Lights on the Shadows of Public Procurement

Transparency as an antidote to corruption

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Abstract

The increased focus on marketizing mechanisms and contracting-out operations following the New Public Management reform agenda has sparked a debate on whether the close interactions between public and private actors might drive corruption in the public sector. The main response to those worries has been increased transparency, but so far empirical evidence of its efficiency remains scant and mixed. This paper argues that the beneficial effects of transparency on corruption are contingent on type of transparency, and in particular, who the intended receiver of the information is. Drawing on newly collected data of more than 3.5 million government contracts between 2006 and 2015, the analysis shows that overall tender transparency reduces corruption risks substantially, yet that the effect is largely driven by ex-ante transparency, i.e. transparency that allows for horizontal monitoring by insiders in the bidding process.

Introduction

A corner stone of the New Public Management (NPM) reform agenda is the shift to greater competition in public sector implying a move to term contracts as well as public tendering procedures (Hood, 1991, p. 5). While the main argument for increased outsourcing of public tasks and responsibilities to private actors are cost-cutting and efficient use of public money through competition (e.g. Forsell & Norén, 2007; Alonso, Clifton, & Díaz-Fuentes, 2015), even strong defenders of more private providers of public services have acknowledged that contracting offers incentives for private and public actors to engage in fraud (e.g. Osborne & Gaebler, 1992, p. 88). In fact, the OECD (2005) has identified public procurement, i.e. the purchase of goods and services by governments, as a sector that is particularly vulnerable to corruption, and research in developing (Auriol, Straub, & Flochel, 2015; Davis, 2004; Deininger & Mpuga, 2005; Di Tella & Schargrodsky, 2003) as well as in developed countries (Goldman, Rocholl, & So, 2013; Hyytinen, Lundberg, & Toivanen, 2007; Mironov & Zhuravskaya, 2011) shows that corruption is a serious problem in public procurement, that can lead to everything from wasting taxpayers' money to wasting people's lives.

The answer to worries that frequent interconnections between public and private actors will increase corruption is often *transparency,* that by its promise to increase the possibilities for efficient accountability has become both a central element of the NPM agenda (e.g. Pollitt, 1995; Hood, 1996; Lapsley, 2008) and a widely endorsed principle in the anti-corruption movement (e.g. Transparency International, 2016). The logic behind the purifying force of transparency is generally derived from principal agent theory where access to information would tone down "illicit bargains and political self-dealing" by exposing these activities to the public (Klitgaard, 1988; Malesky, Schuler, & Tran, 2012; Prat, 2005). However, systematic evidence of transparency's ability to promote good governance in general (Fukuyama, 2015) or reduced corruption in public procurement specifically (Knack, Biletska, & Kacker, 2017) remains scant.

One of the most compelling explanations for why the beneficial effects of transparency sometimes fail to materialize is insufficient attention to the intended principals or stakeholders of the information made available (Bauhr & Grimes, 2017). Often, comparative studies use broad and sometimes imprecise conceptualizations of transparency that fail to link the concept to the actual information needed by the intended principals. Following up on the recent call by Cucciniello, Porumbescu, & Grimmelikhuijsen (2017 p. 10) for research to match particular forms of transparency to specific outcomes, we suggest that the beneficial effects of transparency is highly contingent on whether or not it allows for horizontal accountability, i.e. the monitoring between different elites. Whereas the standard vertical principal-agent perspective on the role of transparency in public arrangements tends to focus on information provision to outsiders—ultimately the public—we direct attention to the role of insiders when it comes to preventing and detecting potentially corrupt activities. Arguing that insiders, in this case the bidding or potentially bidding firms, are those with the highest motivation and the technical expertise sufficient to monitor the process ("police patrol") and, if necessary act as whistleblowers ("fire alarms") when detecting irregularities (McCubbins & Schwarz, 1984), we suggest that ex ante transparency (making information available before the contract is awarded) has a stronger negative effect on corruption risks than ex post transparency (making information available after the contract has been awarded).

Using novel data for nearly all major contracts awarded in 28 European Union (EU) member states between 2006 and 2015, totaling more than 3.5 million public procurement contracts awarded by more than 120,000 public bodies (Fazekas & Kocsis, 2017), we construct objective measures of transparency and corruption risks. Our public organization-level fixed effects panel regression and multilevel-modelling results show that transparency has the capacity to reduce corruption risks in public procurement, and that ex ante transparency is the main driver of this effect.

The study makes several contributions to the field. By acknowledging the crucial role of the audience of the information made available through transparency reforms (see i.e. Fox 2015), it develops a new conceptualization of transparency in public procurement that highlights the type of information that is motivational and actionable for different receivers at certain times

in the process. Furthermore, it uses a novel and publicly available dataset of procurement tenders to develop objective indicators of transparency and corruption risks, thus avoiding the "echo-chamber" criticism often directed at expert surveys, and in particular that experts risk inferring assessments of government transparency from general government performance. It also provides important practical insights into the type of transparency that has the best potential to reduce corruption risks in public procurement: information released before the contract is awarded that allows the insiders of the procurement process to monitor each other. Our results suggest that the financial benefits of investing in greater transparency are, in addition, non-negligible: increasing transparency by five items, on average, (out of ten items considered) could decrease single bidding by 2.5 to 6 percentage points translating into 0.18 to 0.43 percent cheaper contracts, equaling about EUR 4.5–10.9 billion savings per year across the EU.

Transparency as a Key to Reducing Corruption

Echoing Louis Brandeis's (1913) famous statement, "Sunlight is said to be the best of disinfectants; electric light the most efficient policeman," scholars and policymakers frequently advocate the doctrine of transparency as a promoter of good governance in general, and as an efficient tool against public sector corruption more specifically (e.g., Bauhr & Grimes 2014; Islam, 2006; Kosack & Fung, 2014). Generally associated with insight, purity, and sunshine, transparency has been a frequently advocated anticorruption measure. Not least is the argument of transparency as a purifying force against dubious practices reinforced in the public debate by organizations such as the Transparency International that the very name equates transparency with a lack of corruption (Transparency International, 2016).

Although an agreed-upon definition of transparency is still lacking, commonly cited definitions such as those by Florini (2007), Grimmelikhuijsen (2012), and Meijer (2013) emphasize the importance of the availability of information about an organization or process that allows for monitoring by those outside. In this vein, the standard logic of transparency as a cure for corruption, that is, abuse of entrusted power for private gain, is derived from the logic of principal agent theory (e.g., Kolstad & Wiig, 2009; Prat, 2006): transparency reduces information asymmetries between principals (i.e., the public) and agents (i.e., the government) and allows the former to monitor the latter. Theoretically, this makes corruption less likely

because agents become more likely to act according to rules and regulations as the risk of getting caught increases. Furthermore, transparency makes it easier for principals to detect the abuses that still take place, and if necessary, demand accountability. In the long run, more honest and efficient incumbents may assume public office.

There is considerable empirical support for the beneficial effects of increased transparency on public demand for accountability and government performance (e.g., Alt, Lassen, & Skilling, 2002; Besley & Burgess, 2002; Brunetti & Weder, 2003; Reinikka & Svensson, 2005; Winters & Weiz-Shapiro, 2013), lending support for the contention that access to information may reduce government corruption. However, scholars have recently suggested that the beneficial effect of government transparency may be contingent on the nature of the demand for accountability, and that the field builds on a number of "heroic assumptions" (Fukuyama, 2015, 16) about the nature of stakeholders' willingness and ability to act upon the information received (Fenster 2005; Kolstad & Wiig, 2009; Bauhr and Nasiritousi 2012; see also Fox 2007). For instance, Bauhr & Grimes (2014) showed that government transparency may lead to demobilization and resignation in highly corrupt countries (see also Chong, De La O, Karlan, & Wantchekon, 2015), Bac (2001) found that transparency may increase corruption by making it easier to identify who to bribe, and Malesky, Schuler, & Tran (2012) found that the beneficial effect of transparency may not be universally applicable across contexts.

This points to the importance of developing conceptualizations and measurements that capture relevant and actionable information. Many studies, and in particular those using cross-country comparative data, rely on broad measures of transparency and corruption that are somewhat divorced from its context (see e.g. Brunetti & Weder, 2003; Lindstedt & Naurin 2010).[1] Comparative research is thus limited by conceptualizations and measurements of transparency that remains at higher levels of abstraction (Bauhr & Grimes 2017), that may not always be relevant and actionable to stakeholders (Michener, 2015). By seeking to answer not only the broad question of whether transparency "works" but also "what type of transparency can be used by whom when" in order to achieve desirable goals, the present research provides for a closer understanding of the type of exposure and openness that may prevent corruption.

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[1] For a helpful overview of available transparency measures see Williams (2015). For a particularly interesting addition to the non-perceptions-based measures of transparency see Hollyer, Rosendorff and Vreeland (2014).

While reforms under the New Public Management (NPM) umbrella are generally argued to disable forms of corruptions connected to governmental monopolies, the implementation of increased marketization and competition may accordingly open up for a different kind of corruption based in more intense relationships between private and public actors (e.g. Erlingsson, Bergh & Sjölin, 2008; Tambulasi, 2009). Specifically, the process of transferring public money into the hands of individuals and companies by public procurement has been identified as an area particularity at risk for corruption (Rose-Ackerman, 1999; Murillo, 2015; da Cruz, Tavares, Marques, Jorge, & de Sousa, 2015; OECD, 2005). Infrastructure contracts such as construction of major bridges, dams, and tunnels are the main areas exposed to corruption in public procurement (OECD, 2005), but corrupt practices such as bribes and political considerations influencing the contracting process or bid riggings during procurement have also been identified as problems in sectors such as health (Vian, 2008) or defense (Rendon & Rendon, 2016).

The main reason for the high exposure to corruption is that there are clear incentives to stretch the rules for all involved. Bidding firms want to secure government contracts as they involve large amounts of money and tend to be long-term and relatively secure. Public officials may have an interest in making quick and convenient deals—either to save public money or their own efforts—or to consider aspects that cannot be explicitly acknowledged as criteria of choice in the design of the call, such as local employment (OECD, 2005, p. 30). Taken together, this means that even in the absence of outright bribing, the procurement situation clearly creates incentives for fruitful cooperation between firms and public officials. Sophisticated methods include organizing the procurement process as an emergency call with a very short deadline, and setting an unrealistically low price allowing for after-bidding negotiations with favoured bidders (e.g. Dorn, Levi, & White, 2008).

In search for the proper flashlight

Based on the experiences and perceptions of the wide group of experts who participated in a Global Forum on Corruption in Public Procurement, the OECD (2005, p. 11) identified increased transparency as "among the most effective deterrents of corruption in public

procurement." Although the OECD did not provide an elaborate explanation, the organization contends primarily that transparency is a pre-condition for accountability. By opening up the tendering process, "a wide variety of stakeholders" will be able to scrutinize the decisions and performance of public officials and contractors, and hopefully keep the actors involved from engaging in dubious activities, either because non-serious actors opt out from the beginning or because actual corrupt activities are detected and punished. Although the use of open auctions has also been criticized for being costly in terms of time and money and it has been argued that the use of more informal mechanisms such as reputation and long-term relationships may, at least in some cases, actually save public money rather than wasting it (see Kelman, 1990; Bandiera, Prat, & Valletti, 2009; Coviello, Guglielmo, & Spagnolo 2017 for discussion), transparency and competition are often seen as the main answers to corruption in the sector.[2]

A number of recent studies have addressed—directly or indirectly—the relationship between transparency in public procurement and reduced corruption risks. Evidence from Italy (Coviello & Mariniello 2014) and Japan (Ohashi, 2009) showed that publicity requirements increase the number of bidders. Auriol, Straub, & Flochel (2016) found that the main channel for procurement corruption in Paraguay is the use of an "exceptional" purchase mechanism that bypasses legally required minimum standards of transparency and competition. Basheka, Oluka, & Mugurusi (2015) surveyed citizens in Uganda to explore how citizen involvement could contribute to increased transparency and less corruption in public procurement. Evidence from India and Indonesia has shown that e-procurement that increased transparency leads to improved road quality and reduced delays (Lewis-Faupel, Neggers, Olken, & Pande, 2016). Knack, Biletska, & Kacker (2017) used a sample of 34,000 firms in 88 countries to show that in countries with more transparent procurement systems, firms are more likely to engage in bidding and pay fewer and smaller kickbacks to officials.

These previous studies suggest that transparency requirement should favor fair competition between bidding firms. Although undue influence can occur already at the stage of designing a call (e.g. Dorn, Levi, and White 2008)—thereby masking benefits for a certain part as objective criteria—a *lack* of transparency requirements would certainly make it easier to engage in corrupt activities (OECD 2005, p. 11). Transparency would both increase the risk of getting

caught for illicit activities as well as deterring dubious actors from participating in the process, which means that all else equal, transparency rather than secrecy should counteract corruption. Thus, since the transparency literature does not always find a strong association between broader measures of transparency and corruption levels (i.e. Hollyer, Rosendorff and Vreeland 2014), but case studies seem to find this association, we hypothesize that this overall relationship will be present when we use more precise and comparative tender transparency data. The first hypothesis is formulated as follows:

H1. Higher levels of transparency in the procurement process decrease corruption risks.

Hypothesizing a general effect of transparency on reduced corruption does not, however, imply that all types of information are equally important. In public procurement, a main distinction can be drawn between ex ante transparency (the availability of information *before* the contract is awarded) and ex post transparency (the availability of information *after* the contract has been awarded to a bidder). Generally, ex ante transparency implies that all information needed to propose a winning bid is released in the call for tenders and that the criteria for choosing the winner are clearly stated, whereas ex post transparency implies that information about the outcome of the process is communicated to the wider public.

Ex ante transparency and ex post transparency are relevant to insiders and outside monitors to different degrees, which imply that they can be expected to serve different functions in a process leading to less corruption. Broadly speaking, there are three potential user groups of transparency in the procurement sector: governments (for internal audits, performance measurement, and control of public officials), bidding firms that consider bidding or are already in the market (for finding calls, developing bids, and researching competitors), and the wider public, including investigative journalists and external auditors (for holding the government accountable).

We argue that ex ante transparency should be predominantly relevant for firms in the field because it allows firms to identify suitable calls and develop bids in accordance with the stated preferences of the public agency. Ex ante transparency thereby establishes conditions for fair

competition, and prevents corruption by allowing firms to monitor the requirements and the formal processes for selection of the winning bid. Firms already in or aspiring to be in the bidding process can be expected to fulfill many of the demands of a capable audience for transparency information (e.g., Fenster, 2005; Kolstad & Wiig, 2009). They have the technical expertise to understand the information, and they have clear incentives to act upon it if they, for example, suspect that a call is rigged or that the process does not allow for full competition. This means that ex ante transparency is more related to Heald's (2006; 2012) concept of horizontal transparency than to the standard principal-agent vertical comprehension of transparency. A typical example demonstrating this logic is when a potential bidding firm realizes, upon reviewing the call for tenders, that the conditions defining which company is eligible for submitting a bid are unreasonably restrictive, excluding many able bidders. Then, the disadvantaged company submits a complaint to the national public procurement arbitration court which reaches the judgement that the terms are anticompetitive hence should be changed. By implication, the original call for tenders is withdrawn and republished with the new, less restrictive terms allowing for a number of companies to bid. A number of similar, high profile cases reaching the Court of Justice of the European Union are systematically documented in Fazekas & Tóth (2017).

The OECD (2005, p. 34) notes that transparency requirements might be less efficient for preventing pre-bidding collusion between firms than corrupt practices between agencies and firms. However, ex ante transparency can also make pre-bid collusion and cartel-maintenance more difficult since it makes the process more distant and de-personalized. For example, Clark et al. (2018, p. 8) describes a case where firms had to request more information from the municipal office to be able to prepare a submission; a routine which made firms not participating in the current cartel vulnerable to threats and even violence from cartel-members and their in-office informants. This suggests that the more information there is in the call—i.e. the more transparent the call is—the better the chances for a non-corrupt process because it recuces the need for personal contacts. Further, although the main cause of cartel breakdown seems to be internal conflicts, an increase in non-member firms competing for contracts can make cooperation in a cartel or bid-ring more difficult (e.g. Levenstein & Suslow 2006). The more potential firms there are in the process, the more actors there are to scare away, and more actors there are that can detect and report abuses to anti-trust authorities. Taken together, this

means that ex ante transparency has a good chance of being efficient in creating fair competition between firms and reducing collusive behaviour.

Ex post transparency, on the other hand, is predominantly useful for the wider public—including journalists—and for government employees, as they primarily care about the actual money spent, the actual deadlines for getting the job done, and the actual contractor assigned to the task. Firms certainly use ex post information to evaluate their competitiveness and occasionally to submit formal complains, but generally, the process is over for competing firms once the contract is awarded. Engaging in appeals is often costly in terms of time and money, and the prospects of being successful are low. In addition, it comes with the risk of being classified as troublesome which can have long term detrimental effects on firms' reputation. This implies that the average users of ex post information can be expected to be less engaged and less motivated to use the information than the users of ex ante transparency. Public procurement is a complex and technical area that by delegation from responsible politicians to a large extent concerns arrangement between administrators and contract-seekers (OECD, 2005, p. 31). Even auditors or journalists may need an indication of something shady going on from an inside whistle-blower involved to gain investigative interest in the activities (e.g., Gottschalk & Smith, 2016, p. 9). Further, even though corrupt procurement processes involve potentially huge losses for the public sector and the society at large, the incentives for individuals to monitor the activities or use them as the basis for demanding of accountability remains low because benefits are typically dispersed and individual gains are often small, which means that free-riding is a serious problem (Olken, 2007:Bauhr 2017).

Taken together, this implies ex post transparency is, to a larger extent, dependent on external—and in this case, less motivated or able—actors to actually affect potentially corrupt actors. If these potentially corrupt actors calculate the risk of getting caught, the prospect of ex post transparency may therefore not be enough to deter potentially corrupt actors from engaging in dubious activities. Media and civil society scrutiny based on ex post transparency may certainly be an important condition for creating a culture of openness and for wider vertical public accountability to emerge, but this effect should be more long-term.Therefore, the second hypothesis is formulated:

H2. Ex ante transparency more strongly decreases corruption risks than ex post transparency.

Data and Measurement

Data

This study uses administrative public procurement data from European countries. The data contain information on individual public procurement tenders that were regulated administrative procedures in which public bodies purchased goods and services in the 28 EU member states (EU28)—and other European states such as Switzerland and Norway—between 2006 and 2015. The data are derived from the European Union's Tenders Electronic Daily[3] (TED), which is an online publication portal where all tenders falling under the remit of the Public Procurement Directives must be published. The application of the Directives is mainly dependent on contract value, requiring publication of large (national and EU funded) contracts, with the publication thresholds varying over time: approximately EUR 130,000 EUR for service and EUR 5,000,000 for public works contracts (publishing tenders below these thresholds is voluntary hence they are excluded from the analysis to avoid selection bias). Because the TED portal is the mandatory publication place for close to all high value tenders and government contracts across the EU, it represents the main source of information for bidding firms as well as non-governmental actors aiming to hold governments accountable.. Similarly, structured and regulated public procurement data exist across the globe, making this measurement strategy generally replicable outside Europe as well (http://ocds.open-contracting.org/). The full contract-level public procurement database used in the analysis can be downloaded at digiwhist.eu/resources/data.

This data is used to create an organization-level panel database on public procurement characteristics annually over time, both independent and dependent variables. Organizations, that is buyers in public procurement tenders, are the effective decision makers when it comes to reporting on tenders(i.e. transparency) as well as designing tenders (i.e. corruption), hence the unit of analysis directly matches the locus of relevant decision-making powers.

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[3]http://ted.europa.eu/

Organization-year level indices represent the simple average of all contracts awarded by the organization and year in question. As official organizational ID numbers are not published, we identified the contracting authorities by their names. The potential error that this introduces is assumed to be random noise due to two reasons: i) We assume that organization name variants, (i.e. abbreviations) are orthogonal to the main variables (there is virtually no missing buyer name in the database, so the transparency or administrative quality likely does not influence the organization names in the announcements), and ii) combining truly different organizations due to the same spelling of their names is very unlikely, while splitting the same organization under different IDs due to i.e. abbreviations is most of the bias we introduce. Thus, the point estimates of organization-level indices using only a subsample of contracts belonging to an organization increases random noise rather than systematic bias.

Variables

The dependent variable is a simple and straightforward indicator of corruption risk: when only one bid was submitted in a tender in an otherwise competitive market (Charron et al, 2017). Although, like most other measures of corruption, this is only an indirect measure of corruption, the percentage of single bidder contracts awarded in all the awarded contracts of a contracting authority gives a good indication of whether the procurement process involves dubious practices and corruption risks. This interpretation was supported by a range of validity tests demonstrating the relationship between single bidding and higher prices, higher prevalence of tax haven–registered suppliers, or on the country-level higher perceptions of corruption (Fazekas & Kocsis, 2017). One clear potential pitfall with the measure, however, is that it may not actually capture corruption but a lack of competitive markets or low administrative quality. In addition, sometimes inter-bidder collusion also leads to single bidding without the necessary involvement of public officials, however this is considered to be much less frequent than other collusive practices such as companies submitting losing bids (Fazekas & Tóth, 2016). The risk-part of our measure is, however, important. We do not say that a single-bid auction is equal to corruption. On the contrary, if a single-bid auction reflects a long-term, stable, relationship built on trust between benevolent public officials and honest companies it could actually save resources both in terms of time and money. We do, however, say that single-bid auctions—especially if they are recurring over years—should be noted and examined as they indicate that competition has not worked as intended which could be a result of corrupt practices.

In order to avoid mismeasurement from less competitive markets (i.e., markets where even in the absence of corruption, more than one bidder should not be expected), such as specialized legal services, markets with less than three different companies winning public procurement contracts a year were excluded from the analysis. More restricted samples were used for robustness tests in Appendix B, using 5 and 10 different companies as cut-points. (Results are shown in Table B1 and Table B2 for 5 companies, Table B3 and Table B4 for 10 companies). We also removed voluntary reporting below mandatory reporting thresholds (e.g., services contracts worth more than about EUR 130,000 in the services sector) in order to retain only the tenders that are strictly comparable complying with the same regulatory framework. Finally, the dataset is based on approximately 3.5 million awarded contracts which covers nearly all major contracts awarded by governments across the EU.

The novel measurement approach to transparency was motivated by the desire to move away from country-level macro-indices which risks reflecting how well a state "ticks a number of boxes considered favorable" without regard to which features are crucial and which are less essential (Bauhr & Grimes, 2017; Michener, 2015; Scheppele, 2013). Thus, to measure our independent variable, transparency in public procurement, we build on the number of missing pieces of information in two types of public procurement notices: calls for tender and contract award notices. This is the most basic test of transparency: Is the information which by law is required to be published in announcements [4] actually present? Although admittedly an approximation since we cannot check the accuracy of the information reported, it does provide an indication of whether officers provide mandatory information. Also, it is important to note that not reporting all mandatory bits of information is a choice left to public buyers as no hard sanctions are attached to non-compliance. Only one warning letter is sent out by the European Commision (EC) Publications Office to ask for more complete information which can be ignored without a fine or delay in the tender process.

Building on the theoretical concepts outlined above, we distinguish between two different forms of transparency: ex post and ex ante transparency. Ex ante transparency is measured by the

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[4] While we acknowledge that in specific circumstances not publishing basic information on tenders can be justified by for example exceptionally complex negotiated tenders or national security concerns, repeatedly failing to publish information may still point at the abuse of legally mandated transparency.

share of missing information in calls for tenders (in an extreme case, the complete lack of such an announcement) which most directly affect potential bidders' decisions about participating. Each of the items is selected because it is indispensable for successfully bidding and receiving information about the tender, hence omission can be used for corruptly manipulating the bidder pool. For example, if contract duration is not defined pricing services or works is rendered very imprecise, allowing the connected firm with insider information to prepare better estimates. Ex post transparency is related to contract award notices which typically contain information of much broader use, such as journalists writing about suppliers connected to politicians. The selected items in this category also have to represent fundamental information for stakeholders. For example, not knowing the name of the winning company prevents journalists form investigating potential links between politicians and the recipient of public money. The binary variables included in the ex-ante and ex post measures of transparency are shown in table 1 and table 2.

Table 1 about here
Table 2 about here

The ex post transparency index on the tender level was constructed by averaging the five individual components:

Ex post transparency = 100 – 100 × (missing winner name + missing NUTS codes + missing subcontracting + missing contract value + missing EU funds)/5.

The ex-ante transparency index was constructed similarly but took into account that calls for tenders are not always published, which is, in itself, a strong indicator of a lack of transparency. This implies that the minimum ex ante transparency score is reached either when the call for tender is not published or when it is published, but all key information items are missing:

Ex ante transparency = 100 – 100 × (no call for tenders + (1- no call for tenders) × (missing language information + missing selection method + missing criteria + imprecise CPV codes + missing duration)/5).

In order to measure the effect of transparency on single bidding in general (that is, without differentiating between ex post and ex ante), we constructed a measure of general transparency as follows:

$$\text{Overall transparency} = (\text{Ex ante transparency} + \text{Ex post transparency})/2.$$

All three indices take high values (close to 100) if many pieces of information are present in public procurement notices and thus, indicate high levels of transparency, while low values (close to 0) indicate a low level of transparency. Transparency measures used in the below analysis characterize organizations (i.e. public bodies awarding contracts) over time (i.e. annually) based on their typical tendering publication behavior. Hence, they proxy organizational transparency behavior more broadly than just in individual tenders (e.g. publishing information on winning bidders and their contract values also allow for civil society scrutiny of subsequent calls for tenders or contracts of past winners by providing context and benchmarks). Taking the organization-year panel as the unit of analysis allows for directly collating ex ante and ex post transparency which would be impossible on the contract level (i.e. information in a contract award publication cannot influence the contract award decision which is prior to publication).

Detailed descriptive statistics and distributional graphs can be found in Appendix A. Figure A1 shows the distribution of share of contracts with single bid, Table A1 presents the correlations between ex ante transparency index and its elements, Table A2 shows the same for ex post transparency. The number of contracts we took into account in this paper can be found in Table A3. Table A4 displays the descriptive statistics of variables in the panel regression. Figure A2, Figure A3 and Figure A4 show the histogram of overall transparency, ex ante transparency and ex post transparency, respectively.

Methods

We utilize three regression methods representing different degrees of restrictions on parameter estimates and approximation of causal effects: Ordinary least squares, fixed-effects panel data regressions, and multilevel regression models (random slopes and intercepts). We cluster standard errors on the regional level (NUTS2) in order to account for correlation among organizational features in the same locality. Fixed-effects panel data regressions in the

organizational-level database is considered to deliver the most reliable estimates for the causal effect of transparency on corruption. As public organizational quality is expected to remain largely stable over time, the inclusion of an organization constant removes the greatest part of omitted variable bias, that is, unobserved organization-level corruption driving both observed corruption risks and transparency. In addition, some specifications also include a lagged dependent variable and year fixed effects which should account for some of the temporal reverse-causality bias, that is an organization's corruption change driving its transparency change rather than the other way around. Controlling for time-invariant unobserved organizational characteristics, observed time-variant corruption risks, as well as major observed confounders such as contract value, we strive to approximate causal identification as best as possible in the absence of an experimental setting.

In particular, we estimated the following generic model:

$$Sb_{i,t} = \alpha_i + \beta \text{Transparency}_{i,t} + \beta Xti'_{i,t} + \beta Xte'_{i,t} + \beta Xre'_{i,t} + \varepsilon_{i,t}, \tag{1}$$

where *Sb* is the share of contracts with a single bidder in organization *i* in year *t*, and α_i is the organization-level fixed effect. The main explanatory variables were the Transparency variables: Overall Transparency, Ex Ante Transparency, and Ex Post Transparency, three continuous scores reflecting the share of missing information in public procurement notices in organization *i* in year *t*. We either entered the three transparency measures separately or the ex post and ex ante transparency measures jointly in the regressions (the two transparency measures were only weakly correlated at the organizational level; the linear correlation coefficient was 0.223). While on the tender level single bidding cannot be influenced by information in the contract award notice as the latter precedes the former; on the level of organizations there is no such temporal discrepancy among our transparency predictors and single bidding outcome. Hence, any observed empirical relationship should be interpreted bearing in mind the organization-year as a unit of analysis where the average annual administrative behavior gives rise to a particular corruption risk outcome.

In addition, we added vectors of covariates that differed by the type of estimation carried out, but in the fullest form of the model, *Xti*, *Xte* and *Xre* are included. *Xti* encompasses time varying

control variables such as the lagged dependent variable and year fixed effects. *Xte* represents a vector of covariates that describe key characteristics of the tenders conducted by the contracting authorities. The vector includes, per organization i and year t, the logarithm of the average contract value and the share of different types of procurement (i.e., services, supplies, and works). *Xre* includes economy- and employment-related covariates at the regional level. This vector was included only in estimations carried out on a subsample of local authorities which operate in only one NUTS2 region. This vector contained, per organization i and year t, a measure of GDP per capita, the regional employment rate, and fertility rate (Varvarigos and Arsenis, 2015). The regional level is the most relevant higher-order grouping we use as most public procurement markets have local supplier markets and political oversight often follows regional state structures.

All these covariates are in theoretical terms potential additional explanatory factors for corruption in a country (Fazekas and Cingolani 2016). Overlooking them could easily lead to omitted variable bias where changes in the explanatory and dependent variables may be driven by these omitted aspects. Finally, ε is the random error measure by organization i in year t.

Additionally, in the 3-level multilevel models we additionally include organization-level covariates such as agency type, and agency sector.

Results

In order to test H1, we ran simple pooled ordinary least squares (OLS), fixed-effects panel regressions and multilevel models (MLM). Hausman tests showed that the less efficient but consistent fixed-effects estimator is preferable to the random effects model which is also in line with the theoretical expectation of strong organizational inertia. The results are shown in Table 3. H1 is supported by all regression models: Increasing organizational transparency by one additional information item on average decreases single bidding by 0.4 to 1.2 percentage points across the different models. In the preferred, most complete model with regional controls (model 5 in Table 3), a one standard deviation (23.0 points) increase in transparency decreases single bidding by 1.8 percent. The organization-level fixed-effects panel regression including regional control variables is the preferred set-up because the organization constants control for unobserved organization-specific factors, such as latent organizational capacity or staff effort;

and regional controls account for the development of local supplier markets and business practices which influence procurement outcomes even after holding organizational quality constant. Nevertheless, all regression specifications show a remarkable consistency of effect sizes, predominantly in the range of 0.7-0.8 percentage points increase as a response to one additional information item.

Table 3 about here

In order to explore H2 on the different effects of ex ante and ex post transparency, we ran the same panel regressions[5] with the two transparency indicators entered separately and then jointly, using both the full and the local organizations only sample (Table 4). The regressions show noteworthy differences between the two forms of transparency. The effect of ex ante transparency on corruption risks was statistically significant and large in every specification. Across the different models, increasing an organization's ex ante transparency by one additional information item on average decreased single bidding by 0.9-1.4 percentage points. In the preferred, most complete model (model 4 in table 4), a one standard deviation increase in ex ante transparency (36.1 points) decreased single bidding by 1.7 percentage point. However, the effect of ex post transparency was comparatively smaller and statistically insignificant in all but one model suggesting that while ex post transparency may contribute to lowering corruption risks, its effect is weaker than ex ante transparency. Nevertheless, observing a consistently negative albeit small effect of ex post transparency on corruption risks supports our claim that transparency in contract awards can have an influence on tendering outcomes on the organization-year level. Simultaneously including ex ante as well as ex post transparency variables is warranted by the low level of correlation between them (0.2). These results provide considerable support for H2.

Robustness tests that run on more restricted samples of most competitive markets are discussed in appendix B in order to address the concerns that our results are simply artefacts of not having enough potential competitors on the market rather than transparency choices of public buyers. A potential further concern plaguing our interpretation is that the ex-ante transparency effects are driven by the non-publication of the call for tenders only. While this scenario is consistent

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[5] The OLS regression variant delivers substantially the same results as the preferred FE models.

with our theoretical arguments (see above), we also run further robustness tests separating ex-ante transparency indicator into 2 sub-components: i) publishing the call for tenders; and ii) transparently including the 5 key fields in the publication (Table 1, top 5 rows). These robustness tests found in Appendix B Table B5 are confirmatory: both call for tenders and the 5 other transparency components have a significant negative impact on single bidding, albeit with the former having a larger effect size (-0.08 versus -0.03).

Table 4 about here

Another way of demonstrating the evidence we gathered in support of H1 and H2 is the visual representations of predicted single bidder percentage as a function of the different transparency measures (figure 1-3). Interestingly, the overall transparency effect was very close to the effect of ex ante transparency, which emphasizes the observation that ex post transparency is considerably less influential in determining high-level corruption risks in public procurement in Europe.

Figure 1 about here
Figure 2 about here
Figure 3 about here

Although a decrease of about 0.5–1.2 percent in single bidding due to an additional missing information item might not sound substantial (table 4), given that single bidder contracts are, on average, 7.1 percent more expensive than contracts with two or more bidders, the associated annual price savings across Europe are substantial. As a back-of-the-envelope calculation, take increasing transparency by five items on, average, in Europe (out of ten items considered) which would decrease single bidding by 2.5 to 6 percentage points translating into a 0.18–0.43 percentage point cheaper procurement tendering on average: about EUR 4.5–10.9 billion savings per year across the EU.

Conclusions

The introduction of public sector reforms under the flag of New Public Management has generated an increased focus on marketizing mechanisms and contracting-out operations such as public procurement. While these reforms are intended to increase efficiency and good service through competition between bidding firms, they also provide opportunities and incentives for public and private actors to engage in corruption or other forms of dubious activities.

This paper suggests that the success of public procurement in terms of establishing fair and non-corrupt competition largely depends on the transparency of the procurement procedures. Using newly collected data of more than 3.5 million public procurement contracts between 2006 and 2015 and employing fixed-effects panel regression methods on the public organization-year level, this research investigated the impact of transparency on corruption risks in public procurement across Europe. Findings show a negative impact of overall tender transparency on corruption risks: One additional information item published decrease single bidding by 0.5 to 1.2 percentage points across the different regression models. Although this effect size might not sound substantial, given that single bidder contracts are, on average, 7.1 percent more expensive than contracts with multiple bidders, the associated annual price savings across Europe are substantial. For example, increasing transparency by five items, on average, (out of ten items considered) could decrease single bidding by 2.5 to 6 percentage points translating into 0.18 to 0.43 percent cheaper contracts, equaling about EUR 4.5–10.9 billion savings per year across the EU. Further, the results show that ex ante transparency (transparency before the contract is awarded) has a stronger effect on corruption risks than ex post transparency (the availability of information after the contract has been awarded). Horizontal transparency, or transparency that provides information primarily to the parties involved in the bidding process rather than to outside observers (cf. Heald 2006), is the main condition to secure fair competition. These results point to the important role of internal stakeholders for transparency to reach the desired effects..

This research contributes to the literature on transparency and corruption in general, and to the literature on corruption in public procurement more specifically. First, it develops the theoretical distinction between ex ante and ex post transparency. Several of the most influential empirical analyses on the causes and effects of transparency have focused on how much transparency there is in a particular polity, rather than on its different types. A limited focus on

levels of transparency, however, entails the risk of false inferences, as different forms of transparency may have widely different causes and societal effects, and distinguishing between different forms of transparency may be essential to actually understand its effects. The distinction between ex ante and ex post transparency is particularly relevant to detect corruption risks in public procurement, with implications for the types of users that are likely to access and use the information involved and whether the information will primarily be used for internal or external use.

Second, the study uses objective rather than perception-based measures of transparency and corruption, and tailors the measures to the specific situation at hand, i.e. public procurement, rather than linking broad constructs of transparency to broad democratic objectives (see. e.g. Cucciniello, Porumbescu, & Grimmelikhuijsen, 2017 for discussion). Although new and authoritative cross-country measures of government transparency—based on published government statistics and expert perceptions (Bauhr & Grimes, 2017; Hollyer, Rosendorff, & Vreeland, 2014; Williams, 2014)—have proliferated recently, scholars have recently criticized that these measures risk being detached from the contexts in which the measures would be used. Perception-based measures, furthermore, risk producing echo chambers where experts may rate countries' levels of transparency based on general perceptions of the countries' performances, including the GDP per capita. The measures at hand in this study are admittedly rough, but still indicators of actual information provision and actual outcomes of procurement processes, resulting in a lower level of abstraction than many similar studies on transparency and corruption.

Finally, and perhaps most importantly, these results also lend themselves to directly policy-relevant insights: Improving publication quality, especially the quality of the calls for tenders, can deliver tangible improvements in competition, reduced corruption risks, and savings to public budgets. Moreover, in the context of recent policy reforms aiming to make government information more understandable (e.g. the Plain Language Act in the US), our results deliver a nuanced argument. In the context of a highly complex field such as public procurement, for outsiders such as journalists or NGOs, the mere publication of relevant information is not enough for holding governments to account as the legal and technical complexity of

data presents substantial barriers to data use. However, for insiders with excellent legal and technical skills jargon and lots of complicated details can actually be a boon.

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Tables and figures

Table 1 Components of the Ex Ante Transparency Index

Component name	Definition
Missing language information	Information about eligible languages is missing from the call for tender (0: not missing 1: missing)
Missing selection method	Information about the selection method (lowest price/economically most advantageous tender) is missing from the call for tender (0: not missing 1: missing)
Missing criteria	Information about the exact criteria is missing in the call for tender (when the selection method is economically most advantageous tender) (0: not missing 1: missing)
Missing duration	Information about the estimated duration of the contract is missing from the call for tender (0: not missing 1: missing)
Imprecise CPV codes	The CPV codes in the call for tender are imprecise (only 2 digits are given) (0: precise 1: imprecise)
No call for tender	The call for tender is not published (0: published 1: not published)

Table 2 Components of the Ex Post Transparency Index

Component name	Definition
Missing winner name	Information about the name of the winner is missing from the contract award notice (0: not missing, 1: missing)
Missing NUTS codes	Information about the address of implementation (NUTS code level) is missing from the contract award notice (0: not missing, 1: missing)
Missing subcontracting	Information about subcontracting is missing from the contract award notice (0: not missing, 1: missing)
Missing contract value	Information about the contract value is missing from the contract award notice (0: not missing, 1: missing)
Missing EU funds	Information about the use of EU funds is missing from the contract award notice (0: not missing, 1: missing)

Table 3. Pooled OLS, Fixed-Effects Panel Regressions and Multilevel Modelling regressions for the Total Organizational Sample (models 1-4) as well as for the Local Sample Only (Models 5-6), Contracting Authorities if They Awarded at Least 3 Contracts per Year

Model nr.	(1)	(2)	(3)	(4)	(5)	(6)
Model type	Pooled OLS, full	FE, full	FE, full	FE, full	FE, local	MLM, local
Dependent var.	Corruption risk (single bid %)					
Overall transparency	-0.0776***	-0.0459***	-0.0768***	-0.123***	-0.0803***	-0.0703***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Purchase type: Supplies (ratio) ref cat: Services	-1.487*		0.283	0.0271	1.418*	1.067***
	(0.034)		(0.607)	(0.965)	(0.031)	(0.000)
Purchase type: Works (ratio) ref cat: Services	-10.64***		-6.825***	-7.403***	-6.048***	-8.766***
	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)
Logarithm of contract value (net, EUR)	0.0925		0.0875	0.0737	-0.0279	0.0411
	(0.574)		(0.423)	(0.510)	(0.805)	(0.539)
GDP at current market prices, EUR/inhabitant					-0.000054	-0.00034***
					(0.691)	(0.000)
Employment rates, 15-64 years					-0.334**	-0.417***
					(0.003)	(0.000)
Fertility rate					-2.698	-13.36***
					(0.498)	(0.000)
Lagged singleb bid %				-0.0597***		
				(0.000)		
Constant	12.58***	21.81***	17.63***	29.65***	44.47***	75.84***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year	Y	N	Y	Y	Y	Y
Country	Y	N	N	N	N	N
Region	N	N	N	N	N	Y
Organisation type	Y	N	N	Y	N	Y
Organisation sector	Y	N	N	Y	N	Y
Organisaiton ID	N	Y	Y	Y	Y	N
Observations	106523	121680	107028	58877	56486	55400
R-squared	0.265	0.016	0.014	0.039	0.104	0.108

Note: standard errors clustered on NUTS2 level; * p<0.05, ** p<0.01, *** p<0.001

Table 4. Fixed-Effects Panel Regressions and Multilevel Modelling regressions for the Total Organizational Sample (models 1-3) as well as for the Local Sample Only (Models 4-5), Contracting Authorities if They Awarded at Least 3 Contracts per Year

Model nr.	(1)	(2)	(3)	(4)	(5)
Model type	FE, full	FE, full	FE, full	FE, local	MLM, local
Dependent var.	Corruption risk (single bid %)				
Ex ante transparency	-0.0719***		-0.0712***	-0.0459***	-0.0465***
	(0.000)		(0.000)	(0.000)	(0.000)
Ex post transparency		-0.0354***	-0.0166	-0.0121	-0.00244
		(0.001)	(0.116)	(0.261)	(0.716)
Purchase type: Supplies (ratio)	0.0404	-0.204	0.0440	1.446*	1.211***
ref cat: Services	(0.947)	(0.749)	(0.942)	(0.028)	(0.000)
Purchase type: Works (ratio)	-7.526***	-7.565***	-7.489***	-6.100***	-8.696***
ref cat: Services	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Logarithm of contract value (net, EUR)	0.0818	0.0711	0.0798	-0.0229	0.0398
	(0.464)	(0.527)	(0.475)	(0.839)	(0.552)
GDP at current market prices, EUR/inhabitant				-0.000054	-0.00033***
				(0.691)	(0.000)
Employment rates, 15-64 years				-0.334**	-0.421***
				(0.003)	(0.000)
Fertility rate				-2.603	-12.67***
				(0.514)	(0.000)
Lagged singleb bid %	-0.0598***	-0.0599***	-0.0598***		
	(0.000)	(0.000)	(0.000)		
Constant	25.18***	24.21***	26.49***	42.25***	72.97***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year	Y	Y	Y	Y	Y
Region	N	N	N	N	Y
Organisation type	N	N	N	N	Y
Organisation sector	N	N	N	N	Y
Organisaiton ID	Y	Y	Y	Y	N
Observations	58877	58877	58877	56486	55400
R-squared	0.024	0.037	0.028	0.107	0.109

*Note: standard errors clustered on NUTS2 level; * p<0.05, ** p<0.01, *** p<0.001*

Figure 1. The Predicted Effect of Overall Transparency on the Percentage of Single Bidding in Public Procurement (Table 3, Model 3)
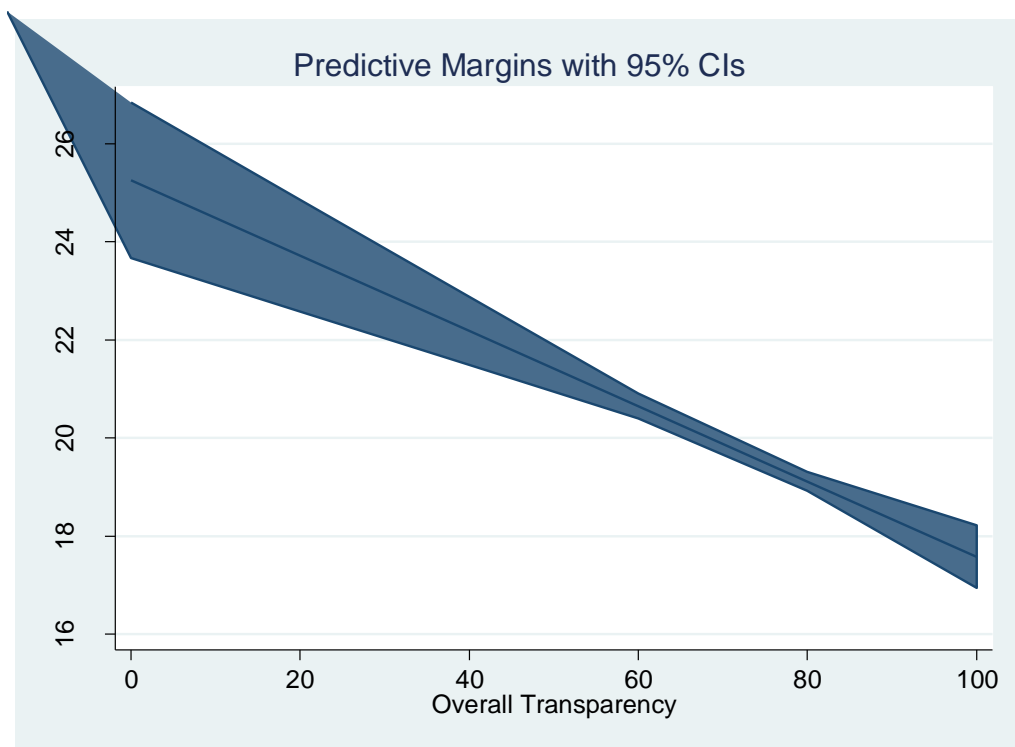
Figure 2. The Predicted Effect of Ex Ante Transparency on the Percentage of Single Bidding in Public Procurement (Table 4, Model 1)

Predictive Margins with 95% CIs
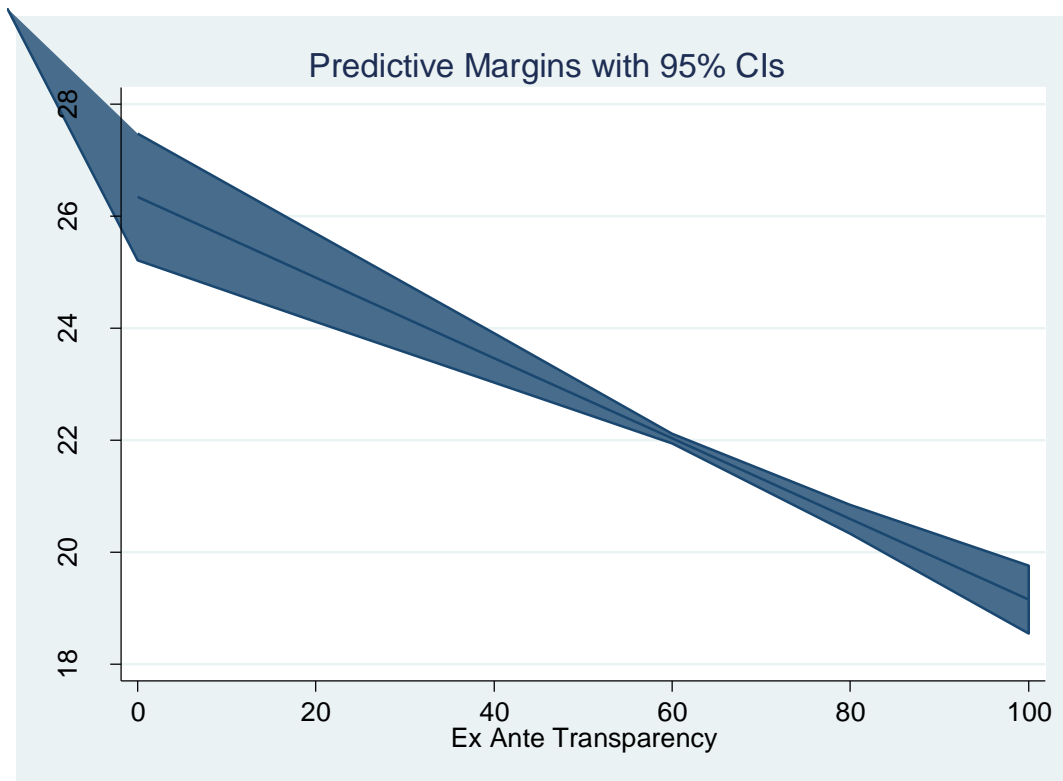
Figure 3. The Predicted Effect of Ex Post Transparency on the Percentage of Single Bidding
in Public Procurement (Table 4, Model 2)

Predictive Margins with 95% CIs
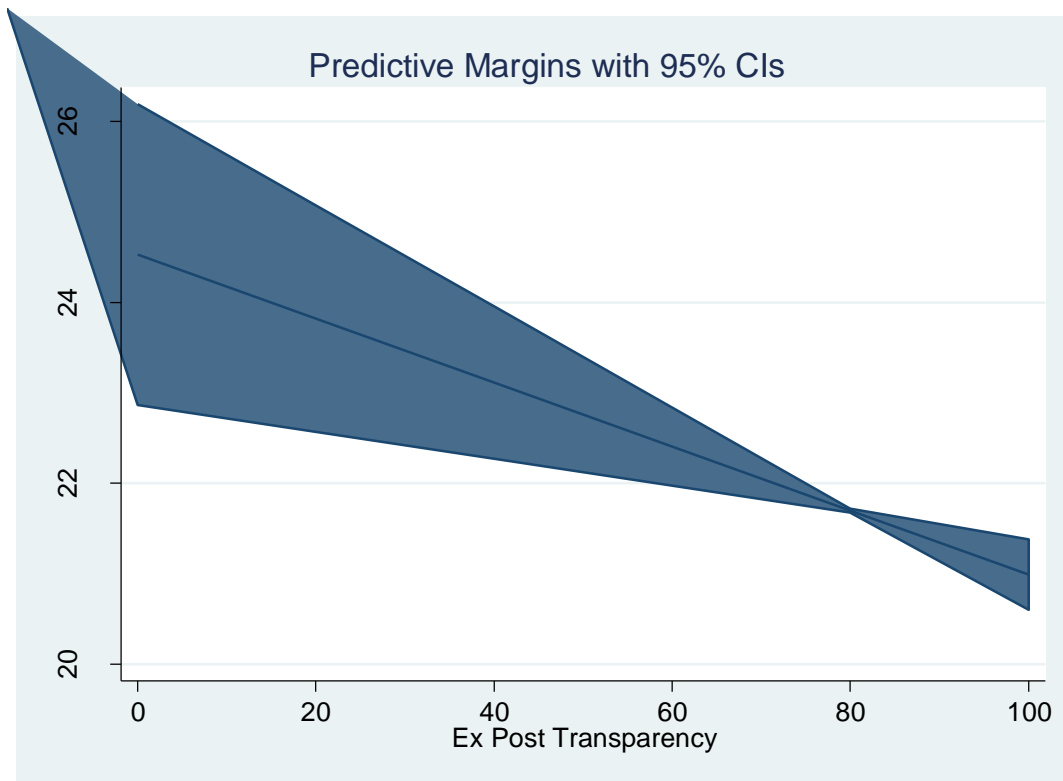
Appendix A: Additional descriptive statistics

Figure A1 Distribution of Share of Contracts with Single Bid among Contracting Authorities, TED, 2006–2015, Non-Competitive Markets Filtered Out, Only Contracting Authorities with at least 3 Contracts per Year
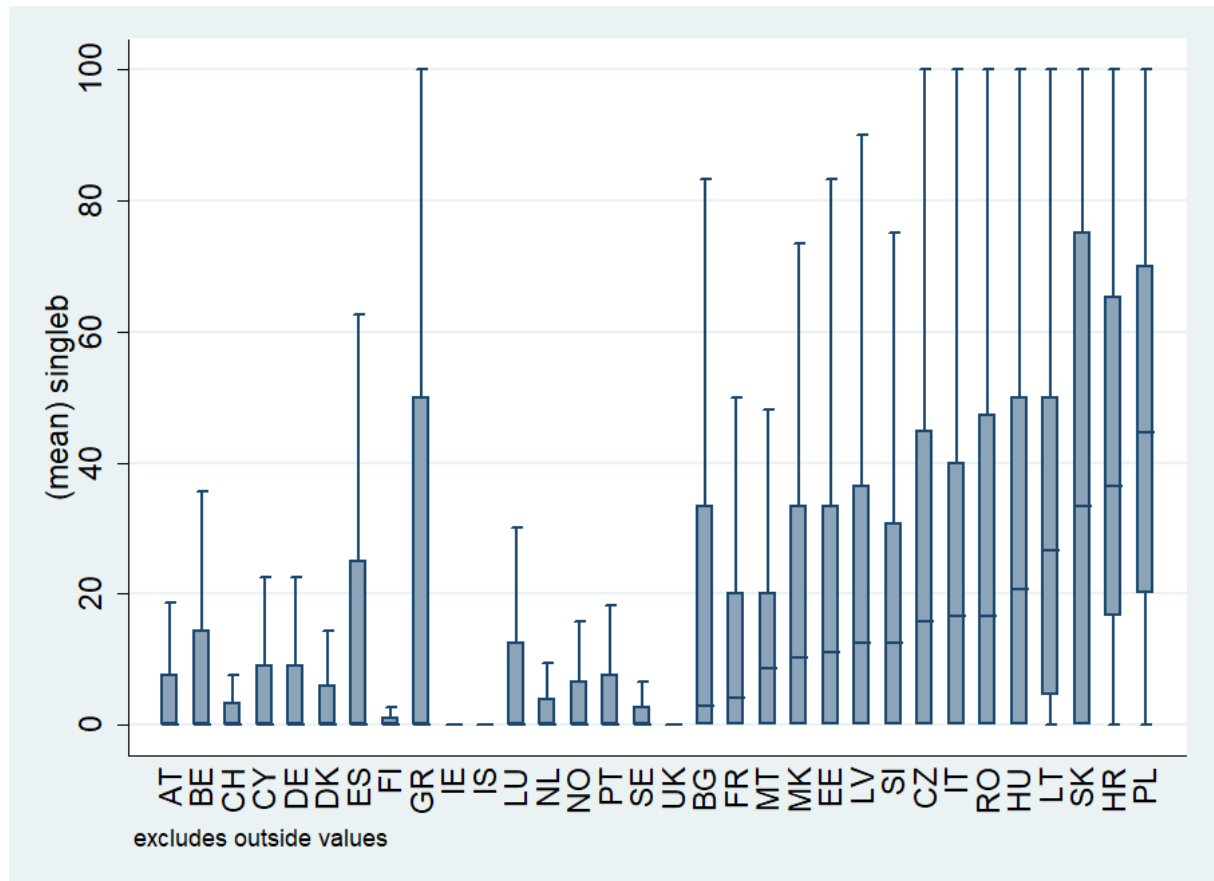
Table A1 Correlations between Ex Ante Transparency and Missing Information, Contracting Authority–Level Data (Authorities with at Least 3 Awarded Contracts per Year)

	Missing selection method	Missing criteria	Missing language information	Imprecise CPV codes	Missing duration	Ex ante transparency
Missing selection method	1.0000					
Missing criteria	−.1168*	1.0000				
Missing language information	.1328*	.0214*	1.0000			
Imprecise CPV codes	.0359*	.0472*	.0271*	1.0000		
Missing duration	.2109*	.0452*	.0940*	.0394*	1.0000	
Ex ante transparency	−.1442*	−.3023*	−.1396*	−.1915*	.0558*	1.0000

Table A2 Correlations Between Ex Post Transparency and Missing Information, Contracting Authority–Level Data (Authorities with at Least Three Awarded Contracts per Year)

	Missing NUTS codes	Missing EU funds	Missing subcontracting	Missing contract value	Missing winner name	Ex post transparency
Missing NUTS codes	1.0000					
Missing EU funds	.2173*	1.0000				
Missing subcontracting	.1221*	.5467*	1.0000			
Missing contract value	.0309*	.1997*	.3201*	1.0000		
Missing winner name	.0261*	−.0041	.0722*	−.0447*	1.0000	
Ex post transparency	−.5491*	−.7280*	−.7665*	−.5579*	−.1338*	1.0000

Table A3 Number of Contracts Between 2006 and 2015, Non-Competitive Markets Excluded

Year	Freq.	Percent	Cum.
2006	167,174	4.91	4.91
2007	246,063	7.23	12.15
2008	291,254	8.56	20.71
2009	322,104	9.47	30.18
2010	357,311	10.50	40.68
2011	376,689	11.07	51.75
2012	391,043	11.49	63.24
2013	398,359	11.71	74.95
2014	411,922	12.11	87.06
2015	440,182	12.94	100.00

Table A4 Descriptives of Variables in Panel Regressions (Contracting Authority–Level Data, 2006–2015)

Variable	Mean	SD	Min	Max	N
Single bidder ratio	18.60	27.25	0	100	122477
Overall transparency	67.39	23.53	0	100	136523
Ex ante transparency	58.58	36.76	0	100	136523
Ex post transparency	76.20	21.47	0	100	136523
Purchase type: supplies (ratio)	0.40	0.43	0	1	136523
Purchase type: works (ratio)	0.15	0.31	0	1	136523
Log contract value (net EUR)	12.70	1.69	4.72	22.39	116882
GDP at current market prices per inhabitant (EUR)	28033	16202	2900	172600	117471
Employment rates (15–64 years)	64.95	6.69	38.90	81.80	115206
Fertility rate	1.65	0.31	0.95	3.80	111383

Figure A2. Histogram of Overall Transparency, Contracting Authorities if They Awarded at Least 3 Contracts per Year
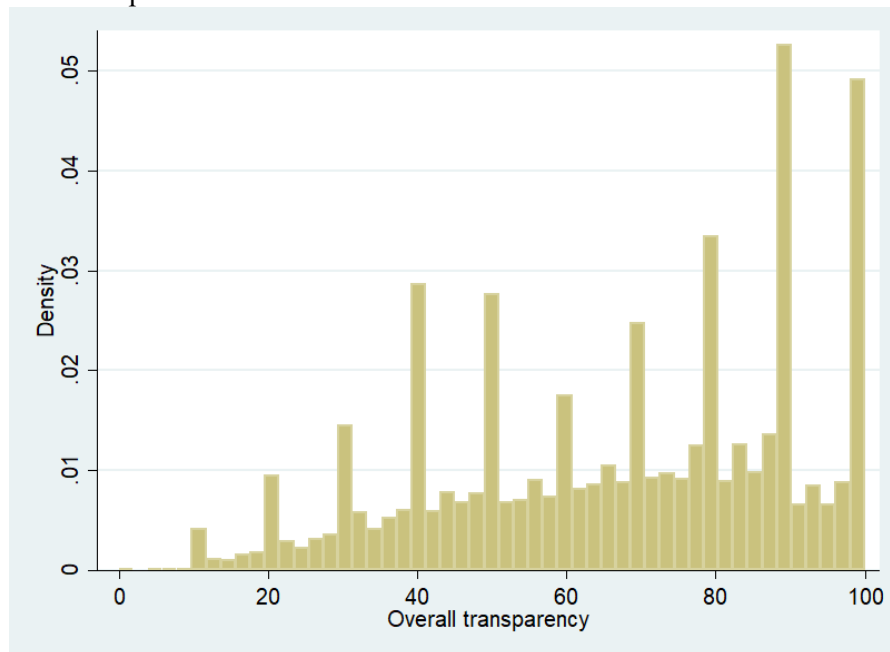
Figure A3. Histogram of Ex Ante Transparency, Contracting Authorities if They Awarded at Least 3 Contracts per Year
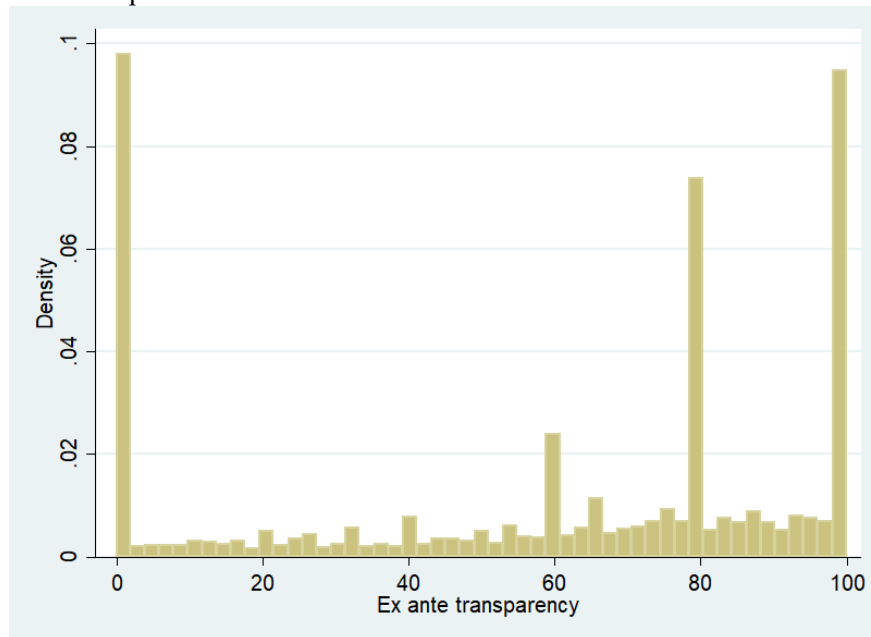
Figure A4. Histogram of Ex Post Transparency, Contracting Authorities if They Awarded at Least 3 Contracts per Year
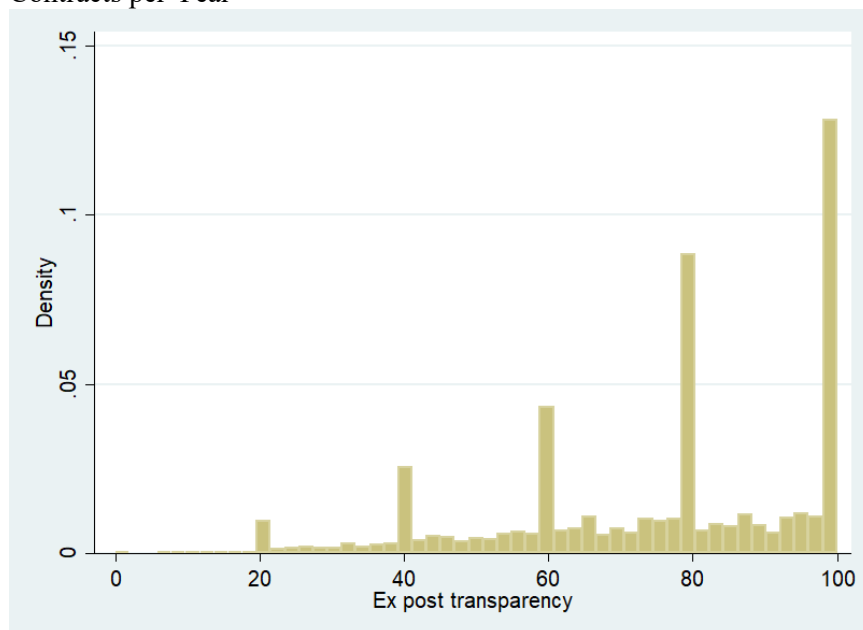
Appendix B: Robustness Tests

A major challenge to our interpretation of single bidding as a corruption risk indicator is the presence of markets which are non-competitive by nature making single bid contracts unavoidable even under non-corrupt scenarios. To test how sensitive our main results are to markets with few potential bidders, we rerun all specifications in table 3 and 4 on samples excluding markets with less than 5 as well as 10 unique suppliers on the market per year. In all these specifications, the substantive conclusions remained the same, while coefficient sizes varied somewhat, supporting the main findings (table B1-B4). This underlines that the overwhelming majority of markets considered in the analysis are by nature competitive allowing to use single bidding as a corruption proxy.

Table B1. Pooled OLS, Fixed-Effects Panel Regressions and Multilevel Modelling regressions for the Total Organizational Sample (models 1-4) as well as for the Local Sample Only (Models 5-6), Contracting Authorities if They Awarded at Least 3 Contracts per Year, Markets if there are at least 5 unique suppliers

Model nr.	(1)	(2)	(3)	(4)	(5)	(6)
Model type	Pooled OLS, full	FE, full	FE, full	FE, full	FE, local	MLM, local
Dependent var.	Corruption risk (single bid %)					
Overall transparency	-0. 0804***	-0.0462***	-0.0792***	-0.119***	-0.0849***	-0.0847***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Purchase type: Supplies (ratio) ref cat: Services	-3.500***		0.295	0.0266	1.379	1.151**
	(0.000)		(0.607)	(0.968)	(0.056)	(0.007)
Purchase type: Works (ratio) ref cat: Services	-12.91***		-6.334***	-7.153***	-5.861***	-9.572***
	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)
Logarithm of contract value (net, EUR)	0.107		0.0879	0.168	0.00125	0.0122
	(0.581)		(0.437)	(0.135)	(0.992)	(0.889)
GDP at current market prices, EUR/inhabitant					-0.0000618	-0.000342***
					(0.686)	(0.000)
Employment rates, 15-64 years					-0.287*	-0.355***
					(0.020)	(0.000)
Fertility rate					-0.344	-16.35***
					(0.936)	(0.000)
Lagged singleb bid %				-0.0556***		
				(0.000)		
Constant	12.51***	21.80***	17.34***	28.28***	37.42***	76.55***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year	Y	N	Y	Y	Y	Y
Country	Y	N	N	N	N	N
Region	N	N	N	N	N	Y
Organisation type	Y	N	N	Y	N	Y
Organisation sector	Y	N	N	Y	N	Y
Organisaiton ID	N	Y	Y	Y	Y	N
Observations	58262	108325	94992	50962	49851	27014
R-squared	0.325	0.017	0.013	0.039	0.087	0.140

*Note: standard errors clustered on NUTS2 level; * p<0.05, ** p<0.01, *** p<0.001*

Table B2 Fixed-Effects Panel Regressions and Multilevel Modelling regressions for the Total Organizational Sample (models 1-3) as well as for the Local Sample Only (Models 4-5), Contracting Authorities if They Awarded at Least 3 Contracts per Year. Markets if there are at least 5 unique suppliers

Model nr.	(1)	(2)	(3)	(4)	(5)
Model type	FE, full	FE, full	FE, full	FE, local	MLM. local
Dependent var.	Corruption risk (single bid %)				
Ex ante transparency	-0.0690***		-0.0681***	-0.0477***	-0.0560***
	(0.000)		(0.000)	(0.000)	(0.000)
Ex post transparency		-0.0365**	-0.0173	-0.0161	-0.00298
		(0.002)	(0.146)	(0.117)	(0.757)
Purchase type: Supplies (ratio)	0.0735	-0.194	0.0673	1.411*	1.333**
ref cat: Services	(0.911)	(0.780)	(0.919)	(0.050)	(0.002)
Purchase type: Works (ratio)	-7.293***	-7.298***	-7.249***	-5.920***	-9.545***
ref cat: Services	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Logarithm of contract value (net, EUR)	0.181	0.175	0.177	0.00916	0.0133
	(0.108)	(0.123)	(0.116)	(0.944)	(0.889)
GDP at current market prices, EUR/inhabitant				-0.0000616	-0.000332***
				(0.686)	(0.000)
Employment rates, 15-64 years				-0.289*	-0.359***
				(0.019)	(0.000)
Fertility rate				-0.197	-15.66***
				(0.963)	(0.000)
Lagged singleb bid %	-0.0557***	-0.0559***	-0.0557***		
	(0.000)	(0.000)	(0.000)		
Constant	23.95***	23.16***	25.32***	35.31***	73.31***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year	Y	Y	Y	Y	Y
Region	N	N	N	N	Y
Organisation type	N	N	N	N	Y
Organisation sector	N	N	N	N	Y
Organisaiton ID	Y	Y	Y	Y	N
Observations	50962	50962	50962	49851	27014
R-squared	0.025	0.036	0.029	0.090	0.141

*Note: standard errors clustered on NUTS2 level; * p<0.05, ** p<0.01, *** p<0.001*

Table B3 Pooled OLS, Fixed-Effects Panel Regressions and Multilevel Modelling regressions for the Total Organizational Sample (models 1-4) as well as for the Local Sample Only (Models 5-6), Contracting Authorities if They Awarded at Least 3 Contracts per Year. Markets if there are at least 10 unique suppliers

Model nr.	(1)	(2)	(3)	(4)	(5)	(6)
Model type	Pooled OLS, full	FE, full	FE, full	FE, full	FE, local	MLM, local
Dependent var.	Corruption risk (single bid %)					
Overall transparency	-0.0624***	-0.0347***	-0.0648***	-0.112***	-0.0733***	-0.0598***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Purchase type: Supplies (ratio) ref cat: Services	-1.922*		0.221	0.308	2.270**	1.307***
	(0.014)		(0.743)	(0.720)	(0.004)	(0.000)
Purchase type: Works (ratio) ref cat: Services	-9.758***		-6.320***	-7.137***	-5.278***	-8.098***
	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)
Logarithm of contract value (net, EUR)	-0.101		0.143	0.218	0.0874	-0.0579
	(0.554)		(0.248)	(0.072)	(0.560)	(0.462)
GDP at current market prices, EUR/inhabitant					-0.000148	-0.000310***
					(0.337)	(0.000)
Employment rates, 15-64 years					-0.308*	-0.468***
					(0.020)	(0.000)
Fertility rate					4.476698	-12.89***
					(0.333)	(0.000)
Lagged singleb bid %				-0.0454***		
				(0.000)		
Constant	10.14***	21.11***	15.04***	27.16***	30.26***	77.14***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year	Y	N	Y	Y	Y	Y
Country	Y	N	N	N	N	N
Region	N	N	N	N	N	Y
Organisation type	Y	N	N	Y	N	Y
Organisation sector	Y	N	N	Y	N	Y
Organisaiton ID	N	Y	Y	Y	Y	N
Observations	76730	88139	77149	39717	40050	39019
R-squared	0.2917	0.0215	0.0169	0.0301	0.0786	0.115

*Note: standard errors clustered on NUTS2 level; * p<0.05, ** p<0.01, *** p<0.001*

Table B4 Fixed-Effects Panel Regressions and Multilevel Modelling regressions for the Total Organizational Sample (models 1-3) as well as for the Local Sample Only (Models 4-5), Contracting Authorities if They Awarded at Least 3 Contracts per Year. Markets if there are at least 10 unique suppliers

Model nr.	(1)	(2)	(3)	(4)	(5)
Model type	FE, full	FE, full	FE, full	FE, local	MLM. local
Dependent var.	Corruption risk (single bid %)				
Ex ante transparency	-0.0636***		-0.0624***	-0.0410***	-0.0370***
	(0.000)		(0.000)	(0.000)	(0.000)
Ex post transparency		-0.0426**	-0.0251	-0.0153	-0.0138
		(0.003)	(0.081)	(0.217)	(0.079)
Purchase type: Supplies (ratio)	-0.275	-0.492	-0.282	2.300**	1.466***
ref cat: Services	(0.749)	(0.584)	(0.741)	(0.004)	(0.000)
Purchase type: Works (ratio)	-7.337***	-7.208***	-7.246***	-5.354***	-8.037***
ref cat: Services	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Logarithm of contract value (net, EUR)	0.231	0.225	0.225	0.0937	-0.0592
	(0.056)	(0.069)	(0.063)	(0.532)	(0.452)
GDP at current market prices, EUR/inhabitant				-0.000149	-0.000302***
				(0.330)	(0.000)
Employment rates, 15-64 years				-0.310*	-0.474***
				(0.019)	(0.000)
Fertility rate				4.639	-12.07***
				(0.316)	(0.000)
Lagged singleb bid %	-0.0454***	-0.0456***	-0.0454***		
	(0.000)	(0.000)	(0.000)		
Constant	23.10***	22.96***	25.04***	28.59***	75.61***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year	Y	Y	Y	Y	Y
Region	N	N	N	N	Y
Organisation type	N	N	N	N	Y
Organisation sector	N	N	N	N	Y
Organisaiton ID	Y	Y	Y	Y	N
Observations	39717	39717	39717	40050	39019
R-squared	0.0167	0.0220	0.0228	0.0810	0.1159

Note: standard errors clustered on NUTS2 level; * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table B5. Fixed-Effects Panel Regressions for the Total Organizational Sample, Contracting Authorities if They Awarded at Least 3 Contracts per Year

Model nr.	(1)	(2)
Dependent var.	Corruption risk (single bid %)	
Ex ante transparency: call for tender published	-0.0786***	-0.0778***
	(0.000)	(0.000)
Ex ante transparency: announcement information content	-0.0277	-0.0262
	-0.056	-0.071
Ex post transparency		-0.0177
		-0.088
Purchase type: Supplies (ratio)	0.331	0.337
ref cat: Services	-0.619	-0.613
Purchase type: Works (ratio)	-7.695***	-7.655***
ref cat: Services	(0.000)	(0.000)
Logarithm of contract value (net, EUR)	0.0563	0.0552
	-0.604	-0.611
Lagged singleb bid %	-0.0552***	-0.0552***
	(0.000)	(0.000)
Constant	29.44***	30.69***
	(0.000)	(0.000)
Year	Y	Y
Region	N	N
Organisation type	N	N
Organisation sector	N	N
Organisaiton ID	Y	Y
Observations	52,931	52,931
R-squared	0.020	0.020

Note: standard errors clustered on NUTS2 level; * p<0.05, ** p<0.01, *** p<0.001