in order to directly model the input-output relationships between corruption ‘red flags’ and statistically differentiate between reliable ‘red flags’ and ‘green flags’. The following model was estimated:

$$\Pr(\text{single bidder}_i=1) = \frac{1}{1+e^{-Z_i}} \quad (5)$$

$$Z_i = \beta_0 + \beta_{1j} R_{ij} + \beta_{4m} C_{im} + \varepsilon_i \quad (6)$$

where *single bidder*$_i$ equals 1 if the *i*th contract awarded had only one bidder and 0 if it has more; Z_i represents the logit of a contract being a single bidder contract; β_0 is the constant of the regression; R_{ij} is the matrix of *j* corruption ‘red flags’ for the *i*th contract such as length of advertisement period; C_{im} stands for the matrix of *m* control variables for the *i*th contract such as the number of competitors on the market; ε_i is the error term; and β_{1j}, and β_{4m} represent the vectors of coefficients for explanatory and control variables.

Each regression includes the full list of control variables except for one (model 6 in Table 2). Control variables account for the most important alternative explanations to our conceptualised corrupt outcome such as low administrative capacity and product market idiosyncrasies, in particular: (1) institutional endowments measured by type (e.g. municipal, national) and sector (e.g. education, healthcare) of contracting body, (2) differences in technology and market standards proxied by type of product procured using 40 different CPV divisions (e.g. financial services, construction works), (3) differences due to contract size and complexity indicated by contract value (logarithm, EUR), and (4) institutional framework as proxied by country and year of contract award. Once again, we run our regressions only on competitive markets. Descriptive statistics for these variables can be found in Annex C.

A logically equivalent, but practically slightly different approach was used for identifying ‘red flags’ in categorical and continuous variables using the above regression model in each of the 28 countries analysed. For categorical variables, those categories were denoted as ‘red flags’ which turned out to be significant and substantial predictors of single bidding compared to the available most transparent and competitive category (e.g. open procedure in the case of procedure types contracting bodies can use when procuring). ‘Red flags’ in continuous variables were identified in an iterative process: first, a model was fitted using the linear continuous predictor; second, two discrete jumps in residual values were identified using residual distribution graphs. These discrete jumps or thresholds represent the points beyond which the probability of single bidding drastically changes.

We looked for two thresholds for each continuous variable because both extremes of the distributions could represent high risk such as in the case of decision periods where snap decisions as well as unusually lengthy decisions could signal corruption albeit for slightly different reasons. While the exact threshold values may contain a certain degree of professional judgement, the fact that they enter into the regression models as significant and substantial predictors provides substantial evidence for their validity. In order to preserve the full population of observations, we always included a missing category in every corruption input. In some cases, missing values predicted single bidding suggesting that concealing relevant tender information from bidders or the wider public served as a corruption technique, hence deserved to be included as 'red flag'. Risky categories and thresholds also differ by country reflecting the diverse market norms for contracting entities and bidding firms (e.g. high risk short advertisement period in Greece was up to 44 days, while only up to 27 days in the UK). Such diversity of 'red flag' definitions is supposed to capture the underlying corruption technique within each context by abstracting from different environmental conditions and norms.[10] The full definition of country-specific 'red flags' can be found in Appendix D.

When determining variable significance in the model, we used significance values from Monte Carlo random permutation simulations (Good, 2006) as well as from standard significance tests. In the regression reported, both tests led to the same conclusions. This is because standard significance tests are appropriate for statistical inference from a random sample to a population. However, our public procurement database contains the full population of interest. While some observations have been removed purposefully from the public domain hence from the database (a corruption risk on its own which is certainly far from random) this cannot be taken into account by standard significance tests. Permutation tests are widely used in the natural as well as the social sciences, for example in social network analysis where data describes full populations and observations are not independent of each other (Borgatti, Everett, and Johnson, 2013). The Monte Carlo random permutation simulation randomly reassigns the outcome variable to observations multiple times and calculates the regression coefficients each time. By doing so, it obtains a distribution of each regression coefficient when the outcome is truly random. The probability of the actual test statistic falling outside this random distribution, therefore, represents the probability of observing the relationship when the outcome is truly random. A low p-value indicates that it is highly unlikely that the observed regression coefficient could be the result of a random process – a very intuitive interpretation.

[10] As predicting the incidence of single bidding defined 'red flags', higher as well as lower frequency of risky categories per country resulted avoiding the problem of selecting only the outliers in the distributions more or less representing the same proportion of contracts in each country.

After testing a wide set of red flags in multiple countries, we identified the following comparatively valid reliably computable components of CRI in addition to single bidding (overview in descriptive statistics and exact definitions in Annex B and D):

Table 1: Overview of corruption 'red flags'

Proc. phase	Indicator name	Indicator values
submission	Call for tenders publication (non-open procedures)	0=call for tender published in official journal 1=NO call for tender published in official journal
	Procedure type	0=open 1=non-open (accelerated, restricted, award without publication, negotiated, tender without competition)
	Length of advertisement period	Number of days between the publication of call for tenders and the submission deadline
assessment	Weight of non-price evaluation criteria	Sum of weights for evaluation criteria which are NOT related to prices
	Length of decision period	Number of days between submission deadline and announcing contract award
outcome	Single bidder contract (valid/received)	0=more than 1 bid received 1=1 bid received

1. A simple way to fix tenders is to avoid the publication of the call for tenders in the official public procurement journal (TED) as this would make it harder for non-connected competitors to prepare a bid. This is only relevant in non-open procedures where publication is up for decision as in open procedures publication is mandatory.
2. While open competition is relatively hard to avoid in some tendering procedure types such as open tender, others such as invitation tenders are by default much less competitive; hence using less open and transparent procedure types can indicate the deliberate limitation of competition, hence corruption risks.
3. If the advertisement period, i.e. the number of days between publishing a tender and the submission deadline, is too short for preparing an adequate bid, it can serve corrupt purposes whereby the contracting body informally tells the well-connected company about the opportunity ahead of time. In some cases, the advertisement period becomes lengthy due to legal challenge which may also signal corruption risks.
4. Different types of evaluation criteria are prone to fiddling to different degrees, subjective, hard-to-quantify criteria such as the quality of company organigram rather than quantitative, price-related criteria often accompany rigged assessment procedures as it creates room for discretion and limits accountability mechanisms. In some cases, according to quantitative and qualitative evidence, price-only criteria can also be abused for corrupt goals whereby

the well-connected firm bids with the lowest price knowing that quality will not be monitored thoroughly (Olken, 2007).

5. If the time used to decide on the submitted bids is excessively short or lengthy, it can also signal corruption risks. Snap decisions may reflect premediated assessment, while long decision period and the corresponding legal challenge suggests outright violation of laws.

Each of the two corruption risk indicators, single bidding and CRI, have its pros and cons. The strength of the single bidder indicator is that it is very simple and straightforward to interpret. However, it is also more prone to gaming by corrupt actors due to its simplicity such as including fake bidders to mimic competition. The strength of the composite indicator approach (CRI) is that it explicitly tries to abstract from diverse market realities to capture the underlying corruption techniques. It allows for 'red flag' definitions to change from context to context in order to best capture the deviation from the prevailing open and fair competitive norms. In addition, as corruption techniques used at any point in time are likely to be diverse, tracking multiple possible corruption strategies in one composite score is most likely to remain consistent even if the composition of the corruption techniques changes. Both of these characteristics underpin its usefulness for international and time-series comparative research. The main weakness of CRI is that it can only capture a subset of corruption strategies in public procurement, arguably the simplest ones, hence it misses out on sophisticated types of corruption such as corruption combined with inter-bidder collusion. As long as simplest strategies are the cheapest for corrupt groups, they are likely to represent the most widespread forms of corrupt behaviour.

6. Regression Results

Regression models were built based on the above measurement model by including each potential corruption input and control variable step-by-step, entering first those 'red flags' which characterise the earliest tender phase such as publication of call for tenders and entering finally those which come into play the last such as length of award decision. All those potential 'red flags' were dropped from the models which were insignificant and/or too small to matter. Here, only final regression results on the full European database are reported for the sake of brevity. The binary logistic regression model was implemented in seven different specifications to show the independent effect of each 'red flag' on single bidding probability (models 1-5) as well as to explore the impact of control variables on 'red flags' (models 6-7) (Table 2).

Our hypotheses are supported by estimation results, pointing at the alignment between the theoretical measurement model and observed data, hence underpinning the proposed set of 'red flags' (Table 2). On a database encompassing enormous diversity across 28 countries and more

than half a decade in over 1.3 million contracts, our arguably simple regression models perform relatively well by explaining 13-15% of variance in single bidding.

First, not publishing the call for tenders in the official journal (TED) increases the probability of single received bid in every regression in line with expectations by 11-18 percent, which is one of the strongest impacts across all models. Second, non-open procedure types carry a higher corruption risk than open procedures in terms of the probability of single received bid, supporting our theoretical expectations. Across the various models, non-open procedures are associated with 11-19 percent higher probability of single bidding. Third, non-price related evaluation criteria behaves as expected with regards to the evaluation criteria red flag, i.e. typically 100% or somewhat lower weight of non-objective criteria, associated with higher probability of a single bid received. The effect is considerably smaller than the two other red flags: risk evaluation criteria associated with 2-4 percent higher probability of single bidding across the different models compared to the reference category. Fourth, the extremely short or lengthy advertisement periods are associated with higher probability of a single bid received in line with expectations. The overall effect size is somewhat smaller than the previous variables, with the ‘red flag’ category associated with about 1% higher probability of single received bid across the different models compared to the normal or typical advertisement periods. Fifth, extremely short or long decision periods are associated with single bidding in line with theoretical expectations. Compared to typical decision period lengths, they are estimated to increase the probability of a single bid received by 3-6 percent across the different specifications. While some of these average estimated effects seem small, they only reflect the Europe-wide relationship, in some countries some ‘red flags’ and the associated corrupt techniques are considerably stronger than in others.

Table 2: Binary logistic regression results on contract level, 2009-2014, EU27 plus Norway, average marginal effects reported

Dependent variable	single bid=1						
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Independent variables							
no call for tender published	0.182***					0.114***	0.120***
	(0.000)					(0.000)	(0.000)
restricted procedure		0.188***				0.106***	0.141***
		(0.000)				(0.000)	(0.000)
non-price evaluation criteria			0.038***			0.020***	0.039***
			(0.000)			(0.000)	(0.000)
extreme submission period				0.008***		0.009***	0.014***
				(0.000)		(0.000)	(0.000)
extreme decision period					0.034***	0.047***	0.057***
					(0.000)	(0.000)	(0.000)
Control variables							
Sector of contracting entity	Y	Y	Y	Y	Y	N	Y
Type of contracting entity	Y	Y	Y	Y	Y	N	Y
Year of contract award	Y	Y	Y	Y	Y	N	Y
Product market	Y	Y	Y	Y	Y	N	Y
Contract value	Y	Y	Y	Y	Y	N	Y
Country	Y	Y	Y	Y	Y	Y	Y
N	1,306,025	1,306,025	1,306,025	1,306,025	1,306,025	1,896,505	1,306,025
R-squared	0.143	0.145	0.135	0.135	0.136	0.134	0.151

Source: PP
Note :p-values in parentheses ; *** p<0.01, ** p<0.05, * p<0.1

Based on these regression results and prior theory, we could identify 'red flags' of corruption: on the one hand single bidding, on the other hand further components of the CRI. There is no need for weighting for the single bidding indicator, but CRI requires component weights. CRI components are weighted in a way that reflects our limited understanding of how 'red flags' are combined or used as substitutes which regression coefficients are not designed to rigorously test[11]. By implication, each 'red flag' is weighted equally making CRI a simple arithmetic average of its components. Additivity reflects our increasing certainty in corruption taking place in the presence of additional 'red flags', rather than any need for combining corruption techniques to reach corrupt goals (i.e. even a single corruption technique is enough on its own to render a procedure fully corrupt). In addition, we normed each component weight so that the resulting composite indicator falls between 0 and 1 (i.e. weights were set at 1/6). Such a simple combination may seem to disregard the theoretical and statistical complexity of this work so far, but it carries the advantage of easy interpretability of

[11] Hence, we did not use the regression coefficients as weights for the components.

changes in CRI scores, i.e. changes can be thought of in terms of additional 'red flags' too. In addition, this simple CRI scale can also be loosely interpreted as a probability score where the minimum (maximum) of the score corresponds to the lowest (highest) corruption risks observed.

7. Validating the Corruption Proxies

The validity of both the single bidder indicator and the CRI stems from their direct fit with the definition of high-level corruption in public procurement and the theoretical model of corrupt rent extraction. Further analysis on their association with widely used survey-based macro-level corruption indicators as well as with micro-level objective indicators of corruption risks underpin their validity, i.e. suggest that they proxy corruption rather than any other phenomena such as low administrative capacity. Additional validity tests can be found in Annex A.

The single bidder indicator and the CRI (as a 2009-2013 average per country using number of contracts) correlate as expected with widely used perception-based corruption indicators such as the World Governance Indicators' Control of Corruption, Transparency International's Corruption Perception Index, and Global Competitiveness Index's Favoritism in decisions of government officials (indicator 1.07[12]) (Table 3). All three perception indices indicate lower corruption with values, hence the rather strong (-0.63 to -0.71) negative correlation with our corruption indices is interpreted as validating evidence (Kaufmann, Kraay, & Mastruzzi, 2009; Transparency International, 2012a; World Economic Forum, 2010). In addition, a 2013 Eurobarometer survey of bidding companies' experience of corruption across the EU provides the most directly comparable survey-based indicator of corruption in public procurement (TNS Opinion and Social, 2013). Here, higher values indicate higher reported experience of corruption in the responding companies' own tendering practices, hence the moderately strong positive linear correlation coefficients (0.56-0.62) also support the indicator.

[12] In your country, to what extent do government officials show favoritism to well-connected firms and individuals when deciding upon policies and contracts? [1 = always show favoritism; 7 = never show favoritism]

Table 3: Bivariate Pearson correlations of % single bidder and the CRI with survey-based corruption indicators, on the country level, 2009-2013

Indicator	Single bidder	CRI	N
WGI - Control of Corruption (2013)	-0.7120*	-0.6933*	28
TI- Corruption Perceptions Index (2013)	-0.6903*	-0.6662*	28
GCI - Favoritism in decisions of government officials (2013)	-0.7003*	-0.6342*	28
Eurobarometer company corruption perceptions (2013)	0.5645*	0.6163*	25

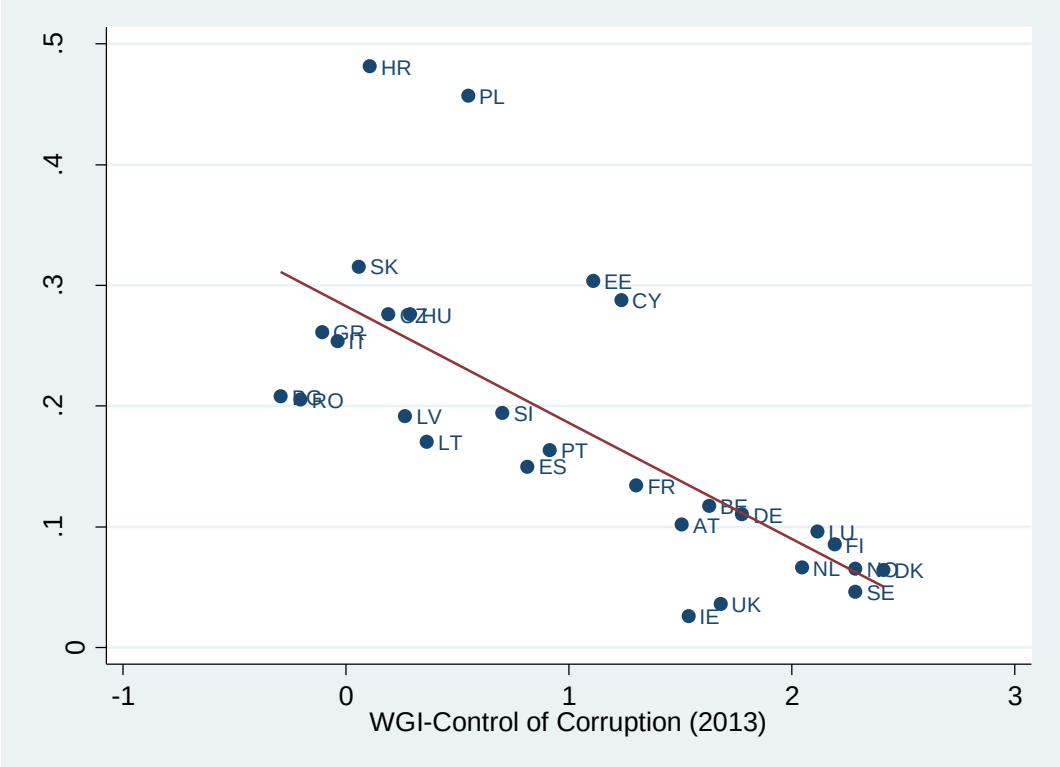
Source: PP, (Kaufmann et al., 2009; TNS Opinion and Social, 2013; Transparency International, 2012a; World Economic Forum, 2010)

*Note: * = significant at the 5% level*

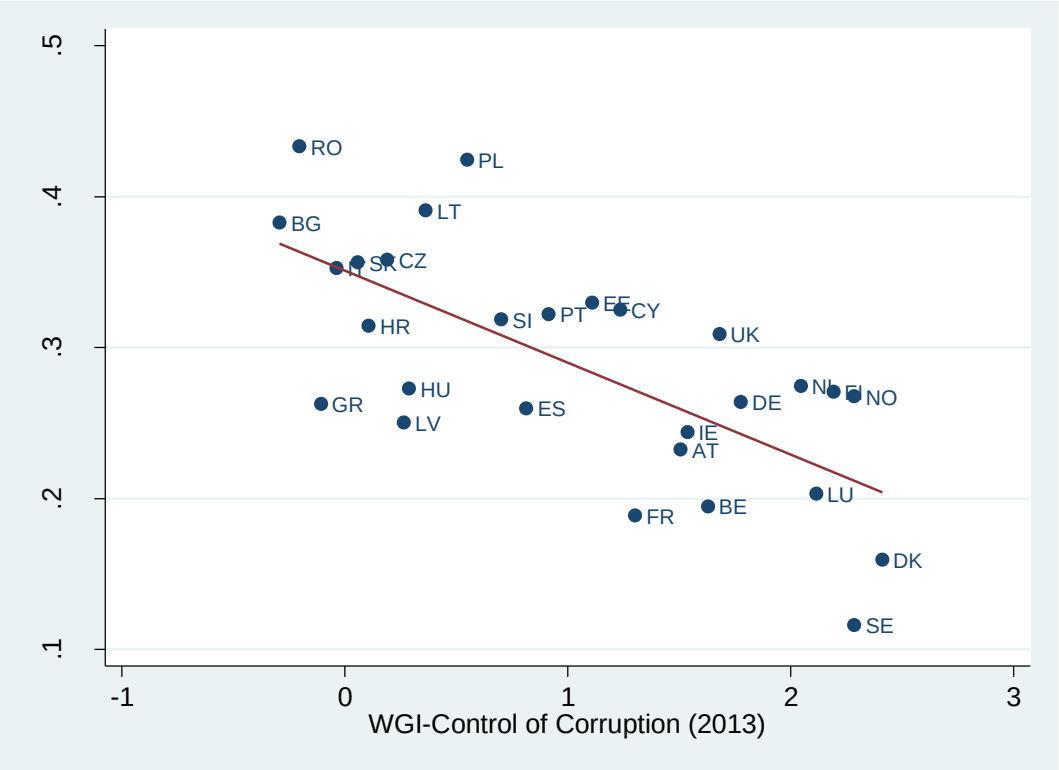
In order to visually demonstrate the above described correlations, we depict the average 2009-2013 single bidder ratio (Figure 2,Panel i) and CRI (Figure 2, Panel ii) scores of EU27 countries and Norway along with their 2013 WGI Control of Corruption scores.

Figure 1: Bivariate relationship between WGI-Control of Corruption (2013) and corruption proxies: single bidder ratio and average CRI (period averages for 2009-2013), EU-27+Norway

Panel I



Panel II



Source: PP

In order to validate our indicators also on the micro-level, we employ two objective risk indicators: procurement suppliers' country of origin and contract prices. It is expected that a contract represents a higher corruption risk if it is awarded to a company registered in a tax haven as its secrecy allows for hiding illicit money flows (Shaxson & Christensen, 2014). In line with our expectations, all across the EU27 plus Norway there is a marked and significant difference in the percentage of single bidder contracts won by foreign companies registered in tax havens versus those which are not: 0.28 versus 0.26; similarly for CRI: 0.34 versus 0.31 respectively ($N_{contract}$=28,642).

We also expect corruption to drive prices up. Although reliable unit prices are not available across many sectors, we can employ an alternative indicator of price, which is the ratio of actual contract value to initially estimated contract value (Coviello & Mariniello, 2014). As expected, both single bidder contracts and a higher CRI are associated with higher prices. Single bidder contracts have between 9-9.6% higher prices than multiple bidder contracts; similarly contracts with one additional red flag (i.e. 1/6 CRI points higher) are 2.5-2.7% more pricey even after controlling for major confounding factors (Table 4). To complement, the full population estimations with more reliable, but small sample price information, we manually collected unit price information from tender announcements for new Computed Tomography scanners (CT machines) and new highway and

road construction. Both tests suggest validity albeit the manually coded random samples are small and some effects are significant at the 10% level only.

Table 4: Linear regressions explaining relative contract value, EU27+NO, 2009-2014

Dependent variable	Relative contract value (contract price/estimated price)				eur/CT machine		eur/km	
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Independent variable	Single bidder	CRI	Single bidder	CRI	Single bidder	CRI	CRI	CRI
	0.0963***	0.1484***	0.0903***	0.1607***	557,505**	881,525*	7,854,589*	7,561,906*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)	(0.10)	(0.06)	(0.10)
Sector of contracting entity	N	Y	N	Y	N	N	N	N
Type of contracting entity	N	Y	N	Y	Y	Y	N	N
Year of contract award	N	Y	N	Y	Y	Y	Y	N
Product market	N	Y	N	Y	N	N	N	N
Contract value	N	Y	N	Y	N	N	N	N
Country	Y	Y	Y	Y	Y	Y	Y	N
CT machine quality	-	-	-	-	Y	Y	-	-
Terrain ruggedness	-	-	-	-	-	-	N	Y
Construction sector price level	-	-	-	-	-	-	N	Y
N	524442	501784	524441	501783	68	68	73	62
R-squared	0.1096	0.1546	0.0710	0.1248	0.32	0.284	0.188	0.165

Note: p-value in parentheses; *** p<0.01, ** p<0.05, * p<0.1*; each regression contains constant; relative contract values equal or smaller than 1 for Model 1-4*

Source: PP

8. Potential Applications

There are many potential applications of the proposed novel indicators of corruption risk internationally from cross-country regressions to micro-level analysis of particular contracts or public bodies (Charron et al., 2015; Fazekas et al., 2014; Klasnja, 2015). In order to briefly demonstrate the usefulness of the new indicators and their capacity to bring new light to long standing debates, a classic problem of corruption research is re-examined with our new indicators: effect of red tape or excessive regulation on corruption. This has been a central issue since the early times of the corruption debate (Hellman, Jones, & Kaufmann, 2003; Mauro, 1998; Rose-Ackerman, 1999), but

remains a salient issue (Treisman, 2007). The literature is still divided about whether red tape causes corruption or the other way around or if casuality is present in both directions. In order to investigate one side of this equation, without making any causal claims, we investigate whether cutting red tape, that is deregulation, decreases corruption risks (Rose-Ackerman, 1999).

In a country-year panel of European countries between 2009 and 2014, we investigate whether public procurement corruption risk, as measured by single bidder share[13], is influenced by regulatory burden as measured by the World Bank's Doing Business Survey. Our expectation is that lowering the regulatory burden decreases the opportunities for corruption hence it leads to lower corruption. We use the overall Doing Business score as well as some of its constitutive elements directly measured by objective criteria such as number of days.

Our random and fixed effects[14] panel regressions confirm the hypothesized relationship between bureaucratic burden and corruption risks (Table 5.). One point higher overall Doing Business score, that is less burdensome business regulation, is associated with approximately 0.5-0.7% lower single bidder share. So, for example, moving from the average Doing Business score in 2014 of Romania (68.5) to that of the UK (80.8) could be accompanied by a drop in single bidding by about 6.1% which could lead to substantial savings given that single bidder contracts are associated with roughly 10% higher prices. In a similar vein, one standard deviation or 260 fewer days required to enforce a contract is associated with 2.5% lower single bidder share. However, and potentially quite interestingly, not every component of the Doing Business score is associated with corruption risks as expected, for example the cost of starting a business is predicted to have a *positive* effect on corruption risks.

While identifying the causal impact of deregulation on corruption is beyond the scope of this article, the fact that lagged values of all the different measures of investigated are significant lend some support for a causal interpretation. However, both single bidding and regulatory burden are highly autocorrelated variables limiting the use of lagged values for countering endogeneity.

[13] Results using the more complex indicator, CRI are substantially the same. Single bidding is used for the sake of simplicity.

[14] Hausman test statistics and the choice of model specification are reported in the table.

Table 5: Random effects panel regressions explaining single bidder ratio, EU27+NO, 2009-2014

	(1)	(2)	(3)	(4)	(5)	(6)
Model type	RE	RE	RE	RE	FE	FE
			single bidder ratio			
Doing Business score	-0.00495*					
	(0.014)					
Lag Doing Business score		-0.00700***				
		(0.001)				
Nr. of days for enforcing contract			0.0000938*			
			(0.044)			
Lag nr. of days for enforcing contract				0.000105*		
				(0.026)		
Nr. of hours for filling in tax return					0.000379**	
					(0.003)	
Lag nr. of hours for filling in tax return						0.000353**
						(0.004)
log contract value procured (EUR)	0.00146	-0.00338	0.000432	-0.000666	-0.00875	-0.00883
	(0.820)	(0.582)	(0.945)	(0.916)	(0.263)	(0.261)
annual GDP growth rate, %	-0.00384	-0.000635	-0.000950	-0.000884	-0.00177	-0.00192
	(0.108)	(0.794)	(0.478)	(0.507)	(0.178)	(0.150)
broadband users	0.000447	0.000104	-0.000130	-0.000264	0.00574*	0.00567*
	(0.810)	(0.958)	(0.936)	(0.870)	(0.011)	(0.014)
Eastern Europe=1	0.136***	0.100**	0.156***	0.155***	0	0
	(0.000)	(0.001)	(0.000)	(0.000)	(.)	(.)
national election year	0.00520	-0.0102	0.00856	0.00710	0.0139	0.0104
	(0.594)	(0.268)	(0.366)	(0.453)	(0.125)	(0.256)
Constant	0.439*	0.723***	-0.314	-0.307	0.133	0.139
	(0.030)	(0.000)	(0.179)	(0.162)	(0.471)	(0.455)
Observations	139	111	167	166	167	166
Overall R^2	0.59	0.63	0.55	0.55	0.094	0.088
Hausman p-value	0.59	0.50	0.29	0.29	0.02	0.03

Notes: *p*-values in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

9. Conclusions

The analysis demonstrated that it is feasible and fruitful to proxy corruption at the micro-level based exclusively on objective behavioural data in an international comparative context. Macro and micro evidence supports the validity of both the simple (single bidding) and more complex indicators (CRI).

The great advantage of our approach is that a large amount of data is already available for research across high and middle income countries, and in many low income economies too, starting from about 2008. In addition, data is being generated on a daily basis by national procurement systems adding to databases automatically in a real-time fashion. As the proposed corruption risk indicators are calculated on the transaction level they also allow a move away from country-level analysis and look into regions, sectors, even public or private sector organisations, or individual persons' behaviour long advocated as necessary for advancing social sciences (King, Keohane, & Verba, 1994). Such large volumes of internationally comparative micro-level data open up a completely new horizon for comparative research on corruption and quality of institutions more broadly.

Research on institutions could also benefit from our corruption proxies which avoid the biases of subjective indicators as well as context bound nature of prior objective indices. Using a corruption proxy which is sensitive to policy interventions and changes in the underlying political economy equilibrium of a country allow for testing theories of institutional change with a much greater precision.

The proposed data and indicator set could underpin the testing of a large number of hypotheses, to name a few: data on tendering organizations can be combined with organizational level data to test various theories of corruption. For example, are higher salaries for bureaucrats more conducive to clean government? Since corruption proxies are calculated on the transaction level and are valid over time, researchers can evaluate how various reforms in different sectors affect corruption. Does industry voluntary transparency initiatives lead to lower corruption? Since proxies can be calculated on the municipal level, one can estimate the impact of political contestation on corruption. Since it can also be aggregated by funding source, researchers can explore whether external funds (e.g. EU funds) erode good government or nurture it.

Due to their sensitivity to change, the use of these corruption proxies can have a great use in policy research and policy advice for understanding what works in anticorruption. They can be used to evaluate single regulatory or organisational changes such as tightening reporting requirements or introducing organisational integrity management. They could also guide

regulators in where to spend their limited resources for conducting audits of contracts and companies. In addition to these and many other academic and policy applications, with a little work the proposed corruption proxies can be made available to citizens, civil society groups and journalists to hold politicians and political parties accountable for corrupt behavior.

10. References

Andersson, S., & Heywood, P. M. (2009). The Politics of Perception: Use and Abuse of Transparency International's Approach to Measuring Corruption. *Political Studies*, *57*, 746–767.

Arndt, C., & Oman, C. (2006). *Uses and Abuses of Governance Indicators*. Paris: OECD.

Auriol, E., Flochel, T., & Straub, S. (2011). *Public Procurement and Rent-Seeking: The Case of Paraguay* (No. 11-224). TSE Working Papers: 11-224, Toulouse: Toulouse School of Economics (TSE).

Borgatti, S. P., Everett, M. G., & Johnson, J. C. (2013). *Analyzing Social Networks*. London: SAGE Publications.

Charron, N., Dahlström, C., Fazekas, M., & Lapuente, V. (2015). *Carriers, connections, and corruption risks in Europe* (No. 2015:6). Gothenburg.

Charron, N., Dijkstra, L., & Lapuente, V. (2010). *Mapping Quality of Government in the European Union: A Study of National and Sub-National Variation* (No. 2010:22). Gothenburg.

Chong, E., Klien, M., & Saussier, S. (2015). *The Quality of Governance and the Use of Negotiated Procurement Procedures: Evidence from the European Union* (No. 2015-3). Paris.

Coviello, D., & Mariniello, M. (2014). Publicity requirements in public procurement: Evidence from a regression discontinuity design. *Journal of Public Economics*, *109*, 76–100.

DG GROWTH. (2015). *TED Structured Dataset (2009-2014), Tenders Electronic Daily, supplement to the Official Journal of the European Union*. Brussels.

Escresa, L., & Picci, L. (2015). *A New Cross-National Measure of Corruption*. Washington DC.

European Commission. (2011). *Establishing an EU Anti-corruption reporting mechanism for periodic assessment ("EU Anti-corruption Report")*. Brussels.

European Commission. (2014). *Public Procurement Indicators 2012*. Brussels.

Fazekas, M., Chvalkovská, J., Skuhrovec, J., Tóth, I. J., & King, L. P. (2014). Are EU funds a corruption risk? The impact of EU funds on grand corruption in Central and Eastern Europe. In A. Mungiu-Pippidi (Ed.), *The Anticorruption Frontline. The ANTICORRP Project, vol. 2.* (pp. 68–89). Berlin: Barbara Budrich Publishers.

Fazekas, M., Tóth, I. J., & King, L. P. (2016). Anatomy of grand corruption: A composite corruption risk index based on objective data. *European Journal of Criminal Policy and Research*, *forthcomin*.

Golden, M. A., & Picci, L. (2005). Proposal for a New Measure of Corruption, illustrated with Italian data. *Economics & Politics*, *17*(1), 37–75. doi:10.1111/j.1468-0343.2005.00146.x

Good, P. I. (2006). *Resampling Methods A Practical Guide to Data Analysis* (3rd editio.). Berlin: Birkhauser.

Hellman, J. S., Jones, G., & Kaufmann, D. (2003). Seize the state, seize the day: state capture and influence in transition economies. *Journal of Comparative Economics*, *31*(4), 751–773.

Hyytinen, A., Lundberg, S., & Toivanen, O. (2008). *Politics and Procurement: Evidence from Cleaning Contracts* (No. 233). HECER Discussion paper No. 233.

Kaufmann, D., Kraay, A., & Mastruzzi, M. (2009). Governance Matters VIII. Washington, DC: World Bank.

Kaufmann, D., Mastruzzi, M., & Kraay, A. (2010). *The Worldwide Governance Indicators. Methodology and Analytical Issues* (No. 5430). Washington, DC.

King, G., Keohane, R., & Verba, S. (1994). *Designing Social Inquiry*. Princeton, NJ: Princeton University Press.

Klasnja, M. (2015). Corruption and the Incumbency Disadvantage: Theory and Evidence. *Journal of Politics*, *forthcomin*.

Knack, S., Kugler, M., & Manning, N. (2003). Second-Generation Governance Indicators. *International Review of Administrative Sciences*, *69*, 345–364.

Kurtz, M. J., & Schrank, A. (2007a). Growth and Governance: A Defense. *Journal of Politics*, *69*(2), 563–569.

Kurtz, M. J., & Schrank, A. (2007b). Growth and Governance: Models, Measures, and Mechanisms. *The Journal of Politics*, *69*(2), 538–554.

Lambsdorff, J. G. (2006). Measuring Corruption – The Validity and Precision of Subjective Indicators (CPI). In C. Sampford, A. Shacklock, C. Connors, & F. Galtun (Eds.), *Measuring Corruption* (pp. 81–100). Aldershot, UK: Ashgate.

Mauro, P. (1998). Corruption: Causes, Consequences, and Agenda for Further Research. *Finance & Development*, *March*.

Mungiu-Pippidi, A. (2006). Corruption: Diagnosis and Treatment. *Journal of Democracy*, *17*(3), 86–99.

Mungiu-Pippidi, A. (Ed.). (2011). *Contextual Choices in Fighting Corruption: Lessons Learned*. Oslo: Norwegian Agency for Development Cooperation.

North, D. C., Wallis, J. J., & Weingast, B. R. (2009). *Violence and Social Orders. A Conceptual Framework for Interpreting Recorded Human History*. Cambridge, UK: Cambridge University Press.

OECD. (2007). *Integrity in Public Procurement. Good Practice from A to Z*. Paris: OECD.

OECD. (2009). *Towards a Sound Integrity Framework: Instruments, Processes, Structures and Conditions for Implementation*. Paris: OECD.

OECD. (2013). *Government at a Glance 2013*. Paris: OECD.

Olken, B. A. (2007). Monitoring Corruption: Evidence from a Field Experiment in Indonesia. *Journal of Political Economy*, *115*(2), 200–249. doi:10.1086/517935

Pricewaterhouse Coopers. (2013). *Identifying and reducing corruption in public procurement in the EU*. Brussels: PricewaterhouseCoopers and Ecorys.

Radelet, S. (2002). *Qualifying for the Millennium Challenge Account*.

Radelet, S. (2003). Bush and Foreign Aid. *Foreign Affairs*, *82*(5), 104–117.

Rose, R., & Peiffer, C. (2012). *Paying Bribes to Get Public Services: A Global Guide to Concepts and Survey Measures* (No. SPP 494). Glasgow, UK: Centre for the Study of Public Policy.

Rose-Ackerman, S. (1999). *Corruption and Government: Causes, Consequences, and Reform*. Cambridge, UK: Cambridge University Press.

Rothstein, B., & Teorell, J. (2008). What Is Quality of Government? A Theory of Impartial Government Institutions. *Governance*, *21*(2), 165–190.

Sequeira, S. (2012). Advances in Measuring Corruption in the Field. In D. Serra & L. Wantchekon (Eds.), *New Advances in Experimental Research on Corruption* (pp. 145–176). Bingley, UK: Emerald Group Publishing Limited.

Shaxson, N., & Christensen, J. (2014). *The Finance Curse. How Oversized Financial Centres Attack Democracy and Corrupt Economies*. Chesham, UK: Tax Justice Network.

TNS Opinion and Social. (2013). *Public Opinion in the European Union-Standard Eurobarometer79*. Brussels: European Commission.

Transparency International. (2006). *Handbook for Curbing Corruption in Public Procurement*. Berlin: Transparency International.

Transparency International. (2012a). *Corruption Perceptions Index 2012*. Berlin: Transparency International.

Transparency International. (2012b). *NIS Assessment Toolkit*. Berlin: Transparency International.

Treisman, D. (2007). What Have We Learned about the Causes of Corruption from Ten Years of Cross-National Empirical Research. *Annual Review of Political Science*, *10*, 211–244.

World Bank. (2009). *Fraud and Corruption. Awareness Handbook*. Washington DC: World Bank.

World Economic Forum. (2010). *The Global Competitiveness Report 2012-2013*. Geneva, Switzerland: World Economic Forum.

11. Appendix

Appendix A: Additional Validity Tests

Table A1: Correlations between corruption risk indicators and corruption perceptions, by year, EU27 pus Norway

2009	CRI	Single bidder	N
WGI - Control of Corruption	-0.6721	-0.6592	27
TI - Corruption Perceptions Index	-0.6382	-0.6500	27
GCI - Favoritism in decisions of government officials	-0.6736	-0.6767	27
2010	CRI	Single bidder	
WGI - Control of Corruption	-0.7229	-0.6597	27
TI - Corruption Perceptions Index	-0.6772	-0.6342	27
GCI - Favoritism in decisions of government officials	-0.6480	-0.6090	27
2011	CRI	Single bidder	
WGI - Control of Corruption	-0.6216	-0.6991	27
TI - Corruption Perceptions Index	-0.5989	-0.6982	27
GCI - Favoritism in decisions of government officials	-0.6307	-0.6915	27
2012	CRI	Single bidder	
WGI - Control of Corruption	-0.6469	-0.6823	27
TI - Corruption Perceptions Index	-0.6123	-0.6725	27
GCI - Favoritism in decisions of government officials	-0.5862	-0.7165	27
2013	CRI	Single bidder	
WGI - Control of Corruption	-0.5853	-0.6600	28
TI - Corruption Perceptions Index	-0.5805	-0.6528	28
GCI - Favoritism in decisions of government officials	-0.5623	-0.6441	28
Eurobarometer company corruption perceptions	0.6241	0.4642	25

Table A2: Correlation between individual components of CRI and corruption perceptions, 2009-2013, EU27 pus Norway

Variable	Single bidder	No CFT	Procedure type	Weight of non-price crit.	Adv. period	Dec. period
WGI - Control of Corruption (2013)	-0.7120	-0.1350	-0.0954	-0.3634	-0.1715	-0.1206
TI - Corruption Perceptions Index (2013)	-0.6903	-0.1323	-0.0832	-0.3525	-0.1731	-0.1118
GCI - Favouritism in decisions of government officials (2013)	-0.7003	-0.1223	-0.0444	-0.3962	-0.0209	-0.1359
N	28	28	25	27	25	28
Eurobarometer company corruption perceptions (2013)	0.5645	-0.0658	-0.1308	0.4002	0.1406	0.1819
N	25	25	23	24	22	25

Annex B: Descriptive Statistics of Corruption 'Red Flags'

Table B1. Descriptive statistics of corruption inputs, 2009-2014, EU27 plus Norway

	mean	min	max	sd	N
Single bidder contract	0.232	0.00	1.00	0.42	1892421
Call for tender not published in official journal	0.387	0.00	2.00	0.64	2381467
Length of submission period in days	44.358	1.00	784	20.48	1661258
Relative price of tender documentation	0.849	0.3	1	0.17	542613
Weight of non-price evaluation criteria	47	0.00	100	31.39	992329
Length of decision period in days	87.06	1	31851	101.89	1544507

Source: PP

Table B2. Distribution of procedure type, 2009-2014, EU27 plus Norway

Type of procedure type followed	N	%
Accelerated negotiated procedure	4,253	0.18
Accelerated restricted procedure	12,780	0.54
Award without publication	60,198	2.53
Competitive dialogue	3,664	0.15
Negotiated with competition	107,701	4.52
Negotiated without competition	51,942	2.18
Open	1,997,843	83.89
Restricted	127,336	5.35
Missing/error	15,750	0.66
Total	2,381,467	100

Source: PP

Annex C: Descriptive Statistics of Control Variables

Table C1. Descriptive statistics of log contract value, 2009-2014, EU27 plus Norway

Variable name	mean	min	max	sd	N
log real contract value	10.866	5.14	23.03	2.43	1,678,656

Source: PP

Table C2. Distribution of issuer type, 2009-2014, EU27 plus Norway

Type of issuer	N	%
Central government	190,387	7.99
Local authorities	558,596	23.46
Water, energy, transport, and telecom	145,029	8.09
EU institutions	8,416	0.35
Body governed by public law	695,618	29.21
National or federal Agency/Office	43,708	1.84
Regional or local Agency/Office	52,859	2.22
Other	550,01	23.10
Missing	136,844	5.57
Total	2,381,467	100

Source: PP

Table C3. Distribution of issuer main sector, 2009-2014, EU27 plus Norway

Main sector of issuer	N	%
Defence	46,082	1.94
Economical	30,860	1.30
Education	120,841	5.07
Electricity	37,303	1.57
Environment	39,830	1.67
General public services	420,814	17.67
Health	779,992	32.75
Housing	68,893	2.89
Missing	197,444	8.29
Other	256,511	10.77
Port/airport-related	7,500	0.31
Postal	15,286	0.64
Production	7,563	0.32
Public order	28,274	1.19
Railway	35,841	1.50
Recreation	12,494	0.52
Social	19,189	0.81
Water	9,968	0.42
Missing	246,782	10.36
Total	2,381,467	100

Source: PP

Table C4. Distribution of contract award year, 2009-2014, EU27 plus Norway

Year of contract award	N	%
2009	339,386	14.25
2010	376,224	15.80
2011	401,016	16.84
2012	417,897	17.55
2013	418,965	17.59
2014	427,979	17.97
Total	2,381,467	100.00

Source: PP

Table C5. Distribution of main market of contract, 2009-2014, EU27 plus Norway

Main market of contract	N	%
Agricultural, farming, fishing, forestry and related products	8,952	0.38
Petroleum products, fuel, electricity and other sources of energy	44,654	1.88
Mining, basic metals and related products	4,857	0.20
Food, beverages, tobacco and related products	98,641	4.15
Agricultural machinery	2,730	0.11
Clothing, footwear, luggage articles and accessories	15,869	0.67
Leather and textile fabrics, plastic and rubber materials	4,010	0.17
Printed matter and related products	16,424	0.69
Chemical products	17,875	0.75
Office and computing machinery, equipment and supplies except furniture and software packages	46,499	1.96
Electrical machinery, apparatus, equipment and consumables; Lighting	18,878	0.79
Radio, television, communication, telecommunication and related equipment	12,356	0.52
Medical equipment, pharmaceuticals and personal care products	771,803	32.45
Transport equipment and auxiliary products to transportation	74,890	3.15
Security, fire-fighting, police and defence equipment	8,708	0.37
Musical instruments, sport goods, games, toys, handicraft, art materials and accessories	4,085	0.17
Laboratory, optical and precision equipments (excl. glasses)	33,632	1.41
Furniture (incl. office furniture), furnishings, domestic appliances (excl. lighting) and cleaning products	47,527	2.00
Collected and purified water	434	0.02
Industrial machinery	15,370	0.65
Machinery for mining, quarrying, construction equipment	6,128	0.26
Construction structures and materials; auxiliary products to construction (excepts electric apparatus)	34,711	1.46
Construction work	270,515	11.37
Software package and information systems	11,723	0.49
Repair and maintenance services	69,893	2.94
Installation services (except software)	1,299	0.05
Hotel, restaurant and retail trade services	14,732	0.62
Transport services (excl. Waste transport)	95,938	4.03
Supporting and auxiliary transport services; travel agencies services	4,676	0.20
Postal and telecommunications services	18,736	0.79
Public utilities	5,165	0.22
Financial and insurance services	59,150	2.49
Real estate services	3,372	0.14
Architectural, construction, engineering and inspection services	95,656	4.02
IT services: consulting, software development, Internet and support	41,439	1.74
Research and development services and related consultancy services	7,968	0.34
Administration, defence and social security services	5,271	0.22
Services related to the oil and gas industry	888	0.04
Agricultural, forestry, horticultural, aquacultural and apicultural services	62,789	2.64

Business services: law, marketing, consulting, recruitment, printing and security	81,213	3.41
Education and training services	57,102	2.40
Health and social work services	56,833	2.39
Sewage-, refuse-, cleaning-, and environmental services	107,701	4.53
Recreational, cultural and sporting services	7,243	0.30
Other community, social and personal services	10,114	0.43
Total	2,378,449	100

Source: PP

Table C6. Distribution of contracts by country, 2009-2014, EU27 plus Norway

Country code	N	Percent
AT	15,082	0.63
BE	31,429	1.32
BG	33,423	1.40
CY	4,872	0.20
CZ	28,036	1.18
DE	157,993	6.63
DK	25,676	1.08
EE	7,308	0.31
ES	111,705	4.69
FI	34,034	1.43
FR	725,636	30.47
GR	16,709	0.70
HR	4,058	0.17
HU	28,177	1.18
IE	14,183	0.60
IT	102,286	4.30
LT	32,905	1.38
LU	3,543	0.15
LV	56,148	2.36
NL	28,772	1.21
NO	16,786	0.70
PL	547,373	22.98
PT	10,386	0.44
RO	86,917	3.65
SE	43,152	1.81
SI	33,721	1.42
SK	12,965	0.54
UK	168,192	7.06
Total	2,381,467	100.00

Source: PP

Annex D: Red Flag Defintions

Table D1. Lack of call for tenders publication in TED red flags by country, 2009-2014, EU27 plus Norway

Country code	NO Call for Tenders publication is red flag
AT	Yes
BE	Yes
BG	No
CY	Yes
CZ	Yes
DE	Yes
DK	No
EE	No
ES	No
FI	Yes
FR	Yes
GR	Yes
HR	Yes
HU	Yes
IE	Yes
IT	Yes
LT	No
LU	Yes
LV	Yes
NL	Yes
NO	Yes
PL	Yes
PT	Yes
RO	Yes
SE	Yes
SI	Yes
SK	Yes
UK	Yes

Table D2. Non-open procedure type red flags by country, 2009-2014, EU27 plus Norway

Country Code	Accelerated negotiated	Accelerated restricted	Award without publication	Competitive dialogue	Negotiated with competition	Negotiated without competition	Open	Restricted	Missing/error
AT	Yes	No	Yes	Yes	No	Yes	No	No	No
BE	Yes	No	Yes	No	Yes	Yes	No	No	No
BG	No	No	Yes	No	Yes	Yes	No	Yes	No
CY	No	No	No	No	No	No	No	No	No
CZ	Yes	No	Yes	Yes	No	Yes	No	No	No
DE	Yes	Yes	Yes	No	Yes	Yes	No	No	No
DK	No	No	Yes	Yes	Yes	Yes	No	No	No
EE	Yes	No	Yes	Yes	No	Yes	No	No	Yes
ES	Yes	No	Yes	No	Yes	Yes	No	No	No
FI	No	Yes	Yes	No	Yes	Yes	No	No	No
FR	Yes	Yes	No	No	Yes	Yes	No	No	No
GR	No	No	No	No	No	No	No	No	No
HR	No	No	No	No	No	No	No	Yes	No
HU	Yes	Yes	No	No	Yes	Yes	No	No	No
IE	No	No	No	Yes	Yes	No	No	No	No
IT	Yes	No	Yes	No	No	Yes	No	Yes	No
LT	No	No	No	No	Yes	Yes	No	No	No
LU	No	No	No	No	No	No	No	No	No
LV	No	No	Yes	No	Yes	Yes	No	No	No
NL	Yes	No	Yes	No	No	Yes	No	No	No
NO	Yes	No	Yes	No	Yes	Yes	No	No	No
PL	Yes	No	Yes	No	Yes	Yes	No	Yes	No
PT	No	No	Yes	No	No	Yes	No	No	Yes
RO	Yes	Yes	No	Yes	No	Yes	No	No	No
SE	No	No	No	No	No	Yes	No	No	No
SI	Yes	No	Yes	Yes	No	Yes	No	No	No
SK	Yes	Yes	No	No	Yes	Yes	No	No	No
UK	No	Yes	Yes	No	Yes	Yes	No	No	No

Table D3. Advertisement period thresholds red flags by country, number of calendar days, 2009-2014, EU27 plus Norway

Country code	red flag	not red flag	is "missing" red flag
AT	0-20;34-47	21-33;48-	
BE	18-34;78-		Yes
BG	0-28;35-	29-34	
CY	0-46;53-60	47-52;61-	
CZ	0-50	51-	
DE			
DK	52-61	0-51;62-	
EE	0-32;50-57	33-49;58-	
ES	39-42;52-	0-38;43-51	
FI	0-39;52-	40-51	
FR	0-40	41-	
GR	0-54	55-	
HR	0-40;49-	41-48	
HU			
IE	41-	0-40	
IT	0-47	48-	
LT	40-42;48-	0-39;43-47	
LU	51-54;86-	0-50;55-85	
LV	0-40;51-57	41-50;58-	
NL	0-38;48-56	39-47;57-	
NO	36-42;50-56	0-35;43-49;57-	
PL	0-25;43-	26-42	
PT	0-42	43-	
RO	41-50	0-40;51-	
SE			
SI	51-	0-50	
SK	49-52	0-48;53-	
UK	0-53	54-	

Table D4. Decision period thresholds red flags by country, number of calendar days, 2009-2014, EU27 plus Norway

Country code	red flag	not red flag	is "missing" red flag
AT	0-56	57-	Yes
BE	0-22	23-	
BG	0-27;120-	28-119	
CY	0-90	91-	
CZ	0-147	148-	
DE	0-36	37-	Yes
DK	0-39;124-168	40-123	
EE	0-41	42-	Yes
ES	0-43	44-	
FI	0-65;92-127	66-91;128-	
FR	0-66;156-	67-155	
GR	0-170	171-	
HR	0-26	27-	
HU	0-46;73-104	47-72;104-	
IE	0-50;87-	51-86	
IT	0-200	201-	
LT	0-32	33-	
LU	0-52	53-	
LV	0-20;106-	21-105	
NL	0-34;58-	35-57	
NO	0-70;98-229	71-97;230-	
PL	0-63	64-	Yes
PT	0-63;243-	64-242	
RO	0-56	57-	Yes
SE	0-44;89-	45-88	
SI	0-51;77-	52-76	
SK	0-68	69-	
UK	0-35;165-304	36-164;305-	

Table D5. Non-price weight red flags by country, number of calendar days, 2009-2014, EU27 plus Norway

Country code	red flag	not red flag
AT	0-39;61-100	40-60
BE	0-30;71-100	31-70
BG	"Lowest price"	
CY		
CZ	"Most economically advantageous tender"	
DE	0-47;66-100	48-65
DK	66-100	0-65
EE	11-40;71-100	0-10;41-70
ES	"Lowest price"	
FI	0-20;56-100	21-55
FR	0-35	36-100
GR	"Most economically advantageous tender"	
HR	"lowest price"	
HU	60-92	0-59;93-100
IE	21-40	0-20;41-100
IT	0-65	66-100
LT	0-40;61-100	41-60
LU	"Lowest price"	
LV	61-100	0-60
NL	0-55	56-100
NO	0-20	21-100
PL	0-40	41-100
PT	"Lowest price"	
RO	0-49	50-100
SE	20-30	0-19;31-100
SI	0-15;26-60	16-25;61-100
SK	"Lowest price"	
UK	0-45;71-100	46-70