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Lights on the Shadows of Public Procurement

Transparency in government contracting as an antidote to corruption?

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Abstract

Transparency is widely promoted as an essential condition for good governance, and as an effective tool against public sector corruption more specifically. Although the empirical evidence on the impact of transparency on corruption is growing, empirical evidence remains mixed. Recent critique holds that a main reason for the lack of robust empirical evidence is that both conceptualization and available measures of government transparency are broad and sometimes imprecise, and that the concepts of transparency are often far removed from the type of information that is relevant to assess government performance. This paper seeks to develop a more precise conceptualization and measure of transparency that is actionable for the stakeholders of government decisions. The paper uses newly collected data of more than 4 million public procurement contracts between 2006-2015 to investigate the impact of transparency on high-level corruption risks in public procurement across Europe. We find a strong negative impact of overall tender transparency on corruption risks. The results also show that ex-ante transparency, i.e. transparency before the contract is awarded, has a stronger effect on corruption risks than ex-post transparency, i.e. the availability of information after the contract has been awarded to a bidder. This suggest that internal transparency, or transparency first and foremost directed to provide information to the parties involved in the bidding process rather than to outside observers, is the main condition for wider public accountability to emerge. However, the effectiveness of this type of transparency is strengthened in contexts where there is also a wider societal demand for reduced corruption. In sum, our results suggest that transparency can reduce corruption risks if the information is both relevant to inside observers and actionable.

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Introduction

Echoing Brandeis's (1913) famous statement that "Sunlight is said to be the best of disinfectants; electric light the most efficient policeman," researchers 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. Islam 2006; Kosack and Fung 2014; Bauhr and Grimes 2014). Not least is the argument of transparency as purifying force against dubious practices reinforced in the public debate by organizations such as the Transparency International that by its very name equates transparency with a lack of corruption.

Although the body of empirical evidence of transparency's impact on corruption is growing, empirical evidence remains mixed, especially when it comes to large N comparisons. Recent critique by, for example Bauhr and Grimes (2017) hold that a main reason for the lack of robust empirical evidence is that several available composite measures of government transparency tend to be rather broad and risk conflating transparency with participation, accountability, or good governance, which makes it difficult to separate the actual effect of government release of information from general performance. Alternatives suggested by for example Bauhr and Grimes (2017) are, on the other hand, often based on expert perceptions rather than objective indicators. Although such measures have the advantage of being able to capture de facto conditions in a country, they are also susceptible to factors such as cognitive biases or prejudice.

This paper builds on the recent call by Cucciniello et al. (2017:10) for more empirical research trying to match particular forms of transparency to specific outcomes rather than linking broad constructs of transparency to broad democratic objectives such as trust or satisfaction. In addition, it strives to explore the effect of transparency on corruption by means of objective rather than perceptions-based measures. We focus on a specific area of potential corruption that has grown considerable with the rise of the New Public Management (NPM) reform agenda during the last decades, namely the process of awarding public contracts to private enterprises. According to OECD (2005), public procurement, i.e. the purchase of goods and services by governments, is a sector that is particularly vulnerable to corruption due to its relatively shadowy nature where all involved have common interest in maintaining

secrecy. Further, the OECD firmly identifies transparency as a crucial component in strategies to combat corruption in public procurement.

Using novel data on over 4 million public procurement contracts awarded by more than 110,000 public bodies in 28 EU member states between 2006 and 2015 (Fazekas and Kocsis 2017), we construct new objective measures of both transparency and corruption. We also link data from a unique large-scale regional survey to the public procurement dataset in order to study cross-level interactions between transparency and the wider public demand for accountability. Employing diverse statistical methods such as fixed effects panel data regressions and multilevel modelling, we find a strong negative impact of public procurement transparency on corruption risks in public buyer organisations. Furthermore, the results show that ex-ante transparency, i.e. transparency before the contract is awarded, has a stronger effect on corruption risks than ex-post transparency, i.e. the availability of information after the contract has been awarded to a bidder. This suggests that internal transparency, or transparency first and foremost directed to provide information to the parties involved in the bidding process rather than to outside observers, is an essential and critical condition for wider public accountability to emerge. However, quite in line with recent evidence (Chong et al 2015; Bauhr and Grimes 2014; Ferraz and Finan 2008), we also show that "insiders" potential to monitor procurement processes is facilitated in contexts where there is also a wider electoral demand for reduced government corruption..

We thereby seek to make both a theoretical and an empirical contribution. First, we critically review the general arguments around why transparency should reduce corruption and identify some of the main reasons why the link between transparency and reduced corruption has not been as firmly established in empirical research as theories suggest. We suggest that broad conceptualizations of both transparency and corruption risks underestimating the strength of the relationship and develop a more precise, context- specific and actionable conceptualization of transparency in public procurement, distinguishing between ex-ante, the availability of information before the contract is awarded, and ex- post transparency, the availability of information after the public contract has been awarded. We suggest that ex ante transparency is essential to reduce corruption risks in public procurement, but that effects are enhanced in contexts where there is a wider public demand for reduced corruption. Our empirical contribution lies in the development and use of novel publicly available datasets from government

administrative records of procurement tenders as well as a large-scale population survey. The datasets are publicly available at https://opentender.eu/download hopefully supporting further research. The empirical results provide insights into the type of transparency that can reduce corruption risks and the conditions under which it is most impactful.

Transparency as a key to reducing corruption

Transparency is clearly a value with positive connotations in discussions of high performing public administration. Generally associated with insight, purity, and sunshine, it is often con-flated with concepts such as participation and accountability, and is frequently used in the public debate as a metaphor for the open and democratic society. In this paper, however, we use transparency in more narrow sense as a quality and activity of an organization that can be empirically assessed and hypothesized to affect other values. Although an agreed-upon defini-tion of transparency is still lacking, commonly cited definitions in empirically oriented litera-ture such as Florini (2007) Grimmelikhuijsen (2012), and Meijer (2013) have in common that they emphasize the importance of availability of information that is possible to act upon. Ac-cepting this general conceptualization, transparency is clearly related but not equal to ac-countability (e.g. Hood 2010). Although transparency clearly facilitates efficient accountabil-ity, there can be transparency without anyone actually demanding accountability. Similarly, transparency is not equal to public participation. Transparency may certainly be an important condition for effective public participation, but a government can be transparent without pub-lic participation taking place (see, however, the discussion by Meijer et al. 2012).

The general logic of transparency as a cure for corruption, i.e. abuse of entrusted power for private gain, is rather straightforward (e.g. Kolstad and Wiig 2009). Transparency in the form of information about an organization's internal workings reduces information asymmetries and allows for monitoring.. Theoretically, this makes corruption less likely in two main ways. First, the insiders become more prone to act professionally and according to rules and regula-tions since the risk of getting caught gets higher. Second, it makes it easier for outsiders to detect the abuses that still takes place, and if necessary, demand accountability and punish the wrongdoers. In the long run, more honest and efficient incumbents may thereby assume of-fice. As the well-known anti-corruption organization Transparency International (2016) puts

it on their webpage: “Transparency ensures that public officials, civil servants, managers, board members and businesspeople act visibly and understandably, and report on their activities. And it means that the general public can hold them to account. It is the surest way of guarding against corruption, and helps increase trust in the people and institutions on which our futures depend.”

Exactly how the mechanism works is, however, not evident. Even if we disregard the fact that that information may be absent or of low quality even when countries have committed to greater transparency (e.g. Murillo 2015), it is far from certain that increased transparency will have a strong effect on corruption and good governance (Hood and Heald 2006). In particular, the nature of the prospective audiences has generated discussions among transparency researchers. Although many emphasize the mediating role of the civil society (Bauhr and Grimes 2014; Chong et al 2015; Bac 2001) and the necessity of a free press for interpreting and spreading the information of transparency reforms (e.g. Lindstedt and Naurin 2010), a frequent assumption is that the ultimate receiver of the information provided by transparency requests is the general public. Once information is released, the public is supposed to punish corrupt politicians by their votes (e.g. Chong et al 2015; Ferraz and Finan 2008) or to force public officials to resign by naming and shaming. Similarly, in private businesses, the public is supposed to vote by their feet as customers on a competitive market (Fung et al. 2007). Several studies (i.e. Kolstad and Wiig 2009, Fenster 2006) have criticized transparency theory’s inherent presumption of a general public that is both interested in being fully informed, *and* motivated and capable of acting upon the released information. In addition, to be able to actually use transparency to demand accountability there has to be realistic alternatives available that the public perceives as more capable of governing; otherwise transparency may simply cause resignation (Bauhr and Grimes 2014; see also Chong et al. 2015). A frequently overlooked condition is that the public access to information is inherently dependent on motivated “insiders”, whether government officials or companies, to package and disseminate information. Despite an increasing body of work on the importance of whistleblowers (Miceli and Near ,1992 Miethe & Rothschild 1994; Dworkin 2002; Brown et al. 2014), the extent to which insiders are dependent on a wider public demand for accountability, to effectively improve government performance is not always well understood.

Empirical research on transparency's ability to reduce corrupt behavior has to a large extent used single-country or experimental designs (e.g. Reinikka and Svensson 2005; Ferraz and Finan 2008; Chong et al. 2015). Such studies are highly valuable to provide context and a deeper insight into causal mechanisms, but cannot automatically be generalized to other contexts. The number of large N cross-country studies is growing (e.g. Brunetti and Weder 2003; Lindstedt and Naurin 2010; Hollyer at al 2014; Williams 2015) but so far, the general association between transparency and corruption is still less established empirically than one might suspect. In fact, many corruption studies rather assume the link between transparency and reduced corruption than test it. A recent example is Charron et al. (2017: 93) that in one of their measures of corruption risks combine a measure of the outcome of a public procurement process (share of single bid contracts) with a set of procedural characteristics having to do with the transparency of the process. Two critical lines in the current research debate are worth highlighting.

First, one might question the available transparency measures. For example Bauhr and Grimes (2017) argue that composite indices of transparency that combine a broad spectrum of indicators may be the best available option for measuring government transparency cross countries (e.g. Williams 2015; Bellver and Kaufmann 2005), but that available indices tend to be too broad in that they often include aspects that go far beyond transparency in itself. The result is empirical findings that are difficult to interpret. A similar argument holds for the index developed by Hollyer et al. (2014), which maps the extent to which states comply with requests from the World Bank to release indicators that make up the World Development Indicator. Although an impressive and very useful attempt to narrow the scope by focusing on actual release and flow of data, the indicators span over such a range of policy areas and economic conditions that it may not necessarily capture or package information in a way that facilitates the detection of abuses (see also da Cruz et al. 2015).

Not only measures of transparency, but also measures of corruption have received its share of critical scrutiny. Although the research community has devoted far more effort on detecting and measuring corruption than transparency (Bauhr and Grimes 2017), corruption is a particularly sensitive topic that by its very nature is difficult to map. Large N studies on corruption tend to use perception-based measures such as the Corruption Perceptions Index (CPI) by Transparency International or the World Bank's Control of Corruption measure (e.g. Jong-

Sung and Khagram 2005; Rose-Ackerman and Palifka 2016). The perceptions by experts and/or the general public can be argued to catch the "real" level of corruption better than for example measures of the prevalence of formal rules, and recently, Charron (2016) has shown that that the consistency between actual reported corruption, as well as citizen and expert perceptions of corruption is fairly high. At the same time, perception-based measures are sensitive to media reporting, policy attention, and to various forms of cognitive biases of the respondent. Therefore, Olken (2009) among others recommends "considerable caution" when using corruption perceptions as a measure of actual corruption.

Taken together, there are good reasons to narrow the focus and empirically explore which type of transparency that works in different contexts. This is also in line with the recent recommendation by Cucciniello et al. (2017) to perform more transparency research that attempts to understand how particular forms of transparency relate to particular objectives. In addition, although there are several advantages with perception-based measures, research using objective measures is needed to validate these results, in particular since they avoid "echo chamber" results, where expert perceptions may, ultimately, be influenced by general perceptions of a country's level of economic development.

Exploring the relationship between transparency and grand corruption in public procurement

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 also open up for different kind of corruption (e.g. Erlingsson et al. 2008). 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 et al. 2015; OECD 2005).

Broadly speaking, a procurement procedure can be divided into at least three phases: a preparatory stage where needs and budget are set, a second stage of solicitation, bidding and selection, and a final stage where the contract is executed (Dorn et al. 2008). Abuses or corrup-

tion can occur at each stage, but according to Dorn et al. (2008) the preparatory stage where the scopes and terms of the job, as well as the criteria for deciding the winner are decided, should be particularly at risk. If interested actors are able to influence the design and requirements of the call, it can be tailor-made to fit their own strengths and competences, and to exclude prospective competitors. OECD (2005) claims that infrastructural contracts such as construction of major bridges, dams, and tunnels are particularly exposed to corruption in public procurement, 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 for example the sectors of health (Vian 2008) and defense (Rendon and Rendon 2016).

The reason for the high exposure to corruption of the public procurement sector is, first, 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, on the other hand, have a clear interest in making quick and convenient deals eventually leading to favouring a company with long work history and personal connections. Taken together, this means that even in the absence of outright bribing, the procurement situation clearly creates possibilities for private-regarding cooperation between firms and public officials.

Second, a further important reason for why public procurement is especially at risk of corruption is, according to OECD (2005:10), its "shadowy nature"; it is simply very difficult to detect wrongdoings in the procurement process. OECD explains the difficulty with: " … the fact that there is often no clear perpetrator nor victim, rather a group of individuals in collusion, with common interests in maintaining secrecy around their corrupt acts." This shadowiness is further sparked by the fact that public procurement in a technical area that by delegation from responsible politicians to a large extent concerns arrangements between administrators and contract-seekers (OECD 2005: 31). In most cases, these processes can be expected to merit little attention from the public directly, and even journalists may need an indication of something shady going on from someone involved to gain investigative interest in the activities.

Following Fazekas and Kocsis (2017), we identify corruption in the public procurement sector as a case of grand corruption, i.e. corruption that involves political and economic elites and occurs at such high level that the public rarely directly observes it (see also Bauhr and Charron 2017). This type of corruption is systemic in that it permeates policies and dictates

the conditions for political and economic processes. It is interwoven into the rules of the game and is, accordingly, hard to detect and challenge.

Based on the experiences and perceptions of the wide group of experts that participated in a Global Forum conference of corruption in public procurement, the OECD (2005:11) identifies increased transparency as "among the most effective deterrents of corruption in public procurement." While not providing an elaborated explanation, the argument is primarily that transparency is seen as a pre-condition for accountability. By opening up the procedure, "a wide variety of stakeholders" will be able to scrutinize the decisions and performance of public officials and contractors, and thereby hopefully keeping involved actors from engaging in dubious activities; either because unserious actors opt out from beginning as the anticipated risk of getting caught gets too high, or because actual corrupt activities are detected and punished.

Although the argument of transparency's ability to reduce corruption carries intuitive strength, the potential obstacles for the realization of transparency effects previously mentioned—such as the reliance on a receiver that is both willing and capable of taking action—clearly apply in this case and will be further discussed under hypothesis 2. The OECD (2005: 32-33) notes the risk that increased transparency may simply move anti-competitive practices and corruption out of the formal procedure; a possibility that seems analogues to suspicions that increased transparency in political decisions-making forums will simply move the *actual* negotiations to the corridors (or the sauna). For example, if the transparency of the procurement process is increased, the potential bidders may choose to agree on a division of the market (i.e. "you take that tender and I take that one") or to compensate competitors for submitting uncompetitive bids. This means that even if the formal process is impeccable, the result of it could be that the public authority ends up with a winning bid that is inferior to what they would have got in a truly competitive procedure—at the expense of the taxpayers.

While acknowledging these potential barriers to the realization of transparency effects, a *lack* of transparency certainly makes it easier to engage in corrupt activities. Without transparency, neither public officials nor the bidding firms need to engage in creative ways of rounding the system whereas transparency continuously raises the efforts. Therefore we formulate our first hypothesis:

H1. Higher levels of transparency decrease corruption risks in public procurement.

Hypothesizing a general effect of transparency on reduced corruption does not, however, imply that all types of information are equally important. In the area of public procurement, we argue that a main distinction can be drawn between ex ante transparency, i.e. the availability of information *before* the contract is awarded, and ex-post transparency, i.e. the availability of information *after* the contract has been awarded to a bidder. The more precise operationalizations are discussed in the method and data section, but generally, ex ante transparency imply that all information needed to propose a winning bid is released in the call for tenders and that the criteria for deciding the winner are clearly stated, whereas ex post transparency imply that information about the outcome of the process is communicated to the wider public.

We argue that ex ante and ex post transparency serve the needs of different stakeholders to varying 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 audit, performance measurement, and control of public officials), bidding firms; potential as well as those already on 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).

Ex ante transparency and ex post transparency are both relevant to each of these groups, albeit to different degrees. Ex ante transparency is predominantly relevant for bidding firms who plan to bid or are in the process of submitting a bid since it allows firms to identify suitable calls, developing bids in accordance to the preferences of the public agency, and researching their own as well as others' relative strengths. As everything at the ex ante stage is still theoretical, it is, generally speaking, less interesting for the general public and the media. Although journalists may, for example, write about a rigged call, it is easier to make a story about dubious connections and overpriced contracts after a winner is decided. Accordingly, ex ante transparency is to a large extent an internal matter: it allows actors that are directly involved in the process, such as firms in a specific sector that either have or would like to have a public contract, to compete on equal terms, thereby securing a competitive process. These main receivers and users of the information can be expected to fulfil many of the demands of

a capable audience for transparency information (e.g. Fenster 2006; Kolstad and Wiig 2009)—such as being interested in the information as well as willing to act upon it—which means that ex ante transparency has a good chance of being efficient in reducing corruption.

Ex post transparency, on the other hand, is predominantly useful for the wider public—including journalists—and for the government, as they primarily care about actual money spent, actual deadlines for getting the job done, and the actual contractor making the job. Firms certainly make use of ex post information to evaluate their competitiveness and occasionally to appeal the decision, but generally the process is over for competing firms once the contract is awarded, and transparency at this stage is more about informing the outside world what is going on within the sector. Given the nature of the public procurement sector as "shadowy" (OECD 2005), i.e. technical, delegated to bureaucrats, and often not at the center of public or media attention, the primary users of ex post information can, we argue, be expected to be less engaged and less motivated to use the information than the primary users of ex ante transparency. Although *some* procurement processes certainly give rise to large media attention or scandals—often as a result of insider whistle-blowing—it is probably fair to say that most fly under the radar. And, even if a scandal is announced, there must considerable public and/or political pressure to actually demand accountability for the wrongdoings and to correct the corrupt decisions.

Taken together, this implies that ex ante transparency may serve a corruption reducing function rather independently from ex post transparency by securing the conditions for a competitive process where firms—insiders as well as current outsiders—can rival each other on equal terms. Ex post transparency, on the other hand, is to a larger extent dependent on external—and in this case less motivated or reliable—actors to actually have an effect on corruption. In addition, and in line with the recent argument by Reynaers and Grimmelikhuijsen (2015), internal or ex ante transparency is often necessary to achieve meaningful external or ex post transparency as it is difficult to properly evaluate the output of the process without knowledge of the ex ante conditions. We therefore formulate the following second hypothesis:

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

Although insiders play an important role as receivers and users of ex ante information—especially under "shadowy conditions"—the surrounding society largely determines the scope and conditions for how this information can be utilized. Ultimately, the design and implementation of public procurement processes are decided politically, which means that they are dependent on voters. The literature on electoral accountability and its relationship with information on government performance (e.g. Eggers, 2014; Ferraz and Finnan, 2008; Larreguy et al, 2014; also World Bank World Development Report 2016, chapter 3) suggests, however, that exposure of inaccuracies or corruption do not necessarily result in losses for incumbents; to some extent because information is not communicated or circulated, and to some extent because voters have other priorities.

This imply that for transparency to work as intended, voters have to be willing and able to punish corrupt politicians by switching to alternative parties. In the absence of such an environment of accountability, insiders do not have to fear that an exposure of dubious affairs will result in a political turnover and a potential change in procurement policy, which means that they have few incentives to abstain from questionable practices. Similarly, insiders detecting actual abuses may see no point in "blowing the whistle" as change is unlikely, only when a powerful coalition of insiders and the broader voter base can change effectively happen (Johnston & Kpundeh, 2002). Therefore, our third hypothesis reads:

> *H3. Transparency more strongly decreases corruption risks in contexts where voters predominantly respond to corruption scandals by switching to another party (voice).*

Data and measurement

We use administrative public procurement data of European countries. The data contain information on individual public procurement tenders that are regulated administrative procedures in which public bodies purchase goods and services for the 28 EU member states (EU28) - and other European states such as Switzerland and Norway - between 2006 and 2015, including, for example, contract value, the deadline for submitting bids, and the assessment criteria used. They derive from the European Union's Tenders Electronic Daily (http://ted.europa.eu/), which is the mandatory online publication that falls under the remit of

the Public Procurement Directive that aims to foster a single market in government contracts. This means that large (both national and EU) contracts are included in the database, with publication thresholds varying over time, while being approximately 125,000 Euro for service contracts and 4,000,000 Euro for public works contracts. Similarly, structured and regulated public procurement data exists across the globe, making our measurement strategy generally replicable outside Europe as well (http://ocds.open-contracting.org/). The full contract-level public procurement database can be downloaded at digiwhist.eu/resources/data.

Using TED data, we created an organisation level panel database to capture public procurement characteristics annually over time, both independent and dependent variables. Organisation-year level indices represent the simple average of all contracts awarded by the organisation and year in question. As official organizational ID numbers are not published in the public procurement notices, we identified the contracting authorities by their names. After basic text cleaning procedures - such as eliminating spaces and punctuation marks, and changing all letters to lowercase – we considered organizations the same, if their names were exactly identical. While these organizational IDs are imperfect, the error they introduce is assumed to be random noise due to 2 reasons: i) we assume that organization name variants such as abbreviations are orthogonal to our main dependent and independent variables (there is virtually no missing buyer name in the database, so transparency or administrative quality are likely not influencing 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 ID-s due to abbreviations and variants on the same organization name is most of the bias we introduce by not knowing the true organizational IDs. Hence, our point estimates of organization level indices using only a subsample of contracts belonging to an organization increases random noise rather than systematic bias. At any rate, the ID generation procedure will be substantially improved in the future by taking into consideration the address of contracting authorities as well, and applying distance measures instead of exact matching.

As dependent variable, we use a simple indicator of corruption risk: when only one bid was submitted on a tender in an otherwise competitive market. Hence, the percentage of single bidder contracts awarded in all the awarded contracts of a contracting authority is the most straightforward measure we use to capture corruption risks and, we argue, this indicates a

climate very favourable for the type of corruption we envision in our theory. As this – like most other measures of corruption – is not a direct measure of corruption, one clear potential pitfall with this measure is that it is not actually capturing grand corruption, but something else, such as lack of competitive markets or low administrative quality. Although occasionally a single-bid process may be perfectly legitimate—we argue that a large share of single-bid contracts gives us a good indication of whether the process of procurement involves dubious practices and grand corruption risks.

In order to avoid distortion from less competitive markets such as defence, markets with less than three public procurement contracts a year were excluded from the analysis as market size is strongly correlated with number of companies on the market, hence competitiveness. In all, the dataset is based on approximately 3.5 million awarded contracts. The dataset covers close to all major contracts awarded by governments across the EU (e.g. contracts worth more than about 130,000 EUR in the services sector).

Our measurement approach towards transparency was very much motivated by the desire of moving away from country-level macro indices which are defined by normative assumptions or policy requirements rather than empirical research on what matters and what not. Aggregate scores may therefore reflect how well a state "ticks a number of boxes considered favorable" without regard to which features are crucial and which are less essential (Bauhr and Grimes 2017; Michener 2015; Scheppele 2013)

Hence, to measure our independent variable, transparency in public procurement, we counted the number of missing pieces of information in two types of public procurement notices: call for tenders and contract award notices. This is the most basic test of transparency, i.e. is the information which is by law required to be published in announcements likely to be actually present. This is only an approximation as we cannot check whether the information present in the announcements is correct or meaningful beyond the type of characters used (e.g. contract value should be expressed using numerical rather than alphabetical characters). 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 share of missing information in call for tenders (in an extreme case, the complete lack of such announcement) which most directly affect potential bidders' decision about participating; while ex post transparency is related to contract award notices which typically contain information

of a much broader use such as journalists writing about suppliers connected to politicians. The following binary variables are included in the ex ante and ex post measure of transparency (Table 1 and Table 2).

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 tenders (0: not missing 1: missing)
missing criteria	Information about the exact criteria is missing in the call for tender (in case of 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 tenders are imprecise (only 2 digits are given) (0: precise 1: imprecise)
no call for tenders	Call for tenders 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 using of EU-funds is missing from the contract award notice (0: not missing, 1: missing)

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

$$\textit{Ex post transparency} = 100 - 100*(\textit{missing winner name} + \textit{missing NUTS codes} + \textit{missing subcontracting} + \textit{missing contract value} + \textit{missing EU funds})/5$$

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

$$\textit{Ex ante transparency} = 100 - 100*(\textit{no call for tenders} + (1 - \textit{no call for tenders}) * (\textit{missing language information} + \textit{missing selection method} + \textit{missing criteria} + \textit{imprecise CPV codes} + \textit{missing duration})/5)$$

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.

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

It is important to note that all three indices take high values (close to 100) if several pieces of information are present in public procurement notices. So, values close to 0 indicate a low level of transparency and values close to 100 indicate a high level of transparency.

For measuring voter responses to corruption by political parties on the regional level we use data from a large survey of 85,000 individuals in 24 European countries (Bauhr-Charron, 2017). The survey was conducted in 2013 using the local language of each country. It solicited views of a randomly selected sample between 1,200 and 10,500 respondents per country (varying by population size), providing a high degree of measurement reliability per region due to the large sample size. While there is no single best way to measure voter responses to corruption among politicians, the survey measured it using the following question:

> *"Now imagine that party was involved in a corruption scandal; which of the following would be most likely? (a) still vote for the preferred party, (b) vote for an alternative party not involved in the corruption scandal, (c) not vote at all."*

Response (c) most closely represents our idea of exit, as the respondent is clearly choosing to abstain from the democratic process. Thus, we create a dummy variable that equals "1" if an

individual selected this response and "0" if otherwise. Response (b) most directly captures our idea of accountability, or voice, as the respondent intends to vote, but decides to punish the corrupt party (despite it being their first preference) by voting for an another party. A dummy variable is thus created, where an individual receives a "1" if he or she gave answer (b) and "0" if otherwise. Loyalty is coded "1" if the respondent chose response (a), "still vote for the preferred party", and "0" if otherwise. Each of these dummy variables then were aggregated to the regional level using standard population weights.

In order to test the effects of transparency on the share of single bidder contracts, we conduct panel data regressions in the organizational level database. In particular the following two models are estimated:

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

(Equation 1)

Where *Sb* is the share of contracts with single bidder in organization *i* in year *t*. The main explanatory variables that we put to test are 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*. The three different transparency measures are either entered separately, or ex post and ex ante transparency entered jointly in regressions (the two transparency measures are only weakly correlated at the organizational level, see Table 3.

In addition, vectors of covariates are added that will differ by the type of estimation carried out, but in its fullest form of the model, *Xte* and *Xre* are both included. *Xte* represents a vector of covariates which describe some characteristics of the tenders conducted by the contracting authorities. It includes, per organization *i* and year *t*: the logarithm of the average contract value, and the share of different types of procurement (ie. services, supplies and works). *Xre* includes economy and employment related covariates at the regional level. This vector is included only in estimations carried out on a subsample of local authorities which operate only in one NUTS2 region. This vector contains, per organization *i* and year *t*: a measure of GDP per capita, and regional employment rate.

All these covariates are in theoretical terms potential additional explanatory factors for corruption in a country (Fazekas & Cingolani, 2016). Overlooking them could easily lead to omitted variable bias

where changes in both the explanatory and dependent variable may be driven by these omitted aspects. Finally, ε is the random error measure by organization *i* in year *t*.

In order to test interaction effects between voter responses to corruption and transparency, we also run multilevel modelling estimations including a wider set of controls on the region and agency levels: Purchase type: Supplies, Works, logarithm of contract value (net, EUR), GDP at current market prices, EUR/inhabitant, employment rates (15-64 years old), fertility rate, agency type, and agency sector. While a cross-sectional set-up is less adequate for identifying causal relationship, we had no better option due to the lack of time series data on voter attitudes towards political corruption.

Results

As a simple preliminary exploration, we analyze the bivarate relationships between the overall, ex ante, and ex post transparency variables on the one hand and single bidder share on the other (Table 3). Initially refuting our hypotheses, increasing transparency in a public body's procurement practice is associated with higher corruption risks as measured by single bidder share. While all linear correlation coefficients are rather small, ex ante transparency appears to have weaker relationship with single bidding than ex post transparency.

Table 3. Bivariate linear correlations between single bidding and transparency variables, for organizations whose yearly contract number is at least three, (N: between 130,000 and 140,000)

	Corruption risk (single bidder ratio)	Overall transparency	Ex ante Transparency	Ex post transparency
Corruption risk (single bidder ratio)	1			
Overall transparency	0.1271*	1		
Ex ante transparency	0.0720*	0.8987*	1	
Ex post transparency	0.1583*	0.6559*	0.2584*	1

*Note: * p<0.05*

In order to test H1 in greater detail, we ran simple pooled OLS as well as fixed effects panel regressions[5]. Hausman test suggested that the less efficient, but consistent fixed effects estimator is preferable to the random effects model which is also in line with our theoretical ex-

[5] Multilevel models were also run with country, region, and public buyer organisation as levels leading to essentially the same conclusions are reported below. We only show the results obtained by using the more widely used panel data methods.

pectation of strong organizational inertia. The results are shown in Table 4, where we run fixed effects models without as well as with regional controls. H1 is supported by all regression models: Increasing transparency by one additional information item decreases single bidding by 0.4-0.7 % points across the different models. In our preferred, most complete model with regional controls (model 4 in table 4), a one standard deviation (23.6 points) increase in transparency decreases single bidding by 1.1%. 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; while regional controls account for the development of local supplier markets and business practices which influence procurement outcomes even after holding organizational quality constant.

Table 4. Pooled OLS and fixed effects panel regressions for the total organizational sample, and for the local sample only (contracting authorities if they awarded at least 3 contracts/year)

	(1)	(2)	(3)	(4)
Model type	Pooled OLS	FE	FE	FE
Dependent variable	Corruption risk (single bid %)	Corruption risk (single bid %)	Corruption risk (single bid %)	Corruption risk (single bid %)
Overall Transparency	-0.0705***	-0.0419***	-0.0425***	-0.0480***
	0.000	0.000	0.000	0.000
Purchase type: Supplies (ratio) *ref cat: Services*	-2.710***		0.014	1.182
	-0.001		-0.98	-0.069
Purchase type: Works (ratio) *ref cat: Services*	-11.70***		-7.089***	-6.140***
	0.000		0.000	0.000
Logarithm of contract value (net, EUR)	0.157		0.157	0.000
	-0.41		-0.126	-0.999
GDP at current market prices, EUR/inhabitant				0.000518***
				0.000
Employment rates, 15-64 years				-0.448***
				-0.001
Fertility rate				6.194
				-0.079
Constant	11.05***	21.67***	21.97***	26.50**
	0.000	0.000	0.000	-0.003

Year dummies	Y	N	N	N
Country dummies	Y	N	N	N
Observations	112107	127467	112106	59434
R-squared	0.252	0.016	0.015	0.036

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

In order to explore H2 on the different effects of ex ante and ex post transparency, we run the same panel regressions with the two transparency indicators entered separately then jointly, this time without regional controls (Table 5). We find noteworthy differences between the two different forms of transparency. The effect of ex ante transparency is statistically significant and large in every specification, decreasing corruption risks, that is across the different models increasing ex ante transparency by one additional information item decreases single bidding by about 0.6 % points. In our preferred, most complete model (model 4 in Table 5), a one standard deviation increase in ex ante transparency (36.8 points) decreases single bidding by 1% points. However, the effect of ex post transparency is very small and insignificant in every model. These results lend considerable support to H2.

Table 5. Fixed effects panel regressions, all contracting authorities (contracting authorities if they awarded at least 3 contracts/year), no regional controls in model

Model	(1) FE	(2) FE	(3) FE	(4) FE
Dependent variable	Corruption risk (single bid %)	Corruption risk (single bid %)	Corruption risk (single bid %)	Corruption risk (single bid %)
Ex ante transparency		-0.0271***		-0.0278***
		0.000		0.000
Ex post transparency			0.000203	0.0119
			-0.981	-0.191
Purchase type: Supplies (ratio) *ref cat: Services*	0.0129	0.0256	0.013	0.031
	-0.981	-0.963	-0.981	-0.955
Purchase type: Works (ratio) *ref cat: Services*	-7.134***	-7.121***	-7.134***	-7.140***
	0.000	0.000	0.000	0.000
Logarithm of contract value (net, EUR)	0.152	0.159	0.152	0.16
	-0.138	-0.120	-0.138	-0.118
Constant	19.01***	20.55***	18.99***	19.62***
	0.000	0.000	0.000	0.000
Observations	112106	112106	112106	112106

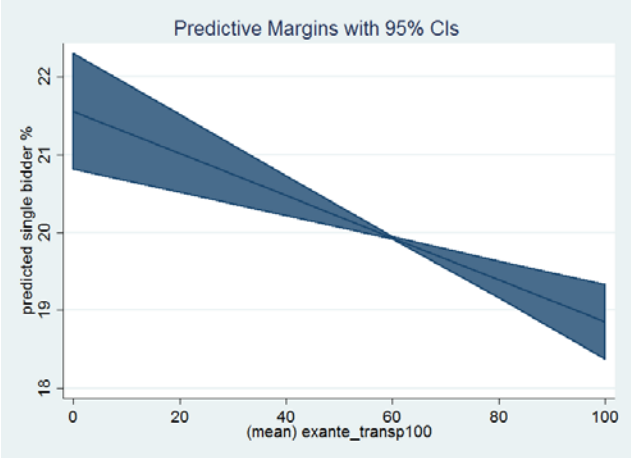
overall R^2	0.034	0.019	0.035	0.023

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

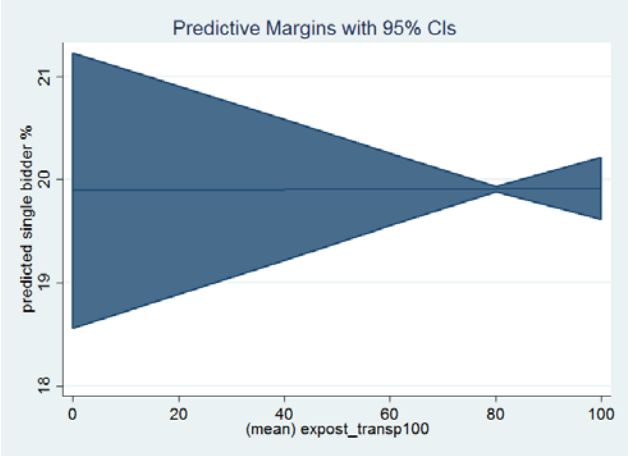
Another way of demonstrating the evidence we gathered in support of H1 and H2 is the visual representations of predicted single bidder % as a function of the different transparency measures (Figure 1). Interestingly, the overall transparency effect is very close to the effect of ex ante transparency,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

Figure 1. The predicted effect of overall, ex ante, and ex post transparency on the percentage of single bidding in public procurement

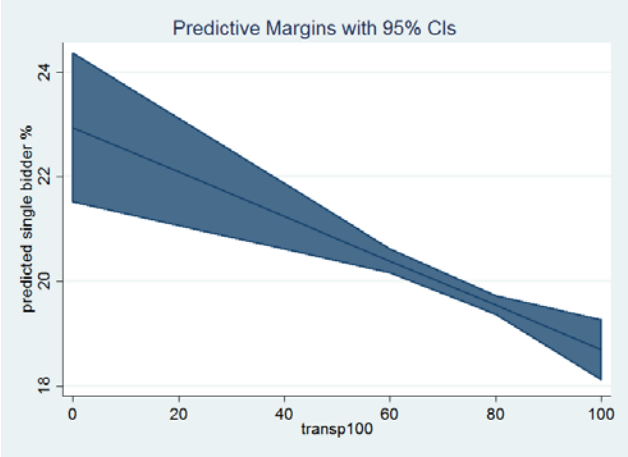
Panel i. Ex ante transparency



Panel ii. Ex port transparency



Panel iii. Overall transparency



While a decrease of about 0.4-0.7% in single bidding due to an additional missing information item might not sound substantial (from tables 4 and 5), given that single bidder contracts are on average 7.1% more expensive than contracts with 2 or more bidders, the associated annual price savings across Europe are substantial. As a back-of-the-envelope calculation, take increasing transparency by 5 items on average in Europe (out of 10 items considered) which would decrease single biding by 2-3.5 % points translating into a 0.14-0.25% cheaper procurement tendering on average, that is about 3.6-6.3 billion EUR savings per year across the EU.

Interactions

Now we turn to analyzing the interactions between voter responses to corruption and transparency in determining corruption risks (H3). As survey data is only available for 2013, we had to revert back to a cross-sectional Multilevel modelling specification using a wide range of control variables and region constant terms to control for unobserved region-effects (*Table 6*). We repeat the previous panel data specifications on the 2013 sample to demonstrate that there is no bias from the narrower sample (models 1 and 2). We find that the estimated regression coefficients are quantitatively close to the full sample results, for example one additional transparency item leads to 1-1.2 % points lower single bidding in the 2013 regressions (models 1 and 3 in *Table 6*) compared to 0.4-0.7% in the OLS and fixed effects panel regression models (*Table 4*). Then we test the impact of voice, i.e. the share of voters responding to corruption scandals by switching party, independently as well as interacting with overall transparency and ex ante transparency (ex post transparency turned out to be insignificant in interactions). In line with our expectations based on prior research (Bauhr-Charron, 2017), a higher share of respondents exercising voice is associated with lower single bidding. The effect size is substantial as well las significant: a 10% increase is the share of voters exercising voice in a region is associated with a 3.4% decrease in average single bidding prevalence among public buyers in that region.

Table 6. Multilevel regressions, 2013, local contracting authorities (contracting authorities if they awarded at least 3 contracts in regions with at least 35 contracting authorities), with regional controls and voice %

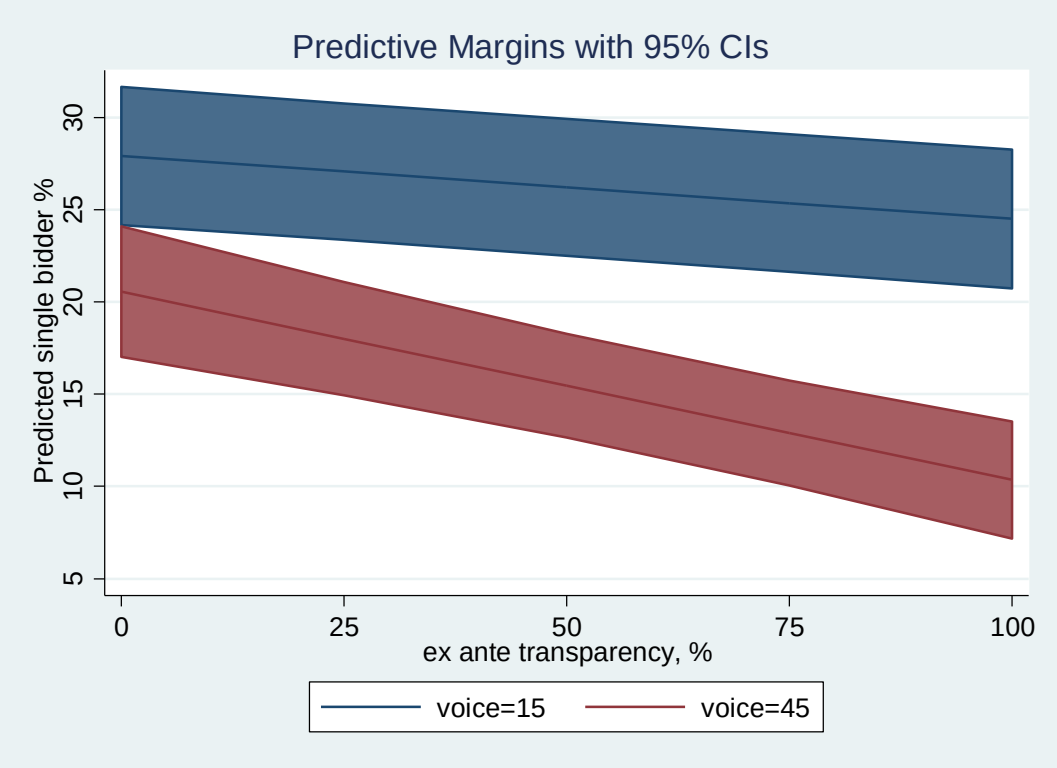
Model	1	2	3	4	5	6
Dependent variable	Corruption risk (single bid %)					
Overall transparency	-0.118***		-0.098***			
	0.000		0.000			
Ex ante transparency		-0.079***		-0.065***		
		0.000		0.000		
Ex post transparency		0.016		0.009		0.015
		-0.478		-0.710		-0.531
Voice			-0.335***	-0.358***	-0.127	-0.245*
			0.000	0.000	-0.245	-0.014
Voice # overall transparency					-0.003***	
					0.000	
Voice # ex ante transparency						-0.002***
						0.000
	Controls					
Purchase type: Supplies, Works	Y	Y	Y	Y	Y	Y
Logarithm of contract value (net, EUR)	Y	Y	Y	Y	Y	Y
GDP at current market prices, EUR/inhabitant	Y	Y	Y	Y	Y	Y
Employment rates, 15-64 years	Y	Y	Y	Y	Y	Y
Fertility rate	Y	Y	Y	Y	Y	Y
Agency type	Y	Y	Y	Y	Y	Y
Agency sector	Y	Y	Y	Y	Y	Y
Constants (main&nuts)	Y	Y	Y	Y	Y	Y
Observations (org)	5149	5149	4532	4532	4532	4532
Observations (nuts)	105	105	94	94	94	94
R-squared (org. level)	0.118	0.119	0.139	0.142	0.139	0.142
R-squared (nuts level)	0.489	0.478	0.557	0.558	0.557	0.558

*Note: p-values are below coefficients; * p<0.05, ** p<0.01, *** p<0.001; Snijders/Bosker R-squared values reported*

When investigating the interactions between voter responses to corruption and transparency, three crucial findings emerge pursuant H3. First, voters' voice crucially enhances the negative impact of ex ante transparency on corruption risks (Figure 2). In regions where the share of

voters responding to a corruption scandal by voting for another party in high (45%), the impact of transparency is very strong: moving from ¼ to ¾ of items reported decreases predicted single bidding from 18% to 13%, a 5% point decrease. While in regions with few voters willing to exercise voice (15%), ex ante transparency has a close to negligible impact: moving from ¼ to ¾ of items reported decreases predicted single bidding from 27% to 25%, a slightly less than 2% point decrease. Second, when including the interaction term in the multilevel regression models, the independent impact of transparency on corruption risks is insignificant; that is most of the beneficial impacts of transparency on corruption control goes through responsive voters and correlated phenomena such as active civil society and business associations. Third, the fact that ex ante transparency is highly significant in interaction with voters exercising voice while ex post transparency is not suggests that anticorruption efforts are most successful where businesses are well informed to demand accountability in tenders while citizens motivate parties to fight corruption through electoral responses. Such a broad-based anticorruption coalition has been identified as effective in a wide range of studies (Johnston & Kpundeh, 2002).

Figure 2. The predicted effect of ex ante transparency on the share of single bidding in public procurement interacted with voice %, local buyers (model 6 in table 6)



Robustness

We also run additional regression models to test the robustness of our findings. First, in order to fully mirror the analysis conducted for the total transparency effect, the models separately analyzing ex ante and ex post transparency are also rerun on the local-level buyer sample including additional development oriented control variables: gdp/capita, employment rate and fertility rate. In all these specifications, the substantive conclusions remain the same, while coefficient sizes vary somewhat, supporting our main findings (for details see Table A6 in the Appendix). This shows that all our results are robust to the inclusion of widely used time-varying controls as well as to restricting the sample to local public bodies.

Second, it is possible that our findings our sensitive to data quality, in particular the imprecision in linking call for tenders to contract awards. Recall, our measure of ex ante transparency is dependent on whether we can observe a call for tenders linked to the contract award or not. However, there are a lot of contract awards where according to the official procedural regulations there must have been a call for tenders, but we cannot observe any which suggests that it might be an error in the IT system linking announcements rather than a genuine lack of transparency. Hence, we separately included two ex ante indicator variants in the regression models, one in which missing call for tenders was taken into account only when the procedural rules allowed for it (i.e. supposedly no database error) and another one otherwise (see Table A7 in the Appendix). Reassuringly, the effect of ex ante transparency almost entirely due to situations where procedural rules allow for avoiding transparency, while the effect of measured lack of transparency when procedural rules would not allow for it (e.g. open procedures without a call for tenders published) is insignificant, essentially representing random noise in our models.

Third, we also explore different specifications underlying our findings on the interactions between transparency and voter responses to corruption among political parties. In order to also use simpler regression models, we also repeat the multilevel analysis presented in Table 6 using simple OLS with clustered standard error leading to the same substantive conclusions (Table A8). In addition, to complement the picture about potential voter responses, we run multilevel models similar to the above taking the share of voters who remain loyal to corrupt political parties (loyalty) and the share of voters who respond by not voting at all (exit). Find-

ings reinforce the importance of diverse interactions between electoral accountability and transparency (Table A9).

Conclusions

Researchers as well as policymakers frequently advocate the doctrine of transparency as a promoter of good governance in general, and as an effective tool against public sector corruption more specifically. Although the body of empirical evidence on the impact of transparency on corruption is growing, the argument still relies to a large extent on its normative attractiveness and its intuitive as well as theoretical strength; especially when it comes to large N or cross-country comparisons. Recent critiques hold that a main reason for the lack of robust empirical evidence is that available composite and country-level measures of government transparency, make it difficult to separate and interpret the actual effects of transparency. This paper follows up on the recent call by Cucciniello et al. (2017:10) for more empirical research trying to match particular forms of transparency to specific outcomes rather than linking broad constructs of transparency to broad objectives. Using newly collected data of more than 4 million public procurement contracts between 2006-2015 linked to voter behaviour data from a unique large-scale regional survey, the paper investigates the impact of transparency on high-level corruption risks in public procurement across Europe and the mitigating effect of voter behaviour in this relationship. Findings show a strong negative impact of overall tender transparency on corruption risks: one additional information item published decreases single bidding by 0.4-0.7 % points across the different regression models. While such effect size might not sound substantial, given that single bidder contracts are on average 7.1% more expensive than contracts with multiple bidders, the associated annual price savings across Europe are substantial. For example, increasing transparency by 5 items on average (out of 10 items considered) could decrease single biding by 2-3.5 % points translating into a 0.14-0.25% cheaper contracts, equalling about 3.6-6.3 billion EUR savings per year across the EU.

The results also point out that that ex-ante transparency, i.e. transparency before the contract is awarded, has a stronger effect on corruption risks than ex-post transparency, i.e. the availability of information after the contract has been awarded to a bidder. This suggest that internal transparency, or transparency first and foremost directed to pro-vide information to the parties

involved in the bidding process rather than to outside observers, is the main condition for wider public accountability to emerge. We also find that transparency decreases corruption risks only when voters are responsive to corruption scandals and switch votes to a competing party.

We thereby make several contributions to the literature on transparency and corruption. First of all, while new and authoritative cross country measures of government transparency have proliferated in recent years, both based on published government statistics as well as expert perceptions (Williams 2014; Bauhr and Grimes 2017; Hollyer et al 2014), recent critique suggest that these measures risks being sometimes detached from the contexts in which it would be used. Perception based measures furthermore risks to produce echo chambers where experts may rate countries levels of transparency based on general perceptions of countries performance, including GDP/capita. In other words we need transparency measures that are relevant for the situation at hand. We therefore suggest a more precise objective measures of transparency relevant for public bids.

In doing so we employ a unique data set containing nearly 4 million public procurement tenders for European countries between 2006 and 2015. The data contain information on individual public procurement tenders including, for example, contract value, the deadline for submitting bids, and the assessment criteria used. This means that large (both national and EU) contracts in are included in our data.

We employ this data to better distinguish between different forms of transparency. The concept of transparency is very likely one of the most complex concepts in the social sciences. Perhaps in response to complexity, several of the most influential empirical analyses on the causes and effects of transparency focus on how much transparency there is in any particular polity, rather than on its different types A limited focus on levels of transparency however, entails a risk of false inferences, since different forms of transparency may have widely different causes and societal effects. While such examination has been underrepresented in transparency research, as well as in comparative empirical research on corruption general, there have been several attempts to distinguish between different forms of transparency. We suggest that the distinction between ex ante and ex post transparency is particular relevant to detect corruption risks in public procurement, with implications for the types of users that is

likely to access and use the information involved as well as whether the information will primarily be used for internal or external use.

Our analysis show the need for both employing more new and better measures of transparency and better distinguishing between its different forms in order to deploy the kind of transparency that can reduce corruption. The results suggest that internal transparency, transparency first and foremost directed to provide information to the parties involved in the bid process rather than to outside observed, is an essential and critical condition for more wider public accountability to emerge.

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Appendix

Table A1: Share of contracts with single bid, TED, 2006-2015, non-competitve markets filtered out

Country	Single bid share
AT	0,10
BE	0,12
BG	0,21
CH	0,07
CY	0,26
CZ	0,25
DE	0,11
DK	0,07
EE	0,29
ES	0,14
FI	0,08
FR	0,13
GR	0,24
HR	0,39
HU	0,28
IE	0,03
IS	0,01
IT	0,25
LT	0,21
LU	0,10
LV	0,18
MK	0,25
MT	0,17
NL	0,08
NO	0,06
PL	0,44
PT	0,15
RO	0,21
SE	0,04
SI	0,20
SK	0,35
UK	0,04
Total	0,22

Table A2: Correlations between ex ante transparency and missing information, contracting authority level data (authorities with at least 3 awarded contracts/year)

	missing selection method	missing criteria	missing language information	imprecise CPV codes	missing duration	ex ante transparency
missing selection method	1.0000					
missing criteria	-0.1168*	1.0000				
missing language information	0.1320*	0.0189*	1.0000			
imprecise CPV codes	0.0338*	0.0453*	0.0274*	1.0000		
missing duration	0.2104*	0.0464*	0.0937*	0.0377*	1.0000	
ex ante transparency	-0.1436*	-0.3007*	-0.1378*	-0.1867*	0.0592*	1.0000

Table A3: Correlations between ex post transparency and missing information, contracting authority level data (authorities with at least 3 awarded contracts/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	0.2201*	1.0000				
missing subcontracting	0.1215*	0.5422*	1.0000			
missing contract value	0.0284*	0.1970*	0.3174*	1.0000		
missing winner name	0.0144*	-0.0043	0.0814*	-0.0513*	1.0000	
ex post transparency	-0.5485*	-0.7257*	-0.7655*	-0.5530*	-0.1448*	1.0000

Table A4. Number of contracts between 2006-2015, non-competitive markets excluded

Year	Freq.	Percent	Cum.
2006	193,020	5.49	5.49
2007	259,361	7.38	12.87
2008	296,644	8.44	21.31
2009	330,274	9.40	30.71
2010	367,019	10.44	41.15
2011	386,475	11.00	52.15
2012	400,853	11.41	63.55
2013	408,787	11.63	75.18
2014	421,978	12.01	87.19
2015	450,254	12.81	100.00

Table A5: Descriptives of variables in panel regressions (contracting authority level data, 2006-2015)

variable	mean	sd	min	max	N
single bidder ratio	18.74	27.45	0	100	155411
overall transparency	67.27	23.57	0	100	
ex ante transparency	58.23	36.83	0	100	140060
ex post transparency	76.30	21.39	0	100	170620
purchase type: supplies (ratio)	0.40	0.43	0	1	170620
purchase type: works (ratio)	0.15	0.31	0	1	170620
log contract value (net EUR)	12.71	1.68	4.33	22.39	150993
GDP at current market prices per inhabitant (EUR)	28034	16116	2900	172600	140470
employment rates (15-64 years)	64.94	6.74	38.90	81.80	142256
fertility rate	1.64	0.31	0.95	3.80	

Table A6. Fixed effects panel regressions, local contracting authorities (contracting authorities if they awarded at least 3 contracts/year), with regional controls

	(1) FE	(2) FE	(3) FE	(4) FE
Dependent variable	Corruption risk (single bid ratio)	Corruption risk (single bid ratio)	Corruption risk (single bid ratio)	Corruption risk (single bid ratio)
Ex ante transparency		-0.0296***		-0.0301***
		0.000		0.000
Ex post transparency			-0.00606	0.00702
			-0.587	-0.541
Purchase type: Supplies (ratio) *ref cat: Services*	1.192	1.2	1.187	1.205
	-0.067	-0.065	-0.068	-0.064
Purchase type: Works (ratio) *ref cat: Services*	-6.235***	-6.178***	-6.223***	-6.191***
	0.000	0.000	0.000	0.000
Logarithm of contract value (net, EUR)	0.00194	0.00378	0.00105	0.00483
	-0.986	-0.972	-0.992	-0.964
GDP at current market prices, EUR/inhabitant	0.000467***	0.000531***	0.000467***	0.000532***
	0.000	0.000	0.000	0.000
Employment rates, 15-64 years	-0.429**	-0.452***	-0.429**	-0.453***
	-0.001	-0.001	-0.001	-0.001
Fertility rate	4.813	6.32	4.853	6.295
	-0.163	-0.074	-0.159	-0.075
Constant	25.46**	24.63**	25.89**	24.11**
	-0.003	-0.005	-0.002	-0.006
Observations	59434	59434	59434	59434
R-squared	0.027	0.036	0.028	0.036

Note: standard errors clustered on NUTS2 level

Table A7. Fixed effects panel regressions, local contracting authorities (contracting authorities if they awarded at least 3 contracts/year), with regional controls and different ex ante transparency measures

	(1) FE	(2) FE	(3) FE	(4) FE
Dependent variable	Corruption risk (single bid ratio)	Corruption risk (single bid ratio)	Corruption risk (single bid ratio)	Corruption risk (single bid ratio)
Ex ante transparency (open procedure)	0.00858		0.0115	0.0112
	0.053		0.154	0.167
Ex ante transparency (non-open procedure)		-0.0280***	-0.0268***	-0.0268***
		0.000	0.001	0.001
Ex post transparency				0.00482
				0.790
Purchase type: Supplies (ratio) *ref cat: Services*	1.122	0.408	-0.0856	-0.0822
	0.100	0.673	0.943	0.945
Purchase type: Works (ratio) *ref cat: Services*	-6.298***	-6.432***	-6.924***	-6.940***
	0.000	0.000	0.000	0.000
Logarithm of contract value (net, EUR)	0.0421	-0.0188	0.132	0.132
	0.735	0.882	0.390	0.390
GDP at current market prices, EUR/inhabitant	0.000533***	0.000372**	0.000548***	0.000547***
	0.000	0.005	0.000	0.000
Employment rates, 15-64 years	-0.417**	-0.546**	-0.571**	-0.571**
	0.002	0.001	0.003	0.003
Fertility rate	3.848	9.861*	9.235*	9.198*
	0.262	0.027	0.048	0.049
Constant	24.11**	29.37**	26.51*	26.23*
	0.006	0.005	0.028	0.029
Observations	52771	23911	17248	17248
R-squared	0.007	0.010	0.011	0.011

Table A8. OLS regressions, 2013, local contracting authorities (contracting authorities if they awarded at least 3 contracts), with regional controls and voice %

Model	1	2	3	4	5	6
Dependent variable	Corruption risk (single bid %)					
Overall transparency	-0.095***		-0.073**			
	0.000		-0.003			
Ex ante transparency		-0.059***		-0.051***		
		0.000		0.001		
Ex post transparency		-0.007		0.012		0.012
		0.762		0.647		0.629
Voice			-0.340***	-0.362***	-0.189*	-0.262***
			0.000	0.000	0.039	0.001
Voice # overall transparency					-0.002**	
					0.005	
Voice # ex ante transparency						-0.002***
						0.001
Controls						
Purchase type: Supplies, Works	Y	Y	Y	Y	Y	Y
Logarithm of contract value (net, EUR)	Y	Y	Y	Y	Y	Y
GDP at current market prices, EUR/inhabitant	Y	Y	Y	Y	Y	Y
Employment rates, 15-64 years	Y	Y	Y	Y	Y	Y
Fertility rate	Y	Y	Y	Y	Y	Y
Agency type	Y	Y	Y	Y	Y	Y
Agency sector	Y	Y	Y	Y	Y	Y
Constants	Y	Y	Y	Y	Y	Y
Observations	6181	6181	5479	5479	5479	5479
R-squared	0.114	0.115	0.133	0.134	0.133	0.134

Note: standard errors clustered on NUTS2 level

Table A9. Multilevel regressions, 2013, local contracting authorities (contracting authorities if they awarded at least 3 contracts in regions with at least 35 contracting authorities), with regional controls and voice %

Model	1	2	3	4	5	6
Dependent variable	Corruption risk (single bid %)					
Loyalty	0.029		0.025		0.196	
	-0.868		-0.891		-0.284	
Exit		0.196*		0.190*		0.264**
		-0.018		-0.025		-0.003
Ex ante transparency			-0.065***	-0.065***		
			0.000	0.000		
Ex post transparency			0.001	0.006		0.008
			-0.983	-0.782		-0.733
Loyalty # ex ante transparency					-0.003***	
					0.000	
Exit # ex ante transparency						-0.002***
						0.000
Controls						
Purchase type: Supplies, Works	Y	Y	Y	Y	Y	Y
Logarithm of contract value (net, EUR)	Y	Y	Y	Y	Y	Y
GDP at current market prices, EUR/inhabitant	Y	Y	Y	Y	Y	Y
Employment rates, 15-64 years	Y	Y	Y	Y	Y	Y
Fertility rate	Y	Y	Y	Y	Y	Y
Agency type	Y	Y	Y	Y	Y	Y
Agency sector	Y	Y	Y	Y	Y	Y
Constants (main&nuts)	Y	Y	Y	Y	Y	Y
Observations (org)	4532	4532	4532	4532	4532	4532
Observations (nuts)	94	94	94	94	94	94
R-squared (org. level)	0.125	0.131	0.128	0.133	0.128	0.132
R-squared (nuts level)	0.506	0.535	0.491	0.518	0.498	0.520

*Note: p-values are below coefficients; * p<0.05, ** p<0.01, *** p<0.001; Snijders/Bosker R-squared values reported*