

The Impact of Open Data on Public Procurement

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Abstract

We examine how the increased accessibility of public purchasing data affects competition, prices, contract allocations, and contract performance in government procurement. The European Union recently made its already public but difficult-to-access information about the process and outcomes of procurement awards available for bulk download in a user-friendly format. Comparing government contracts above EU publication thresholds with contracts that are not, we find that increasing the public accessibility of procurement data raises the likelihood of competitive bidding processes, increases the number of bids per contract, and facilitates market entry by new vendors. Following the open data initiative, procurement prices decrease and EU government agencies are more likely to award contracts to the lowest bidder. However, the increased competition comes at a cost — firms execute government contracts with more delays and ex-post price renegotiations. These effects are stronger for new vendors, complex procurement projects, and contracts awarded solely based on price. Overall, our results suggest that open procurement data facilitates competition and lowers ex-ante procurement prices but does not necessarily increase allocative efficiency in government contracting.

Keywords: Public Procurement; Transparency; Data Accessibility; Competition; Allocative Efficiency

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1. Introduction

The government is the single largest customer in developed countries, accounting for 10% to 20% of GDP (OECD 2015a). Citizens rely on government agents to procure a wide variety of goods and services from the private sector, ranging from routine supplies to large infrastructural projects, such as schools, hospitals, and airports. However, citizens cannot perfectly observe how public officials make purchasing decisions on their behalf, giving rise to agency problems that potentially increase the cost of public procurement (OECD 2015b; World Bank 2017). International organizations and advocacy groups argue that greater procurement transparency could reduce these problems by facilitating the monitoring of public officials (DeParle 2006; OECD 2015b; World Bank 2017). To promote transparency in public purchasing, several governments recently made their procurement data easily accessible on open data platforms (OCP 2019). Although these data have been used to examine various questions surrounding the procurement process (e.g., Mills et al. 2013; Liebman and Mahoney 2017; Boland and Godsell 2019; Heese and Pérez Cavazos 2019; Samuels 2019; Schoenherr 2019), there is no evidence on the effects of open procurement data *per se* on government contracting. In this paper, we study how the increased accessibility of public information about procurement awards (henceforth, “open procurement data”) affects competition, prices, contract allocations, and contract performance in government purchasing.

To examine these effects, we use the European Union (EU) as our empirical testing ground. In the EU, public contracts above a certain size are awarded via public calls for tender. Federal and local government agencies first publish contract notices on the *Tenders Electronic Daily* (TED) website, inviting firms to submit their bids.¹ Once a supplier has been selected, the government agency is required to publish an award notice on TED to report the identity of the winning contractor, nature of the

¹ TED is the supplement to the *Official Journal of the European Union*, publicly accessible at: <https://ted.europa.eu>.

procurement process, number of bids received, and terms of the procurement contract. These notices are made available in PDF and HTML format upon announcement of the award.

Before July 2015, the EU archived the content of contract award notices in XML format, which users could access through the TED website. However, these XML files were notoriously difficult to process. Retrieving award notice data required advanced programming skills in functional query languages (such as XQuery) and the raw files were organized in hierarchal rather than tabular format. In addition, data formats varied widely across contracting authorities and countries. Thus, while all contract award notices on TED were viewable as PDF or HTML files upon announcement, they were not available as one coherent dataset.² In July 2015, the EU made all current and historical contract award data easily accessible by organizing award notices in tabular format as separate, machine-readable CSV files that users can download as a single dataset. This initiative substantially lowered the information processing costs of anyone interested in government contracts.³ We exploit this sudden increase in data accessibility to study the effects of open procurement data on government contracting in Europe.⁴

The EU setting offers several unique advantages. First, the European Union represents the world's largest procurement market, estimated at about €2 trillion per year (European Commission 2019), allowing us to provide large-sample evidence on the effects of open procurement data. Second, the change in data accessibility affects all procurement projects above pre-determined size thresholds across EU countries

² Prior to the open data initiative, investigative journalists argued: (i) that “there should be a database of companies winning tenders. TED could be that, but is it not. It is impossible to work with” (European Commission 2012); and that (ii) “[m]any pieces of essential information are missing [from the XML files]—including many contract values and supplier names. Additionally, the existing data is very messy, particularly when it comes to clearly identifying the public body and economic operator involved in a contract” (Lindenberg 2014).

³ We define information processing costs based on the corporate disclosure literature as the costs of monitoring, acquiring, and analyzing the EU's procurement award notices (Blankespoor et al. 2019). In the framework of Blankespoor et al. (2019), the policy change reduced the cost of monitoring and acquiring procurement data but did not affect the actual content of the available information.

⁴ In Appendix A, we describe how the easily accessible data were advertised by the European Commission and how this facilitated the use of procurement data by investigative reporters, NGOs, and other citizen groups.

(treated contracts) but does not affect smaller government contracts, which are recorded in national procurement databases but not published on the TED website (control contracts). This institutional feature allows us to estimate the effects of open procurement data *within country* \times *contract type* \times *quarter-year*, alleviating concerns that our results are driven by concurrent but unrelated economic, regulatory, or institutional changes.⁵ In our primary specification, we compare changes in competition, prices, contract allocations, and contract performance between procurement contracts above and below EU publication thresholds around July 2015 within the same country, contract type, and quarter.⁶ To control for unrelated shocks that could differentially affect the procurement outcomes of small and large contracts around the open data initiative, we include contract size \times quarter-year interactions.

A potential threat to our identification strategy is that public officials could respond to the increase in data accessibility by artificially splitting procurement contracts into smaller units to avoid their publication on TED. If government agents intensify their avoidance behavior around the open data initiative, our results could be driven by changes in the composition of our treatment and control samples as opposed to the increase in data accessibility. To address this concern, we test for discontinuities in the frequency distribution of procurement contracts around TED publication thresholds. We do not find evidence of bunching below these cutoffs, either before or after the open data initiative, suggesting that our results are not driven by manipulation around TED thresholds.

Having validated our research design, we begin our empirical analysis by examining the effect of open procurement data on the level of competition in government contracting. A key friction that limits competition and prevents the selection of the best-suited contractor is the incentive of public officials to

⁵ We define contract types using two-digit Common Procurement Vocabulary (CPV) codes. CPV is a classification system that standardizes contract types by product.

⁶ We do not estimate a regression discontinuity design because EU publication thresholds impose unrelated regulatory requirements that likely affect our outcomes of interest (e.g., contracts above EU size thresholds must be publicized on the TED website and tendered throughout the European single market).

make procurement decisions that foster their private interests at the expense of taxpayers (e.g., Goldman et al. 2013; OECD 2014; Tahoun 2014; Schoenherr 2019). Political agency theory predicts that higher public scrutiny increases government agents' accountability and curbs opportunistic behavior (e.g., Besley 2006). Because easier access to procurement information facilitates the monitoring of public officials, open procurement data can incentivize bureaucrats to implement more competitive bidding processes. Consistent with procurement transparency increasing the accountability of public officials, we find that after the open data initiative, government agencies are approximately 20% more likely to allocate procurement contracts through an open bidding procedure, where any vendor can bid on the advertised contract.

Next, we examine whether the increased accessibility of procurement data affects the intensity of competition among vendors in open bidding contests. If public officials are more likely to evaluate all submitted bids after the open data initiative, we expect an increase in the number of vendors competing for a given tender offer. Easier access to procurement data also lowers information processing costs for potential bidders, which can further promote competition for government contracts. In line with these predictions, we find that after the open data initiative, the number of bids received per call for tender increases by approximately 12% for contracts above EU publication thresholds, relative to contracts below these thresholds.

To provide more direct evidence on how open procurement data fosters competition among potential government suppliers, we examine changes in the characteristics of firms that ultimately win competitive bidding contests. Consistent with open procurement data reducing barriers to entry, we find that public officials are more likely to award government contracts to new vendors after the increase in data accessibility. However, we do not find changes in the likelihood that foreign firms win contracts, suggesting that the open data initiative does not promote cross-border competition across the European

single market.

If government vendors compete on price, the pro-competitive effects of open procurement data should translate into lower prices at the contract award stage. To test this prediction, we compare changes in ex-ante prices between treated and control contracts of similar size within the same industry, country, and quarter. Indeed, we find that after the open data initiative, prices for contracts above TED publication thresholds decrease by approximately 8%, relative to contracts below these thresholds.

So far, our evidence indicates that easier access to public procurement information promotes competition and lowers prices in government contracting, in line with the policy objectives of procurement transparency (World Bank 2017). However, these results are limited to the contract award stage and do not speak to whether open procurement data improves or impedes the allocation of government contracts to firms. To more directly assess potential changes in allocative efficiency, we examine how open procurement data affects the execution of public contracts.

An important feature of the open data files on TED is that they only contain ex-ante information about the procurement process and contract terms at the award stage, but do not provide information about subsequent stages of the procurement project. While it is plausible that the open data initiative increases government agents' accountability on contractual dimensions that are observable in the data (e.g., the level of competition at the award stage), it is less clear how it affects ex-post contract performance, which remains difficult to observe by the public. On the one hand, if the open data initiative mitigates moral hazard problems and improves the pool of potential suppliers, government officials will select better vendors and contract performance should improve (Vickrey 1961; Besley 2006). Alternatively, if the public exerts increased pressure on procurement officials to select contracts only based on ex-ante information contained in the open data files, government agents might make suboptimal allocation decisions, and ex-post contract performance could decline (Holmstrom and Milgrom 1991; Maskin and

Tirole 2004). Consistent with open procurement data potentially distorting resource allocation, we find that the performance of treated contracts deteriorates significantly relative to control contracts. Contracts above mandatory TED publication thresholds are 2.9 percentage points more likely to exhibit adverse modifications in the form of project delays and ex-post price increases.

To provide more direct evidence on the channels through which the open data initiative lowers ex-post contract performance, we conduct three additional analyses. First, we examine whether open procurement data affects the award criteria that public officials use in their contract allocation decisions. Given that the open data files only contain information on ex-ante contract terms but not ex-post execution quality, one explanation for our results is that improved information accessibility shifts the contract allocation decision from quality towards price. Under this channel, open procurement data induces government agencies to allocate contracts to the lowest bidder, which is not necessarily the best firm to carry out the project. Consistent with this argument, we find that treated contracts are 38% more likely to be awarded solely based on price, and that the decrease in contract performance is concentrated in contracts where price was the only award criterion.

Second, we examine whether the increase in contract modifications is stronger for new vendors. Since open procurement data incentivizes public officials to establish new contracting relationships, execution quality could decline because public officials are less informed about the quality of new vendors (e.g., Petersen and Rajan 1994; Berger and Udell 1995; Costello 2013). Consistent with this explanation, we find that the decrease in contract performance is concentrated in contracts awarded to new government suppliers. The fact that contracts with existing vendors are less prone to ex-post modifications than those with new vendors suggests that, prior to the open data initiative, procurement relationships were not necessarily corrupt or otherwise inefficient.

Third, we examine whether complex procurement projects become more vulnerable to poor

performance after the open data initiative. Due to the limits of contracting, complex projects with many contingencies at the award stage often benefit from the judgement and knowhow of government officials. If open procurement data pressures officials to relinquish their discretion, these contracts are more likely to experience ex-post performance issues (e.g., Manelli and Vincent 1995; Bajari et al. 2014). To empirically assess this argument, we separately estimate our treatment effect for highly versus less complex procurement projects based on each contract type's modification rate prior to the open data initiative (Schoenherr 2019). Consistent with project complexity playing a role for the observed deterioration in contract performance, we find a stronger treatment effect for more complex procurements.

Overall, our results indicate that increasing the accessibility of public procurement data facilitates competition and lowers ex-ante procurement prices but pressures public officials to select suppliers that execute contracts with more delays and ex-post price renegotiations. These findings are potentially useful in informing current regulatory debates in several OECD countries about the costs and benefits of increasing transparency in public procurement (Yukins 2008; Spagnolo 2012; Molander 2014; World Bank 2017).

Our paper contributes to an emerging literature in public economics that examines the effects of transparency in government procurement. Coviello and Mariniello (2014) study the impact of advertising public procurement auctions and find that increased auction publicity promotes bidder participation and lowers the winning bid but does not affect the execution quality of public contracts in Italy. In contrast, we examine how the increased accessibility of *already publicized* procurement information affects EU government contracting. We add to the prior literature by showing that open procurement data can increase competition at the expense of contract performance.

We contribute to accounting research by studying how government disclosures affect agency problems in public entities. A recent line of research examines the causes and consequences of financial

reporting by governments (see Kim et al. 2018 for a review). Most of these papers focus on the use of governmental accounting data by creditors (e.g., Baber and Gore 2008; Cuny 2016; Gillette et al. 2019). In contrast, we focus on the behavior of public officials and show that easier access to disaggregated procurement information leads bureaucrats to implement more competitive tendering processes. In this context, we also contribute to the literature on disclosure processing costs, which mostly examines capital market effects.⁷ A notable exception is Blankespoor (2019), who focuses on firm behavior and shows that companies increase their quantitative footnote disclosures when facing anticipated reductions in investors' disclosure processing costs. We add to this literature by studying public officials and examining the broader implications of lower information processing costs on competition, project selection, and resource allocation. In doing so, our paper answers the call for research by Blankespoor et al. (2019) on how disclosure processing costs affect stakeholders and information sources in decision contexts outside of the capital market setting.

Finally, our results contribute to the literature on the real effects of disclosure, both in accounting and economics.⁸ Most accounting studies in this area examine how the disclosure of new information affects corporate behavior (e.g., Biddle et al. 2009; Shroff 2017; Granja 2018; Breuer 2019; Rauter 2019). Christensen et al. (2017) find that the dissemination of information in financial reports that was already publicly available elsewhere can trigger changes in firm behavior. We add to this literature by documenting that easier access to procurement information through the same disclosure medium has economically significant real effects on the behavior of public officials and firms. Moreover, our evidence is broadly consistent with the analytical insight that imprecise measurement and disclosure of investments can induce short-termism at the expense of long-run economic efficiency (e.g., Stein 1989; Kanodia and

⁷ See Blankespoor et al. (2019) for a review of the literature on disclosure processing costs.

⁸ Kanodia and Sapra (2016), Leuz and Wysocki (2016), and Roychowdhury et al. (2019) survey the accounting literature on the real effects of disclosure. Milgrom (2008) and Dranove and Jin (2010) provide reviews of the (quality) disclosure literature in economics.

Sapra 2014, 2016). In a similar vein, our results are related to prior work in microeconomics indicating that the partial disclosure of (some but not all) quality metrics can have adverse performance consequences for those tasks that are not subject to disclosure (e.g., Holmstrom and Milgrom 1991; Dranove et al. 2003). Our evidence echoes these results by showing that greater transparency about procurement awards has pro-competitive effects at the award stage but impedes contract performance thereafter because information about execution quality is not included in the open data.

2. Institutional Setting, Conceptual Underpinnings, and Empirical Predictions

2.1 Public Procurement in the European Union

The EU Public Procurement Directives establish how member states award government contracts. These directives are based on the premise that transparent, fair, and competitive procurement processes are key to achieving an efficient use of public funds across the European single market (OJEU 2004). For high-value projects above certain size thresholds, government entities must open public tenders to all EU member states by posting a call for tender or “contract notice” on the EU’s *Tenders Electronic Daily* (TED) website, the online supplement of the *Official Journal of the European Union*. Once the contract is awarded, a notice is published on the TED website to announce the identity of the winning firm, type of tendering process, number of bids received, and actual terms of the contract.

Government agencies are typically required to use procurement processes that facilitate open and transparent competition.⁹ The most competitive is the “open procedure” process, where any business may bid in response to the advertised contract. In the “restricted procedure” process, the agency first publishes a contract notice inviting potential suppliers to submit pre-qualifying information, and then allows a subset of selected candidates to submit a full tender. Contracting authorities freely choose between open and

⁹ In exceptional circumstances (e.g., when open or restricted procedures do not attract suitable vendors, when there is only one possible supplier, or in cases of extreme urgency), EU procurement rules allow a “negotiated procedure without prior publication,” where agencies approach one or several suppliers directly without any advertising.

restricted procedures. Occasionally, EU regulations allow procurement processes that limit competition. However, these procedures cannot be used for off-the-shelf services or supplies that many vendors could provide. EU procurement directives are enforced through a variety of regulatory bodies, including (i) Supreme Audit Institutions (SAIs), which monitor procurement spending in every member state, and (ii) the European Court of Auditors, which performs audits across the EU, analyzes reports prepared by SAIs, and issues procurement guidelines.

Prior to July 2015, the EU posted contract award notices in PDF and HTML format on its TED website, and archived the contents in XML format. However, these XML files were difficult to process, as retrieving the award notices required advanced programming skills in functional query languages (such as XQuery) and the raw data were organized in hierarchal rather than tabular format. In addition, data formats varied widely across countries and government agencies due to differences in language and variable names. In July 2015, the EU standardized the XML files and made its current and historical procurement data available for bulk download in easily-accessible CSV format, which substantially lowered the information processing costs of anyone interested in government contracts. Award notice data is prominently featured on the TED website and published in tabular format as small, separate CSV files that users can open in any data analysis software and immediately analyze. In Appendix A, we describe how the easily accessible data were advertised by the European Commission and how this facilitated the use of procurement data by investigative reporters, NGOs, and other citizen groups.

Contracts below TED publication thresholds appear in local government gazettes and are recorded in national procurement databases. Award notice data for these contracts were difficult to access until

mid-2018, when the data became available on the Open Tender platform of Digiwhist, an NGO focused on digital transparency in government procurement (Digiwhist 2016).¹⁰

2.2 *Conceptual Underpinnings*

Political agency theories describe the principal-agent relationship between citizens and the government, where voting citizens are the principals and politicians are the agents. As citizens cannot perfectly observe the agent's actions, a moral hazard problem arises where politicians can act opportunistically to extract private benefits (e.g., Holmstrom 1979). Electoral accountability is an important mechanism that helps solve this problem. Re-election incentives impose greater discipline on government agents and reduce moral hazard (e.g., Barro 1973; Ferejohn 1986; Besley 2006).

The political science literature defines accountability as the agent's understanding that they are obliged to act on behalf of the principal and that the principal has the power (by some formal institution or by informal rules) to sanction or reward the agent for their performance (e.g., Fearon 1999). The principal's information is key to this accountability mechanism; voters can hold politicians accountable more effectively when they have better information about politicians' actions. Besley (2006) models the role of information in political accountability and shows that an increase in the observability of the agent's actions improves both the quality of the action and the selection of the politician. Besley and Pratt (2006) focus on the role of the media in improving the observability of the policymaker's actions and show that lower media capture increases the turnover and accountability of incumbents. Relatedly, Besley and Smart (2007) predict that an increase in information about the cost of public goods improves the selection of politicians.

These models suggest that easier access to procurement information could promote competition for public contracts. Facing a moral hazard problem, government officials have incentives to make

¹⁰ For contracts below EU publication thresholds, national procurement rules apply. These rules differ across member states in their requirements to publicize contract notices and to use competitive procedures.

procurement decisions that foster their private interests (e.g., Goldman et al. 2013; Tahoun 2014; Schoenherr 2019). Open procurement data likely increases accountability and reduces bureaucrats' incentives to extract private benefits. We predict that this increase in accountability leads government agents to choose more competitive procurement processes. Moreover, as public officials are more likely to evaluate all submitted bids after the open data initiative, we expect an increase in the number of vendors that compete for a given tender offer (e.g., Klemperer 2004). Easier access to procurement data also lowers information processing costs for potential bidders, which can further promote market entry.

If open procurement data mitigates moral hazard problems and improves the pool of potential suppliers, theory predicts that government agents select better vendors (Vickrey 1961; Besley 2006). However, these models rely on the assumption that voters know the optimal procurement action. If public officials are better informed about the best procurement decision than voters, but this choice is different than what voters perceive as optimal (e.g., lowest price), open procurement data could pressure bureaucrats to make suboptimal allocation decisions (Maskin and Tirole 2004). Therefore, it is ultimately an empirical question whether open procurement data improves or distorts allocative efficiency in government contracting.

3. Research Design and Data

3.1 Empirical Model and Identification Strategy

We test our predictions using a sample of European public contracts where the call for tender and the outcome of the tendering process were made publicly available. We estimate a difference-in-differences (DiD) design that compares changes in procurement outcomes between treated and control contracts around the EU's open data initiative in July 2015. Our treated observations are government contracts that exceed the threshold for mandatory disclosure on the EU's TED website; our control observations are contracts below this threshold. At the time of the open data initiative, the publication threshold was €5,186,000 for public works contracts and €134,000 for supplies and services contracts.

Contracts in our control group are not covered on TED, but still stored in national procurement databases. As a result, the costs of collecting and processing public procurement data remain unchanged for small local contracts throughout our sample period but decline sharply for contracts above EU publication thresholds after July 2015.

We estimate the following OLS regression:

$$Y_{c,t} = TED\ Contract_c \times Post\ CSV_t + Controls + Fixed\ Effects + \varepsilon_{c,t} . \quad (1)$$

The dependent variable, $Y_{c,t}$, varies across specifications and captures procurement outcomes for government contract c in quarter-year t .¹¹ $TED\ Contract_c$ is a binary indicator equal to one for procurement contracts exceeding EU thresholds for mandatory tendering in the European single market and publication on TED. $Post\ CSV$ is an indicator variable equal to one for contracts tendered after the open data initiative in July 2015. We control for the amount of the winning bid in Euros ($Ln(Contract\ Value)$) to account for structural differences in procurement outcomes across public projects of different size. We also control for a change in the EU Directive on public procurement (*EU Procurement Directive*), which amended existing procurement regulation in the European single market during our post-treatment period. EU member states were required to transpose the new directive into national law, which they did at various points in time between April 2016 and September 2018, (except for the United Kingdom and Denmark, which adopted the directive in February 2015 and January 2016, respectively).¹²

We include country \times contract type \times quarter-year fixed effects to control for concurrent but unrelated economic, regulatory, or institutional changes that differentially affect EU member countries

¹¹ We do not estimate probit models for our binary outcome variables because we use high-dimensional fixed effects that can introduce bias in nonlinear maximum likelihood estimations (e.g., Arellano and Hahn 2007).

¹² The key changes instituted by this directive include: (i) broadening the award criteria to include environmental and social characteristics, (ii) making competitive negotiation procedures available for more contracts, (iii) encouraging the division of contracts into lots, and (iv) simplifying the transfer of contracts between vendors (e.g., in case of vendor insolvency) (OJEU 2014; Crown Commercial Service 2016).

and contract types.¹³ We define contract types using two-digit Common Procurement Vocabulary (CPV) codes, a public procurement classification system that standardizes contract types by product (see Table IA2 in the Internet Appendix for details). We draw statistical inferences based on standard errors clustered at the country level (29 clusters) because procurement outcomes are likely correlated over time within countries.

3.2 *Data and Sample*

We obtain public procurement data from Digiwhist, an NGO that collects micro-level information about individual government contracts across the EU.¹⁴ Digiwhist extracts procurement contracts from the TED website and national procurement repositories and then compiles this information in one standardized dataset. Thus, the Digiwhist procurement data contain both contracts above and below the mandatory TED publication thresholds. Just as EU procurement data (on TED) was difficult to access prior to the open data initiative in July 2015, obtaining information on smaller contracts (outside of TED) was complex and costly throughout our sample period because the underlying contracts were stored in non-standardized hierarchical data formats across multiple national repositories (Digiwhist 2016).

Our sample starts in Q1-2009, the first quarter in the Digiwhist dataset, and ends in Q2-2018, the last quarter with well-populated data. We limit our sample to government contracts where we can observe the contract value, tendering procedure, contract type, and applicable TED threshold. We assign observations to our treatment or control group based on the value of the contract and its TED publication threshold. We exclude micro procurements with project volumes below €25,000 since these very small contracts are likely not a good control group as they are fundamentally different from the large EU-wide procurement projects disclosed on TED. Overall, our sample consists of 253,027 individual contracts

¹³ Our results are robust to alternatively using non-interacted country, contract type, and quarter-year fixed effects. The post indicator of our difference-in-differences design is subsumed by our fixed effects.

¹⁴ Digiwhist is a joint initiative by six European research institutes and is funded by the EU.

across 29 European countries.¹⁵

In Table 1, we report descriptive statistics for our sample. 47% of all contracts are published on the EU's TED website (*TED Contract*). Most procurement contracts (87%) are awarded through an open tendering process. On average, open tenders receive 4.7 bids from vendors, new suppliers win 28% of all contracts, and foreign firms only win 2% of open procurement contests. Approximately 3% of all contracts experience project delays or ex-post price increases. Procurement agencies award about half of the contracts (49%) using price as the sole criterion. The mean and standard deviation of *Contract Value* are €1.56 and €16.37 million, respectively.

3.3 *Treatment Manipulation*

In this section, we examine the possibility that public officials may manipulate contract values to avoid publishing award notices on TED. If government agents intensify their avoidance behavior around the open data initiative, our results could be driven by changes in the composition of our treatment and control samples as opposed to the increase in data accessibility. To assess this concern, we test for discontinuities in the size distribution of procurement contracts around EU publication thresholds using the local polynomial density estimator from Cattaneo et al. (2019).

In Figure 1, we plot the quadratic local polynomial function of contracts around TED thresholds and do not find evidence for contract size manipulation by public officials before or after the open data initiative (p-values of 0.87 and 0.90, respectively).

One plausible explanation for the lack of contract bunching is that EU enforcement agencies closely monitor contract values and heavily penalize artificial contract splitting (European Commission 2015, 2018). Contract size manipulation is relatively easy to spot for procurement regulators. In addition, the European Commission regularly publishes procurement guidelines that specify how public officials

¹⁵ In Tables IA1 and IA2, we provide a breakdown of our sample by country and contract type.

should compute contract values; they also provide examples of illegal contract splitting (e.g., Contact Committee of the SAI 2018).

Although we do not find evidence for contract size manipulation in general, case law and SAI audit reports provide several anecdotes indicating that artificial contract splitting does occasionally occur (Contact Committee of the SAI 2018). Therefore, we perform sensitivity tests in which we exclude contracts in close proximity to EU publication thresholds that could be prone to manipulation and find that our results remain robust (see Section 4.1).

4. The Effect of Open Procurement Data on Public Officials

4.1. Type of Procurement Process

We start our empirical analysis by examining whether open procurement data affects the behavior of government officials. Easier access to information about procurement actions increases the accountability of bureaucrats and curbs incentives to limit competition and extract private benefits (see Section 2). We predict that this increase in accountability leads government agents to award more contracts through an open tendering process.

In Table 2, we present regression results for the estimated effect of open procurement data on the likelihood that government agencies allocate public contracts through an open procedure. In Column (1), we report the results from our baseline specification. The estimated effect of $TED\ Contract \times Post\ CSV$ is positive and highly statistically significant. The coefficient magnitude of 0.174 implies a 20% ($0.174/0.892$) increase in the likelihood of open competitive bidding relative to the sample mean before Q2-2015. The *EU Procurement Directive* coefficient is negative and statistically significant, suggesting that the new European government contracting provisions have anti-competitive effects; the estimate on $Ln(Contract\ Value)$ is indistinguishable from zero.

A potential concern with our research design is that any other shock that differentially affects TED and non-TED contracts around the open data initiative could confound our inferences. To mitigate this

concern, in Column (2), we more flexibly control for differences in contract size by including $\text{Ln}(\text{Contract Value}) \times \text{quarter-year interactions}$. We find that our estimated treatment effect remains robust—the coefficients and t-statistics are both very similar to Column (1).

A critical assumption of our identification strategy is that the assignment of government contracts to treatment or control groups is random, i.e. orthogonal to governments' procurement practices. However, the increased accessibility of procurement data after July 2015 might induce bureaucrats to strategically lower the size of government contracts (particularly around disclosure thresholds) to avoid publication on TED, thereby hiding controversial procurement decisions (see Section 3.3). Relatedly, if government agents learn from the easily-accessible contract awards on TED and amend their procurement practices also for smaller non-TED contracts, our control group could be affected by the treatment. To assess the impact of these potentially problematic observations, in Column (3), we exclude contracts within €100,000 of the TED disclosure threshold that are potentially prone to manipulation and information spillovers. We find that the magnitude of the $\text{TED Contract} \times \text{Post CSV}$ coefficient increases to 0.229, alleviating the concern that our results are driven by procurement agencies manipulating contract sizes around TED publication thresholds.

In Column (4), we include $\text{supplier country} \times \text{quarter-year}$ fixed effects to control for the possibility that changes in economic conditions abroad could lead foreign suppliers to express increased interest in domestic TED procurements.¹⁶ Our estimated treatment effects could be spurious if domestic officials respond to this increase in foreign supply by opening more contracts for competitive bidding. We find that the coefficient of $\text{TED Contract} \times \text{Post CSV}$ does not attenuate and remains highly statistically significant when we condition our analysis on potentially correlated supplier country characteristics.¹⁷

¹⁶ Due to data limitations, we only observe the country of the supplier winning the procurement contest.

¹⁷ The number of observations decreases slightly in Column (4) (relative to our baseline specification) because the added fixed effects result in more singleton groups, which we drop from the regression estimation. Unless otherwise stated, changes in the number of observations are attributable to dropped singletons.

In Figure 2, we provide graphical evidence supporting the parallel-trends assumption. In the years prior to the increase in data accessibility, procurement contracts above and below the EU publication threshold have similar competitive bidding patterns. Figure 2 also indicates that the likelihood of competitive bidding increases sharply for TED contracts around July 2015 and that this increase persists through the end of our sample period.

4.2 *The Role of Prior Regulation*

Having established that open procurement data increases the likelihood that public officials implement more competitive tendering processes, we next examine how this effect interacts with the quality of countries' prior institutions. Open procurement data could primarily affect countries with weak institutions where poor oversight and lenient enforcement allow agents to mismanage public purchasing. Open data could expose illicit government practices, raise public awareness, and ultimately discipline public officials. Alternatively, the increased accessibility of procurement information may be most effective in countries with strong institutions that have the necessary judicial and regulatory mechanisms to act on the data (Christensen et al. 2016).

To empirically assess these competing narratives, we obtain data on the quality of institutions from the European Public Accountability Mechanisms (EuroPAM) database. EuroPAM rates the regulatory environment in all EU member states along five dimensions based on the adoption of accountability mechanisms recommended by the World Bank (EuroPAM 2019). These five dimensions capture whether countries have: (1) *Disclosure Laws* that mandate public information about gifts accepted, assets held, and income earned by government officials; (2) *Procurement Laws* that foster competition in government contracting; (3) *Conflict of Interest Laws* that mitigate vested interests by public officials; (4) *Freedom of Information Laws* that provide access to government records; and (5) *Political Financing Laws* that limit private-sector donations to political groups.

For each EuroPAM measure, we define a binary indicator equal to one for countries whose score is below the median of all EU member states in 2014. We then re-estimate our baseline specification interacting the five institutional quality indicators with our independent variables. In Table 3, we find that the coefficients of the triple interaction terms are positive and statistically significant, except for *Conflict of Interest Laws*. The *TED Contract* \times *Post CSV* estimates are indistinguishable from zero, indicating that the competitive bidding effects are concentrated in countries with weak prior institutions.

Overall, the results in this section indicate that open procurement data leads government officials to implement more competitive bidding processes, and that this increase in competitive bidding is driven by countries that do not have the institutions to effectively monitor public officials.

5. The Effect of Open Procurement Data on Firms

5.1 Intensity of Bidding among Vendors

The increased accessibility of public purchasing data not only impacts the type of procurement process bureaucrats use, it also likely affects the behavior of firms aiming to do business with the government (see Section 2). If public officials are more likely to evaluate all submitted bids after the open data initiative, the number of vendors competing for a given tender offer should increase since firms are more likely to participate when they have a higher chance of winning (e.g., Klemperer 2004). Moreover, easier access to procurement data lowers information processing costs for potential bidders, which should further promote market entry. To provide direct evidence on the impact of open procurement data on firms, we examine changes in the intensity of competition among potential government suppliers around the increase in data accessibility.

We quantify the intensity of rivalry among competitors using the number of bids that firms submit for a given tender offer and limit our sample to public contracts awarded through an open auction to ensure that our results are not mechanically driven by the increase in open tenders. We estimate Equation (1) with the natural logarithm of the number of bids received ($\ln(\text{Number of Bids})$) as our outcome variable.

In Table 4, we present regression results for the estimated effect of open procurement data on the intensity of competition among vendors.

In Column (1), we show that after the open data initiative, the number of bids for contracts above TED publication thresholds increases by approximately 12% ($e^{0.111}-1$) relative to smaller contracts (t-statistic: 2.87). In Columns (2) to (4), we mirror the sensitivity tests in Table 2 to show that our baseline results are robust to: (i) controlling for contract size \times quarter-year interactions, (ii) excluding contracts in close proximity to TED publication thresholds, and (iii) controlling for supplier country characteristics. These robustness tests mitigate the concern that other shocks differentially affecting TED and non-TED contracts around the open data initiative could confound our inferences.

In Figure 3, we provide graphical evidence that, consistent with the parallel-trends assumption, procurement contracts above and below TED publication thresholds exhibit similar patterns in the number of bids prior to the increase in data accessibility. Moreover, the number of bids increases sharply for TED contracts soon after the open data initiative, and this increase persists throughout our sample period.

5.2 *Which Firms Enter the Procurement Market?*

To shed light on the mechanism through which open procurement data fosters competition among potential vendors, we next examine changes in the type of firm that wins competitive bidding contests. We focus on the likelihood that the winning supplier is a new entrant or a foreign firm.

The European Commission wants to broaden governments' supplier base to achieve higher competition in public procurement (European Commission 2008, 2016). For example, EU policymakers aim to eliminate the de-facto preferential treatment of domestic suppliers in most member states and to level the competitive playing field for foreign firms across the European single market (Bovis 2012).

Therefore, understanding whether open procurement data affects the allocation of government contracts to new suppliers and foreign firms has important policy implications.

In Table 5 Column (1), we present our results for the estimated effect of open procurement data on the likelihood that new suppliers win government contracts. The dependent variable, *New Entrant*, is a binary indicator equal to one if the winning supplier is awarded a public contract for the first time.¹⁸ We estimate our baseline specification and find that the *TED Contract* \times *Post CSV* coefficient is positive and statistically significant. The coefficient magnitude indicates that public officials are 8.7 percentage points more likely to award government contracts to new vendors after the open data initiative.

Next, we examine whether open procurement data affects the likelihood that the winning firm is a foreign contractor. We create the binary indicator *Foreign Supplier*, which is equal to one if the vendor is headquartered in a different country than the procurement site.¹⁹ In Column (2), we find that foreign firms are *not* more likely to win procurement awards after the open data initiative. Specifically, the point estimate on *TED Contract* \times *Post CSV* is close to zero (-0.001) and indicates with 95% confidence that foreign firms' likelihood of winning procurement awards does not increase by more than 0.9 percentage points. In Column (3), we examine whether open data promotes competition by suppliers from foreign countries that share the same official language as the country of the procurement site. Again, we find a coefficient close to zero. The null results in Columns (2) and (3) are inconsistent with the idea that easier access to procurement data fosters cross-border competition throughout the European Union.

Figure 4 provides graphical evidence for the result in Column (1). Consistent with the parallel-trends assumption, the graph shows that prior to the open data initiative, procurement contracts above and below TED publication thresholds exhibit similar patterns in the likelihood that the winning contractor is

¹⁸ For the computation of our *New Entrant* variable, we only consider contracts awarded after 2010 to ensure that we have at least one year of historical data. This restriction reduces our sample to 196,646 observations.

¹⁹ Certain national procurement repositories do not specify the supplier's location, reducing our number of *Foreign Supplier* observations to 178,129.

a new supplier. Taken together, the evidence in this section indicates that open procurement data fosters local competition among vendors by reducing barriers to entry but does not promote cross-border competition across the European single market.

6. The Effect of Open Procurement Data on Prices and Ex-Post Contract Performance

6.1 Procurement Prices

So far, our results show that easier access to public procurement data facilitates competitive allocation processes and increases the number of bids by potential suppliers. If vendors compete on price, the pro-competitive effects of open procurement data should translate into lower prices at the contract award stage. To test this prediction, we compare changes in the ex-ante values of treated and control contracts. Specifically, we estimate our baseline specification using the value of the given procurement contract ($\ln(\text{Contract Value})$) as our outcome variable. To account for differences in contract size, we add size quintile \times quarter-year fixed effects. The identifying variation in this specification comes from procurement contracts above and below TED publication thresholds within the same size quintile and quarter-year.

Consistent with the pro-competitive effects of open procurement data, in Table 6 Column (1), we find that contract values fall by approximately 8% for treated (relative to control) contracts after the open data initiative (t-statistic: -3.72). In line with the parallel trend assumption, Figure 5 shows that procurements above and below TED publication thresholds have similar contract values prior to the open data initiative.

Our price analysis faces two empirical challenges. First, procurement projects tend to be highly customized, making it difficult to control for heterogeneity. Second, we do not observe quantities and therefore cannot measure *unit* prices. To mitigate these concerns, we perform two additional tests. In Column (2), we estimate our price regression within recurring contracts. Repeated contracts are more

likely to be similar in nature and quantity, alleviating the concern that concurrent variation in contract properties and quantities could drive our results. We assign a unique identifier to each set of recurring contracts and define them as contracts that share the same title, CPV code, and government agency. We find that the coefficient of *TED Contract* \times *Post CSV* remains negative and statistically significant when we condition the analysis on recurring contracts (coefficient: -0.161; t-statistic: -3.47).

In Column (3), we normalize contract values by the estimated project duration (in days) to better account for the scope of the procurement. We find that the estimated treatment effect remains negative and statistically significant (t-statistic: -4.53). The coefficient magnitude of -0.977 implies that the average contract value per day decreases by approximately 1,000 Euros after the open data initiative. This result alleviates the concern that the estimate in Column (1) is driven by concurrent but unrelated changes in the duration of procurement projects.

6.2 *Contract Performance*

Our findings indicate that open procurement data facilitates competition and lowers procurement prices at the contract award stage. However, these results do not speak to whether increased data accessibility improves or impedes the allocation of government contracts to firms. In this section, we take a first step towards addressing this question by examining how open procurement data affects the quality of contract execution.

If the open data initiative mitigates agency frictions (e.g., cronyism) and improves the pool of potential suppliers, government agencies could select better vendors and contract performance should increase (Vickrey 1961; Besley 2006). Alternatively, if bureaucrats are better informed about the best procurement decision than the public but open data pressures them to make suboptimal allocations,

contract performance could decline (Maskin and Tirole 2004). Understanding which of these forces dominates is important as they have different implications for the optimality of procurement transparency.

In Table 7, we estimate the average treatment effect of open procurement data on contract performance. We define *Poor Performance* as a binary indicator equal to one if a contract experiences ex-post modifications to its terms, which almost always represent price increases and/or execution delays.²⁰ Our results show that after the open data initiative, the likelihood of a contract modification increases by 2.9 percentage points for contracts above TED publication thresholds (t-statistic: 2.13). Figure 6 shows that treated and control contracts have similar trends in modifications before the increase in data accessibility, suggesting that the parallel trends assumption is reasonable in this analysis.

7. Mechanisms: Why Does Open Procurement Data Reduce Contract Performance?

In this section, we perform three cross-sectional analyses to provide more direct evidence on the channels through which open procurement data lowers ex-post contract performance.

7.1 Focus on Lowest Price

First, we examine whether open data affects the award criteria that public officials use in their contract allocation decisions. EU procurement laws allow the use of various award criteria, ranging from “lowest price” for goods with standardized technical specifications to “most economically advantageous tender” criteria, where agents evaluate proposals based on both price and quality (European Commission 2017). The TED open data files only contain information on ex-ante contract terms, but not on ex-post execution quality. Therefore, one explanation for our results is that open procurement data pressures public

²⁰ For 31,002 TED contracts, we observe the reason for modification. All amendments reflect additional work or increases in the scope of the project due to “unforeseen circumstances” that typically result in execution delays (Schoenherr 2019). In addition, 73% of the modifications reflect price increases. For all other contracts in our sample, we observe whether there was a modification, but not its underlying reason.

officials to allocate contracts to the lowest bidder, which is not necessarily the best firm to carry out the project.

To empirically assess this argument, we re-estimate our baseline specification using *Only Price Matters* as the outcome variable. *Only Price Matters* is a binary indicator equal to one if the government contract is awarded solely based on price, instead of the more nuanced “most economically advantageous tender” criterion. Consistent with open procurement data shifting the allocation decision from quality to price, in Table 8 Column (1), we find that after the open data initiative, public officials are 38% (0.173/0.460) more likely to award contracts above TED publication thresholds exclusively based on price (t-statistic: 2.14). Figure 7 provides graphical evidence to support the assumption that treated and control contracts have similar patterns in price focus in the years leading up to the increase in data accessibility.

Next, we examine whether this increased focus on price can explain the observed deterioration in contract performance. In Column (2), we interact *Only Price Matters* with our independent variables and re-estimate our baseline model using *Poor Performance* as the outcome variable. The coefficient on *TED Contract* \times *Post CSV* \times *Only Price Matters* is positive and highly statistically significant (coefficient: 0.025; t-statistic: 2.70), indicating that the performance of treated contracts is significantly worse if price was the only award criterion in the allocation decision. Moreover, the estimate on *TED Contract* \times *Post CSV* is indistinguishable from zero, implying that the decline in performance is concentrated among contracts where price was the only award criterion.

7.2 *Uncertainty about New Suppliers*

As a second mechanism, we examine whether information asymmetries between suppliers and governments can explain the increase in contract modifications after the open data initiative. Asymmetric information between customers and suppliers is higher in the beginning of a contracting relationship (Diamond 1991; Petersen and Rajan 1994; Berger and Udell 1995; Costello 2013). Since open data

pressures public officials to establish new procurement relations (see Section 5.2), execution quality could decline as bureaucrats are less informed about the quality of new vendors.

To assess this mechanism, we interact the explanatory variables of Equation (1) with our *New Entrant* indicator. In Table 8 Column (3), we find (i) that the *TED Contract* \times *Post CSV* \times *New Entrant* coefficient is positive and significant and (ii) that the main treatment interaction (*TED Contract* \times *Post CSV*) is statistically indistinguishable from zero. Our results indicate that the increase in modifications is driven by contracts awarded to new government suppliers, consistent with information asymmetries contributing to the observed deterioration in contract performance. Moreover, this evidence suggests that procurement relationships before the open data initiative were not necessarily corrupt or otherwise inefficient.

7.3 *Project Complexity*

As our third channel, we examine whether the complexity of procurement projects plays a role for the adverse performance effects of open procurement data. Complex procurements often have non-contractible quality dimensions that are prone to renegotiations during the execution phase (Crocker and Reynolds 1993; Bajari and Tadelis 2001; Bajari et al. 2014). If increased data accessibility pressures public officials to select vendors that are poorly suited to carry out the project, complex procurements with many unforeseen events at the award stage should be more likely to experience poor performance ex-post (e.g., Manelli and Vincent 1995).

To test this prediction, we define a new variable, *High Project Complexity*, which is a binary indicator equal to one for contract types whose modification rate prior to the treatment exceeds the median of all EU procurement contracts (Schoenherr 2019). In Column (4), we mirror the specification from Columns (2) and (3) and find a positive and significant coefficient for *TED Contract* \times *Post CSV* \times *High Project Complexity* (coefficient: 0.013; t-statistic: 2.18). This result indicates that the decline in contract

performance is stronger for complex procurements, consistent with project complexity exacerbating the potential allocative distortions of open procurement data.

8. Conclusion

Transparency is a cornerstone of effective government procurement. Many countries make the content of their procurement contracts publicly available in an effort to promote accountability in every stage of the procurement cycle and level the playing field across firms (OECD 2015a). In this paper, we examine how the increased *accessibility* of information about public contracts affects competition, prices, contract allocations, and contract performance in government procurement.

The EU recently made its already public but difficult-to-access information on procurement contracts available for bulk download in a user-friendly format. Comparing government contracts above and below EU publication thresholds, we find that increasing the public accessibility of procurement data raises the likelihood of having competitive bidding processes, increases the number of bids per contract, and facilitates market entry by new vendors. After the open data initiative, procurement prices decrease and EU government agencies are more likely to award contracts to the lowest bidder. However, the increased competition comes at the expense of lower contract performance, particularly if suppliers are new, procurement projects are complex, and contracts are awarded solely based on price.

Overall, our results suggest that open data on procurement awards facilitates competition and lowers ex-ante procurement prices, but does not necessarily increase allocative efficiency in government contracting. To our knowledge, our study is the first to provide evidence on the effects of making public procurement data easily accessible. Our findings are useful in informing current regulatory debates in several OECD countries about the costs and benefits of increasing transparency in public procurement (World Bank 2006, 2017).

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Appendix A: Publication, Dissemination, and Usage of Open Procurement Data

1. Announcement and Dissemination by the European Commission

In July 2015, the European Commission announced the publication of easily-accessible procurement data on TED. Figure A1 shows an excerpt from a newsletter circulated by the Commission and the corresponding announcements on Twitter. The newsletter explicitly mentions that the accessible data is intended for use by “NGOs, academics, companies, and journalists.” A follow-up newsletter was published and circulated in October 2015.

Figure A1: Announcements by the European Commission



Public procurement data now available on EU Open Data Portal

Published on: 15/07/2015

Data on public procurement conducted according to EU-rules has been made available on the EU Open Data Portal. This data, which shows how over €400 billion in EU citizens' money is being spent every year, is provided in a format accessible to NGOs, academics, companies and journalists.

It includes information on who is buying what from whom, for how much, and which procedure and award criteria were used. Analysing the data will support transparency in public spending, as well as help companies make better business decisions when applying for government contracts.



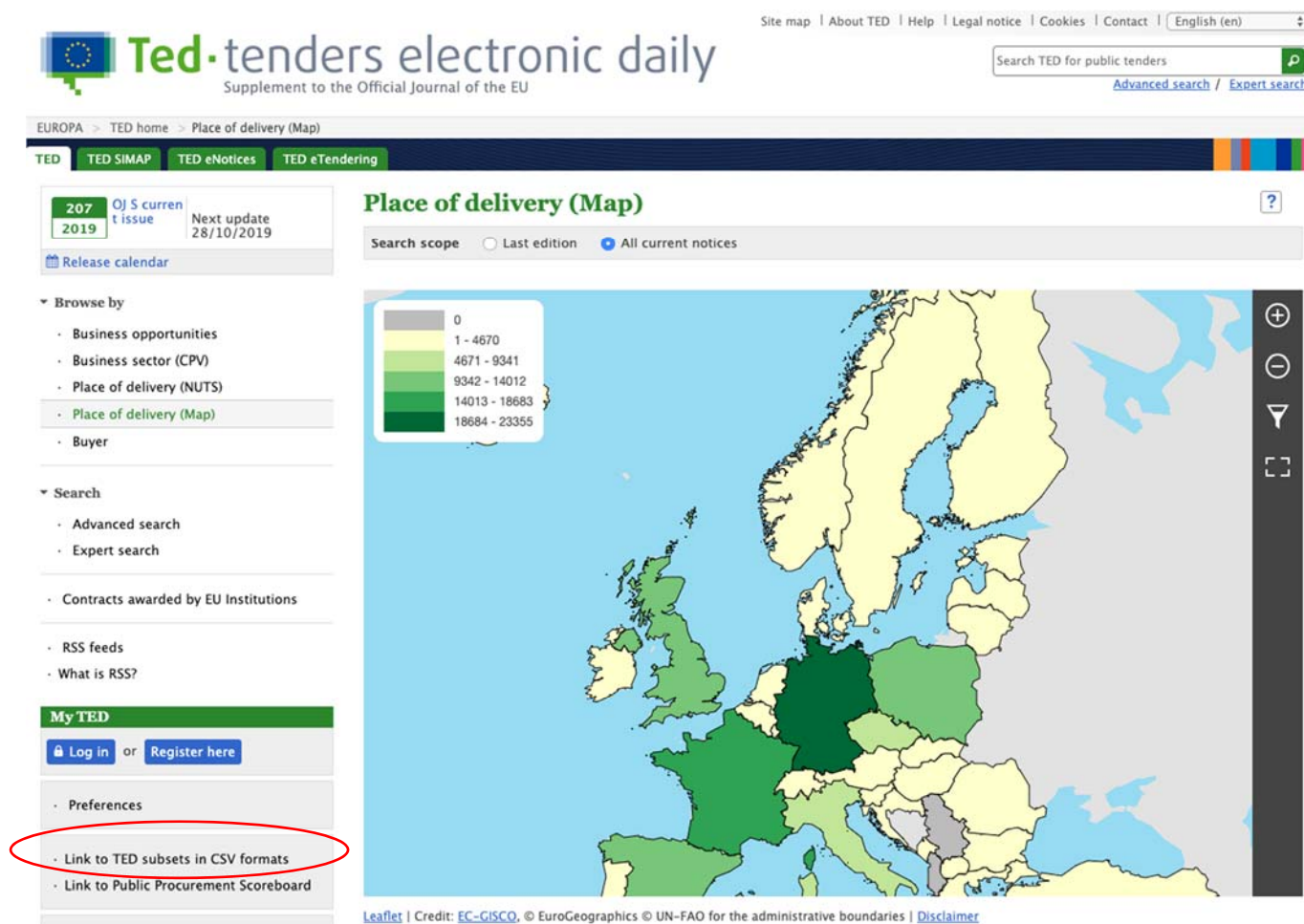
EU Open Data   @EU_opendata · 16 Jul 2015
Data on public procurement in the #SingleMarket now via open-data.europa.eu. See news from @EU_Growth: bit.ly/1e0ITJ1



EU Open Data   @EU_opendata · 17 Jul 2015
#FF @eutenders and check out ted.europa.eu for tenders in open data and more

In addition to these announcements, the Commission posted a hyperlink to the data on the homepage of the TED website. Figure A2 shows that the hyperlink is easily noticeable, appearing below the TED log-in link that users must click to search for contract notices and to submit bids. To date, the hyperlink still appears on the TED homepage.

Figure A2: Hyperlink on Home Page of TED Website



2. Dissemination and Use by NGOs

Following the publication of the data, various NGOs further disseminated the news. Figure A3 presents excerpts of newsletters published by Open Forum Europe, the Open Knowledge Foundation, and Transparency Camp Europe, three NGOs promoting transparency and knowledge about public procurement in the EU.

Figure A3: NGO Newsletters



How open is EU public procurement data?

A huge amount of data is generated daily by public procurement authorities throughout the EU. This is of course immensely useful as that data can be mined to identify interesting trends and produce analysis [...]. Most of that information is collected and made available through an online portal called Tenders Electronic Daily (TED). [...] A subset of TED data (covering the most important fields from each contract award notice) is **also made available in the more accessible CSV format**. In addition, there have also been a number of community initiatives (such as OpenTED) to make that information easier to exploit by the less technology-savvy.

July 24, 2015



Public Procurement Data - Tenders Electronic Database

Public procurement is the procedure through which public authorities are using public money, purchase works, services or supplies from the private sector. This is how around 14% of GDP of the EU is spent. TED [...] covers notices from the European Economic Area [...]. The data comes from public procurement standard forms [...]. **The data is provided in CSV format.** [...] Who is buying? What are they buying? Who responds and participates? Who is awarded the contract in the end? Which procedure is used, which award criteria? What is the value of the contract?

April 19, 2016



EU procurement

Information on public procurement contracts can be found at TED [...]. Data is available on public procurement contracts, according to the EU rules on public procurements, of notices published in EU member states, European Economic Area (EEA) and beyond. [...] A subset of TED covering public procurement from 2009 to 2015 and a number of fields from the contract award notice (who bought what from whom, for how much and which procedure and award criteria were used) is **available in CSV format**.

March 18, 2016

In addition, two NGOs (OpenTED and OpenTender) created a graphic interface enabling the public to search the TED data using a web browser (see Figure A4). OpenTender also uses TED data to compute integrity indicators at the contract, product, and country levels. Contracts receive a higher integrity score if they are awarded through a competitive process and if the call for tender attracted multiple bids. Such monitoring may encourage governments to award contracts competitively and to maximize the number of bids.

Figure A4: Searchable Procurement Interfaces Available to the Public

OpenTED Browser: Insights into European Public Spending

We present the **OpenTED** browser, a Web application allowing to interactively browse public spending data related to public procurements in the European Union. [...] The application is designed to filter notices and visualize relationships between public contracting authorities and private contractors. The simple design allows for example to quickly find information about who the biggest suppliers of local governments are, and the nature of the contracted goods and services. We believe the tool, which we make Open Source, is a valuable **source of information for journalists, NGOs, analysts and citizens for getting information on public procurement data**, from large scale trends to local municipal developments.



Get to know Tender better, play the lottery!

TED Award Notices 2006-2015 Sankey diagram CPV codes What is this interface?

AND OR + Add rule + Add group

Contracting_Authority_Country equal Belgium Delete

AND OR + Add rule + Add group Delete

CPV_Code begins with 301 Delete

CPV_Code begins with 302 Delete

Contract_Value_Euros greater or equal 1000000 Delete

Apply filters

Download selection (CSV)

Select additional variables to display

Show 10 entries

Showing 1 to 10 of 128 entries

Contracting Authority Country	Contracting Authority Name	Dispatch Date	CPV Code Meaning	Contractor Country	Contractor Name	Contract Value Euros	Number Offers Received	CPV Code	Award Notice Id Link
Belgium	Centre de recherche en aéronautique ASBL (Cenaero)	2015-11-30	Super computer	France	Serviware SAS	1496201	2	30211100	427971-2015
Belgium	Resa SA	2015-09-23	Agency fuel cards	Belgium	Total Belgium SA	7062845	3	30163100	340064-2015
Belgium	Universiteit Gent	2015-04-07	Computer equipment and supplies	Belgium	Dimension Data	1250000	1	30200000	123188-2015

3. Dissemination and Use by Investigative Journalists

Before 2015, journalists criticized the lack of available data on European procurement and the difficulty of working with TED data. For example, a 2012 report (“Deterrence of Fraud with EU Funds Through Investigative Journalism”) cites Andras Petho, a Hungarian investigative reporter, who argues that “there should be a database of companies winning tenders. TED could be that, but is it not. It is impossible to work with.” In 2014, investigative journalists discussed the data available on TED at the DataHarvest conference. According to Friedrich Lindenberg, a civic technologist, “[t]he resulting discussion focused on the quality and completeness of the data. Many pieces of essential information are missing—including many contract values and supplier names. Additionally, the existing data is very messy, particularly when it comes to clearly identifying the public body and economic operator involved in a contract” (Lindenberg, 2014).

Anecdotal evidence suggests that after 2015, European journalists began using the easily-accessible TED data. Figure A5 shows an excerpt from the 2016 DataHarvest conference program that included a session dedicated to teaching investigative journalists how to use TED data.

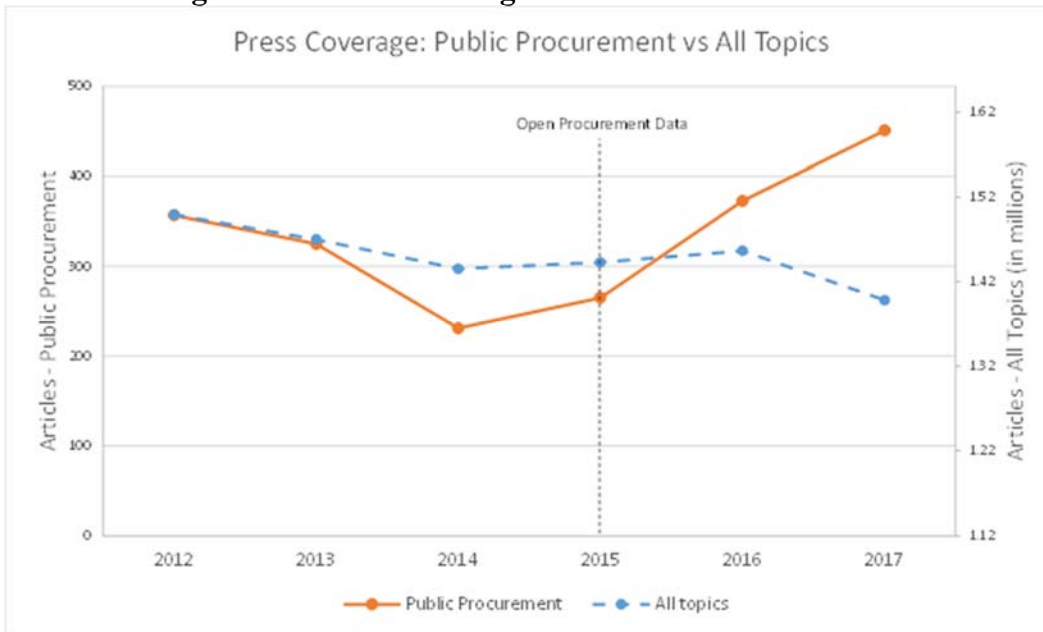
Figure A5: TED Data Featured at an Investigate Journalism Conference



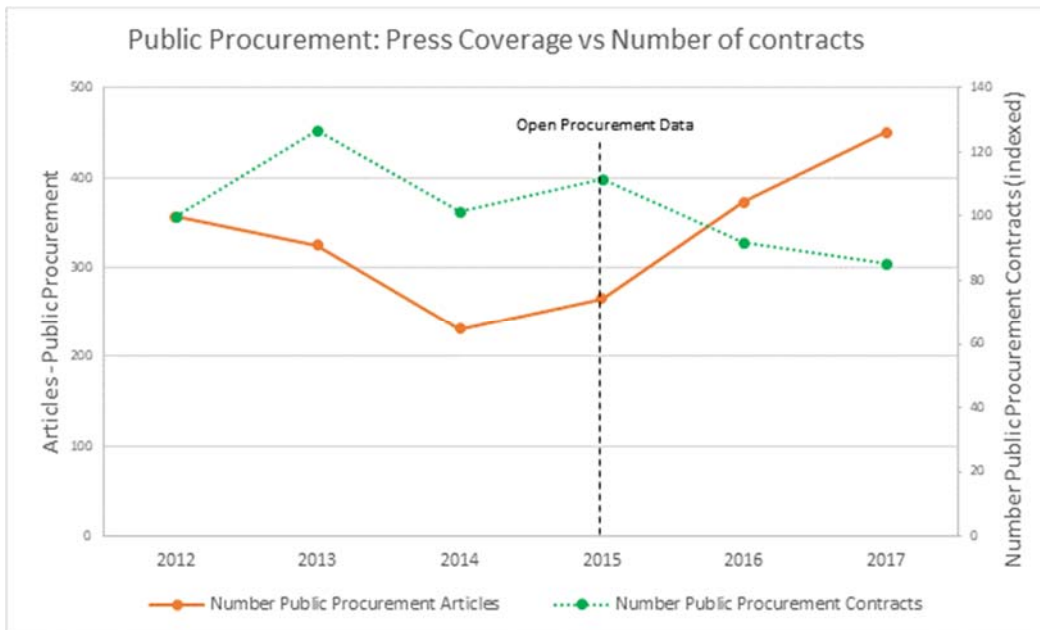
In her 2017 book, “A Reporter’s Guide to the EU,” Sigrid Melchior argues that “TED is a fantastic tool for any European investigative journalist” (Melchior 2017). In 2016, The Economist published an article using the TED data, highlighting the decline in competitiveness across the EU: “[A]ll across the European Union, competition for government contracts is falling. According to the Tenders Electronic Daily (TED) database, an archive of 4 million purchases by European governments during the past decade, 17% of calls for tender in 2006 received only one bid. By 2015 that figure had risen to 30%. The median number of offers per tender fell from five to three” (The Economist 2016).

If journalists rely on information from the TED open data files, we should observe more press coverage on public procurement after Q2-2015. In Figure A6, the upper (lower) graph shows the number of articles on public procurement and the number of articles on all topics (the number of procurement contracts) around the open data initiative. After 2015, we observe an increase in the number of press articles discussing public procurement.

Figure A6: Press Coverage about Public Procurement

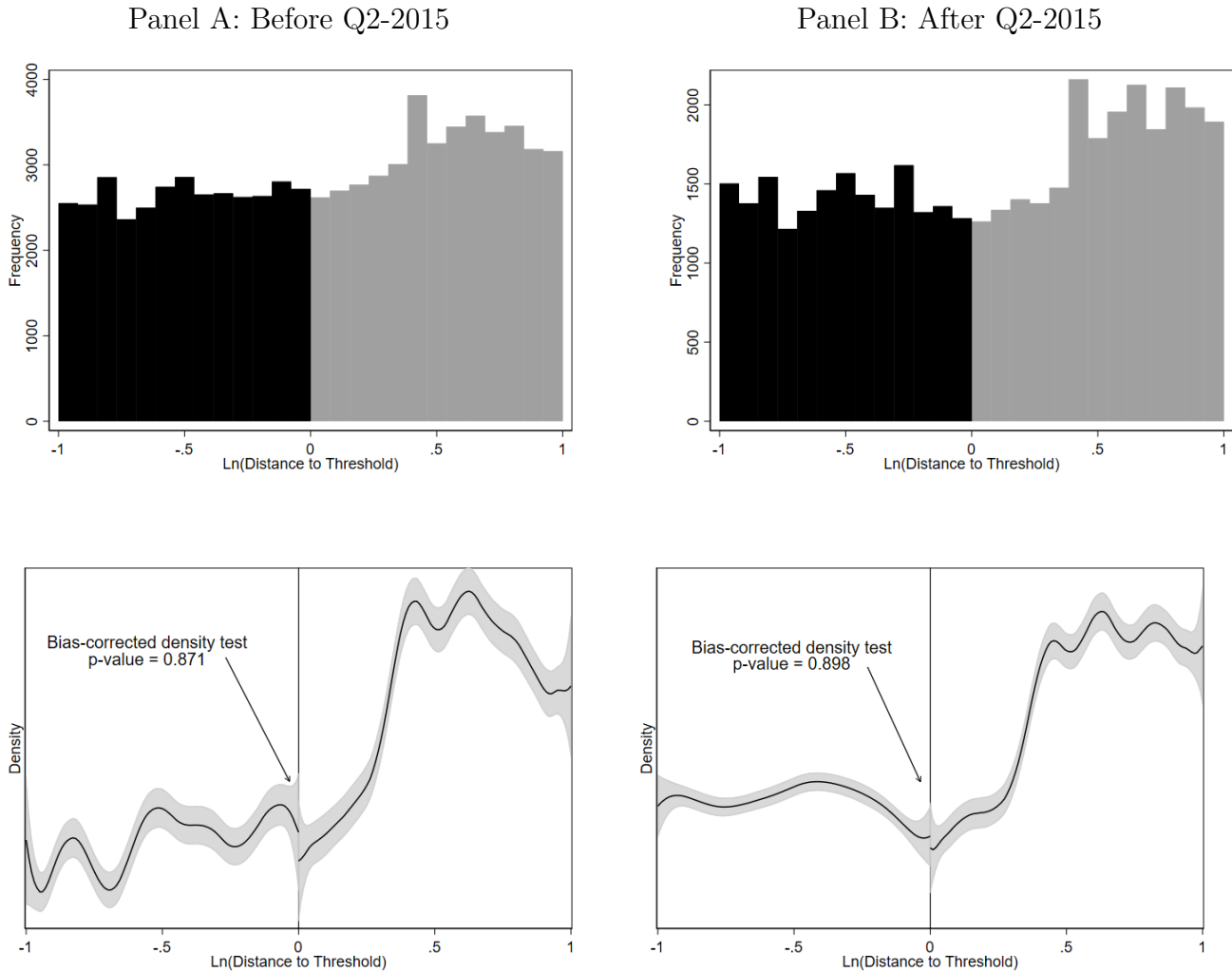


Notes: This figure presents trends for the number of press articles on public procurement and on all topics around the open data initiative in July 2015. We use Factiva to search for English language articles from European publications with a circulation of at least 100,000 copies per day. To identify articles on public procurement, we enter the following expressions in the “free text search” box: public contract* public procurement or public tender* and government procurement or government tender*. To identify articles on all topics, we leave the “free text search” box blank.



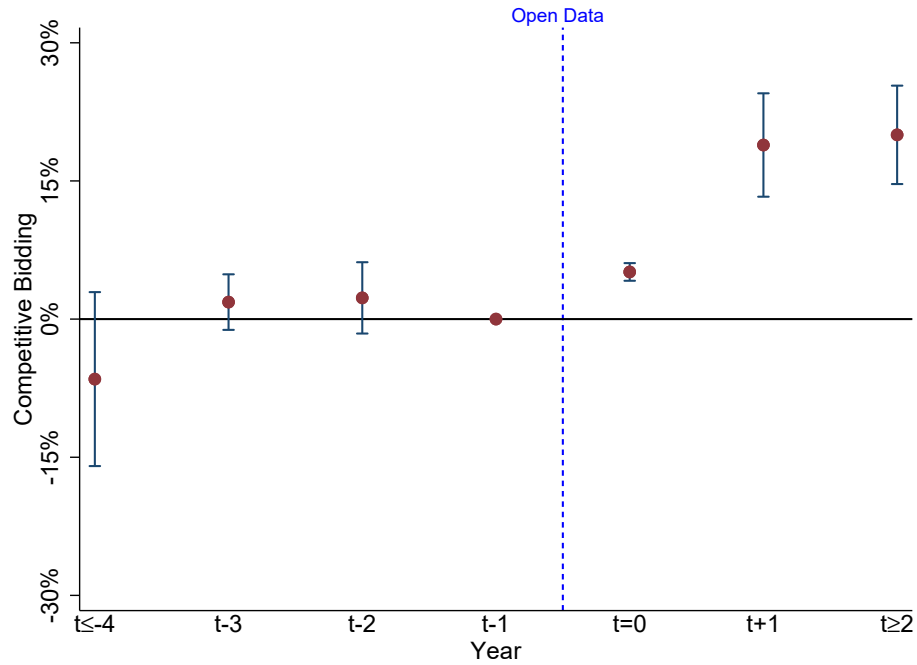
Notes: This figure presents trends for the number of press articles on public procurement and the number of public procurement contracts in the EU around the open data initiative in July 2015. We use Factiva to search for English language articles from European publications with a circulation of at least 100,000 copies per day. To identify articles on public procurement, we enter the following expressions in the “free text search” box: public contract* public procurement or public tender* and government procurement or government tender*. To identify articles on all topics, we leave the “free text search.” box blank. We retrieve the number of public procurement contracts from Digiwhist’s web page.

Figure 1: Distribution of Procurement Contracts around TED publication Thresholds



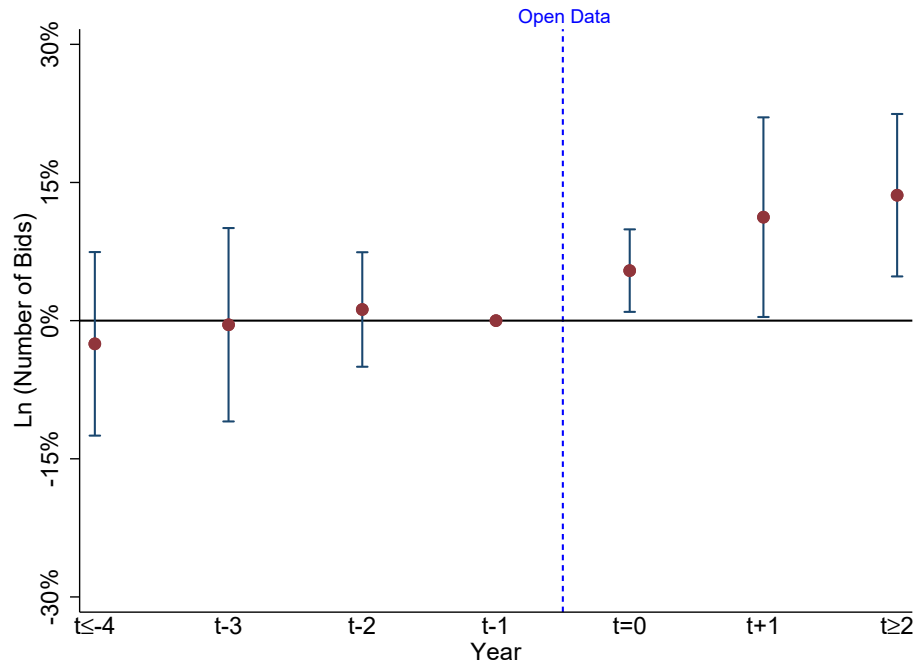
Notes: This figure shows the size distribution of procurement contracts around TED publication thresholds. The upper-left and upper-right charts show the frequency distributions of procurement contracts before and after Q2 2015. The lower-left and lower-right charts show the quadratic local polynomial function (Cattaneo et al. 2019) before and after Q2-2015. The shaded bandwidth represents robust 90% confidence intervals. $\text{Ln}(\text{Distance to Threshold})$ is the difference between the natural logarithms of *Contract Value* and the applicable TED publication threshold.

Figure 2: Competitive Bidding around Open Procurement Data



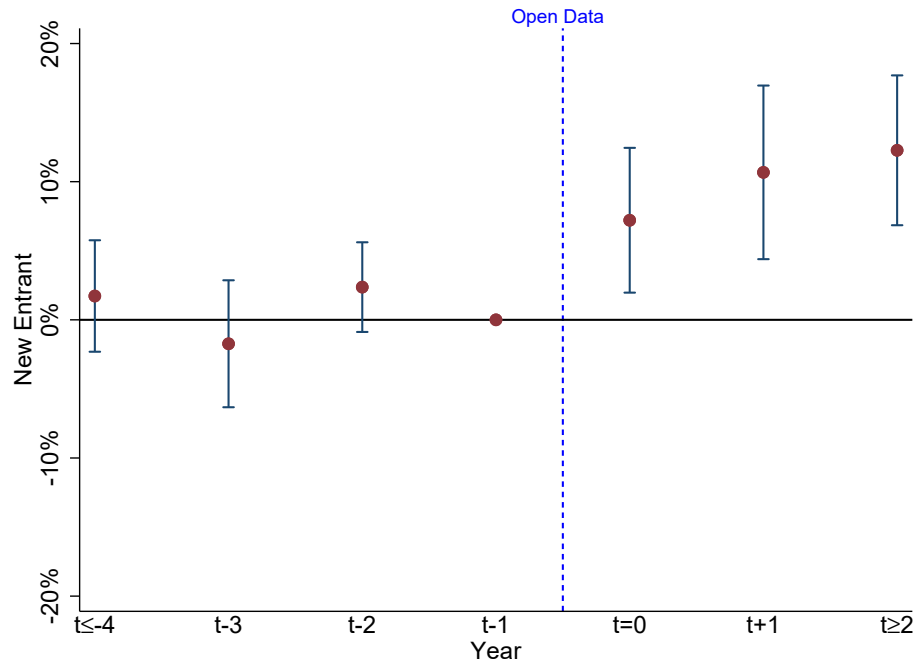
Notes: This figure shows coefficient estimates and 90% confidence intervals for OLS regressions estimating the effect of open procurement data on the likelihood of competitive bidding. *Competitive Bidding* is a binary indicator equal to one if the public contract is awarded through an open competitive bidding process. We estimate the model from Column (1) of Table 2 but interact the *TED Contract* indicator with separate time dummies, each marking a one-year period (except for event period $t-1$, which serves as the benchmark).

Figure 3: Number of Bids around Open Procurement Data



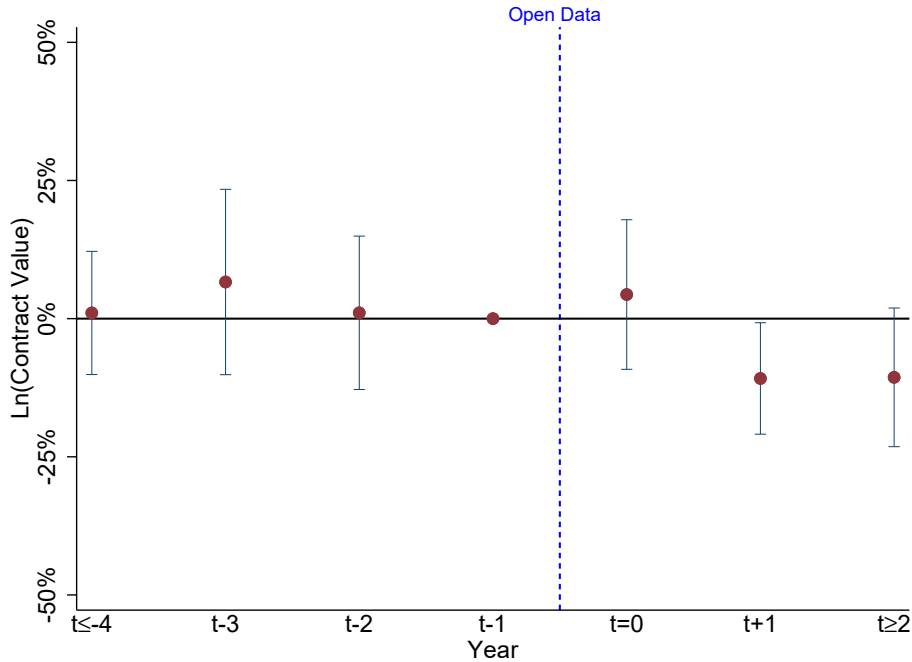
Notes: This figure shows coefficient estimates and 90% confidence intervals for OLS regressions estimating the effect of open procurement data on the number of bids received per government contract. *Number of Bids* is the number of bids received for a given procurement contract. We estimate the model from Column (1) of Table 4 but interact the *TED Contract* indicator with separate time dummies, each marking a one-year period (except for event period t-1, which serves as the benchmark).

Figure 4: Market Entry by New Suppliers around Open Procurement Data



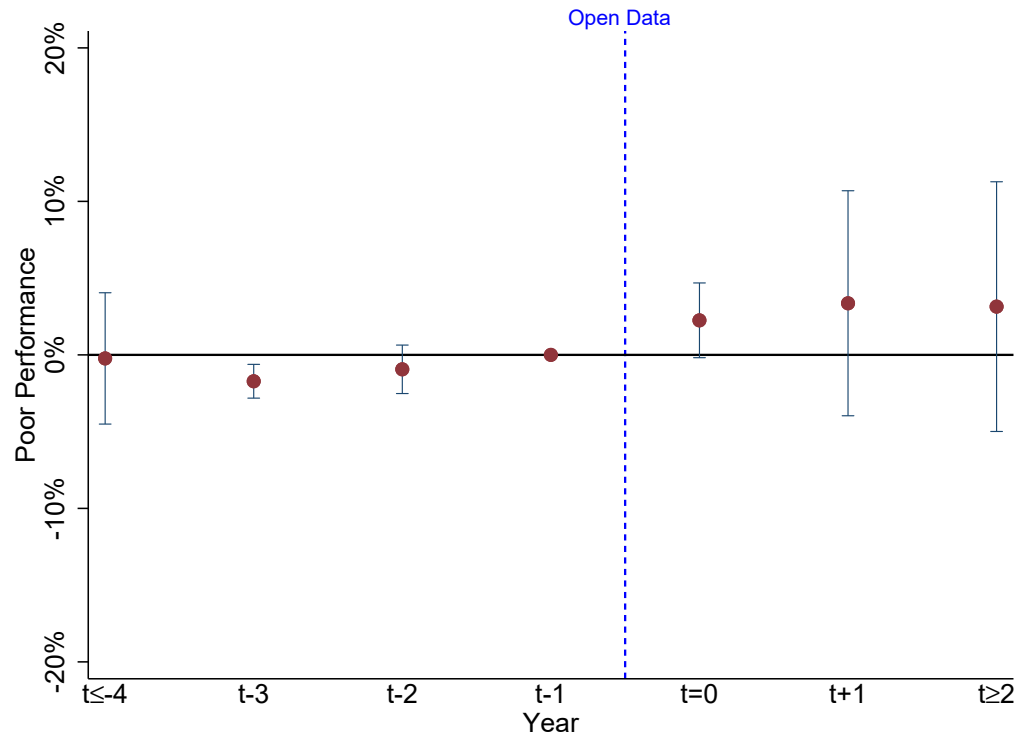
Notes: This figure shows coefficient estimates and 90% confidence intervals for OLS regressions estimating the effect of open procurement data on the entry of new suppliers in the public procurement market. *New Entrant* is a binary indicator equal to one if the supplier is awarded a public contract for the first time. We estimate the model from Column (1) of Table 5 but interact the *TED Contract* indicator with separate time dummies, each marking a one-year period (except for event period t-1, which serves as the benchmark).

Figure 5: Contract Values around Open Procurement Data



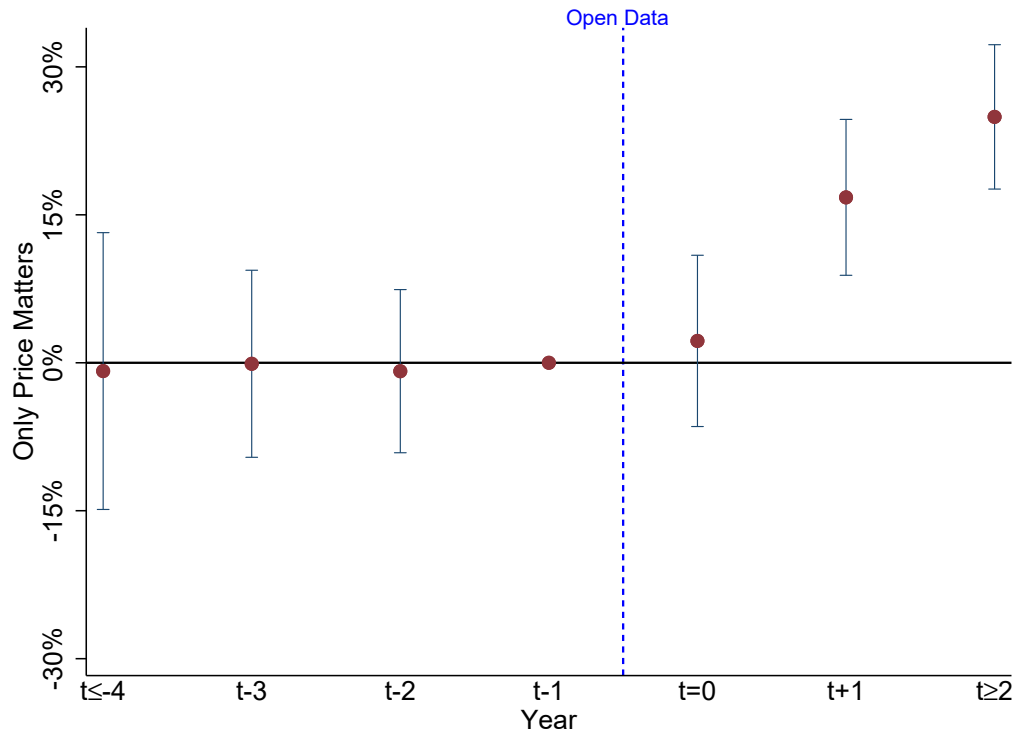
Notes: This figure shows coefficient estimates and 90% confidence intervals for OLS regressions estimating the effect of open procurement data on the value of government contracts. *Contract Value* is the amount of the winning bid in million Euros. We estimate the model from Column (1) of Table 6 but interact the *TED Contract* indicator with separate time dummies, each marking a one-year period (except for event period t-1, which serves as the benchmark).

Figure 6: Ex-Post Contract Performance around Open Procurement Data



Notes: This figure shows coefficient estimates and 90% confidence intervals for OLS regressions estimating the effect of open procurement data on the ex-post performance of government contracts. *Poor Performance* is a binary indicator equal to one if the procurement contract is modified ex post. We estimate the model from Column (1) of Table 7 but interact the *TED Contract* indicator with separate time dummies, each marking a one-year period (except for event period $t-1$, which serves as the benchmark).

Figure 7: Price Focus around Open Procurement Data



Notes: This figure shows coefficient estimates and 90% confidence intervals for OLS regressions estimating the effect of open procurement data on the likelihood that public officials award government contracts solely based on price. *Only Price Matters* is a binary indicator equal to one for contracts awarded solely based on price. We estimate the model from Column (1) of Table 8 but interact the *TED Contract* indicator with separate time dummies, each marking a one-year period (except for event period t-1, which serves as the benchmark).

Table 1: Descriptive Statistics

Variable	N	Mean	SD	P1	P25	P50	P75	P99
<i>TED Contract</i>	253,027	0.472	0.499	0.000	0.000	0.000	1.000	1.000
<i>Post CSV</i>	253,027	0.374	0.484	0.000	0.000	0.000	1.000	1.000
<i>Competitive Bidding</i>	253,027	0.871	0.336	0.000	1.000	1.000	1.000	1.000
<i>Number of Bids</i>	219,561	4.655	6.936	1.000	2.000	3.000	5.000	26.000
<i>New Entrant</i>	196,646	0.277	0.448	0.000	0.000	0.000	1.000	1.000
<i>Foreign Supplier</i>	178,129	0.019	0.136	0.000	0.000	0.000	0.000	1.000
<i>Foreign Supplier Same Language</i>	178,129	0.003	0.056	0.000	0.000	0.000	0.000	0.000
<i>Poor Performance</i>	236,983	0.031	0.172	0.000	0.000	0.000	0.000	1.000
<i>Contract Value (in mn. Euros)</i>	253,027	1.560	16.367	0.001	0.059	0.192	0.591	19.665
<i>Contract Value per Day (in thousand Euros)</i>	69,576	2.132	4.028	0.006	0.190	0.665	2.103	22.029
<i>Only Price Matters</i>	218,359	0.493	0.500	0.000	0.000	0.000	1.000	1.000
<i>EU Procurement Directive</i>	253,027	0.145	0.352	0.000	0.000	0.000	0.000	1.000
<i>Weak Disclosure Laws</i>	253,027	0.326	0.469	0.000	0.000	0.000	1.000	1.000
<i>Weak Conflict of Interest Laws</i>	253,027	0.259	0.438	0.000	0.000	0.000	1.000	1.000
<i>Weak Procurement Laws</i>	253,027	0.548	0.498	0.000	0.000	1.000	1.000	1.000
<i>Weak Freedom of Information Laws</i>	253,027	0.621	0.485	0.000	0.000	1.000	1.000	1.000
<i>Weak Political Financing Laws</i>	253,027	0.551	0.497	0.000	0.000	1.000	1.000	1.000
<i>High Project Complexity</i>	219,736	0.663	0.473	0.000	0.000	1.000	1.000	1.000

Notes: This table presents summary statistics for the analyses in Tables 2 to 8. The sample is based on contract-level data from Digiwhist. The sample period is from Q1-2009 to Q2-2018. *TED Contract* is a binary indicator equal to one for contracts above TED publication thresholds. *Post CSV* is a binary indicator equal to one for contracts tendered after July 2015. *Competitive Bidding* is a binary indicator equal to one if the public contract is awarded through an open competitive bidding process. *Number of Bids* is the number of bids received for a given procurement contract. *New Entrant* is a binary indicator equal to one if the supplier is awarded a public contract for the first time. *Foreign Supplier* is a binary indicator equal to one if the vendor is headquartered in a different country than the procurement site. *Foreign Supplier Same Language* is a binary indicator equal to one if the vendor is headquartered in a different country than the procurement site and shares the same official language. *Poor Performance* is a binary indicator equal to one if the procurement contract is modified ex post. *Contract Value* is the amount of the winning bid in million Euros. *Contract Value per Day* is equal to the *Contract Value* in thousand Euros divided by the estimated contract duration in days. *Only Price Matters* is a binary indicator equal to one for contracts awarded solely based on price. *EU Procurement Directive* is a binary indicator equal to one for TED contracts that are tendered after the given EU country transposed the EU Public Procurement Directive into national law. *Weak Disclosure Laws* is a binary indicator equal to one for countries whose EuroPAM disclosure score is below the EU median in 2014. *Weak Conflict of Interest Laws* is a binary indicator equal to one for countries whose EuroPAM conflict of interest score is below the EU median in 2014. *Weak Procurement Laws* is a binary indicator equal to one for countries whose EuroPAM procurement laws score is below the EU median in 2014. *Weak Freedom of Information Laws* is a binary indicator equal to one for countries whose EuroPAM freedom of information score is below the EU median in 2014. *Weak Political Financing Laws* is a binary indicator equal to one for countries whose EuroPAM political financing score is below the EU median in 2014. *High Project Complexity* is a binary indicator equal to one for contract types whose average modification rate prior to Q2-2015 exceeds the median of all contracts.

Table 2: Effect of Open Procurement Data on Competitive Bidding

	Baseline		Sensitivity Analyses	
	Within Country- Contract Type- Quarter	Including Ln(Contract Value) × Quarter-Year Interactions	Excluding Contracts around TED Publication Thresholds	Controlling for Supplier Country Characteristics
Dependent Variable: <i>Competitive Bidding</i>	(1)	(2)	(3)	(4)
<i>TED Contract</i> × <i>Post CSV</i>	0.174*** (4.96)	0.179*** (5.38)	0.229*** (4.26)	0.178*** (5.06)
<i>TED Contract</i>	0.031 (0.84)	0.037 (0.93)	0.037 (0.91)	0.029 (0.76)
Control Variables:				
<i>Ln(Contract Value)</i>	0.004 (0.47)	-0.019* (-1.87)	-0.004 (-0.76)	0.007 (0.69)
<i>EU Procurement Directive</i>	-0.187*** (-3.20)	-0.191*** (-3.31)	-0.190*** (-2.89)	-0.192*** (-3.22)
Fixed Effects:				
Country × Contract Type × Quarter-Year	Yes	Yes	Yes	Yes
Supplier Country × Quarter-Year	No	No	No	Yes
Contract Size × Quarter-Year Interactions	No	Yes	No	No
Adjusted R ²	0.279	0.283	0.280	0.270
Contract Observations	253,027	253,027	152,659	230,674

Notes: This table reports the coefficient estimates of OLS regressions estimating the effect of open procurement data on the likelihood of competitive bidding. The sample is based on contract-level data from Digiwhist. The sample period is from Q1-2009 to Q2-2018. *Competitive Bidding* is a binary indicator equal to one if the public contract is awarded through an open competitive bidding process. *TED Contract* is a binary indicator equal to one for contracts above TED publication thresholds. *Post CSV* is a binary indicator equal to one for contracts tendered after July 2015. *Contract Value* is the amount of the winning bid in million Euros. *EU Procurement Directive* is a binary indicator equal to one for TED contracts that are tendered after the given EU country transposed the EU Public Procurement Directive into national law. Contract Types are defined based on two-digit Common Procurement Vocabulary (CPV) codes. T-statistics, reported in parentheses, are based on standard errors clustered at the country level. ***, **, and * indicate statistical significance at the 1 %, 5% and 10% levels, respectively.

Table 3: The Role of Prior Regulation for the Competitive Bidding Effects of Open Procurement Data

Dependent Variable: <i>Competitive Bidding</i>	Disclosure Laws (1)	Procurement Laws (2)	Conflict of Interest Laws (3)	Freedom of Information Laws (4)	Political Financing Laws (5)
<i>TED Contract</i> × <i>Post CSV</i> × <i>Weak Disclosure Laws</i>	0.184* (1.71)				
<i>TED Contract</i> × <i>Post CSV</i> × <i>Weak Procurement Laws</i>		0.207*** (4.69)			
<i>TED Contract</i> × <i>Post CSV</i> × <i>Weak Conflict of Interest Laws</i>			0.099 (1.28)		
<i>TED Contract</i> × <i>Post CSV</i> × <i>Weak Freedom of Information Laws</i>				0.145*** (2.91)	
<i>TED Contract</i> × <i>Post CSV</i> × <i>Weak Political Financing Laws</i>					0.162*** (3.11)
<i>TED Contract</i> × <i>Post CSV</i>	0.004 (0.13)	-0.031 (-0.96)	0.016 (0.56)	0.045 (1.12)	0.022 (0.66)
<i>TED Contract</i>	-0.000 (-0.01)	-0.037** (-2.29)	-0.005 (-0.18)	0.031 (1.07)	0.019 (0.65)
Control Variables:					
<i>Ln(Contract Value)</i>	0.006 (0.60)	0.013 (0.94)	0.002 (0.22)	-0.006** (-2.31)	-0.006*** (-2.78)
<i>EU Procurement Directive</i>	-0.013 (-0.28)	0.033 (0.44)	-0.043 (-1.28)	0.043 (0.43)	0.011 (0.15)
Fixed Effects:					
Country × Contract Type × Quarter-Year	Yes	Yes	Yes	Yes	Yes
Main Effects and Interactions	Yes	Yes	Yes	Yes	Yes
Adjusted R ²	0.282	0.282	0.285	0.281	0.282
Contract Observations	253,027	253,027	253,027	253,027	253,027

Notes: This table reports the coefficient estimates of OLS regressions estimating the effect of open procurement data on the likelihood of competitive bidding in countries with weak prior institutions. The sample is based on contract-level data from Digiwhist. The sample period is from Q1-2009 to Q2-2018. *Competitive Bidding* is a binary indicator equal to one if the public contract is awarded through an open competitive bidding process. *TED Contract* is a binary indicator equal to one for contracts above TED publication thresholds. *Post CSV* is a binary indicator equal to one for contracts tendered after July 2015. *Contract Value* is the amount of the winning bid in million Euros. *EU Procurement Directive* is a binary indicator equal to one for TED contracts that are tendered after the given EU country transposed the EU Public Procurement Directive into national law. *Weak Disclosure Laws* is a binary indicator equal to one for countries whose EuroPAM disclosure score is below the EU median in 2014. *Weak Procurement Laws* is a binary indicator equal to one for countries whose EuroPAM procurement laws score is below the EU median in 2014. *Weak Conflict of Interest Laws* is a binary indicator equal to one for countries whose EuroPAM conflict of interest score is below the EU median in 2014. *Weak Freedom of Information Laws* is a binary indicator equal to one for countries whose EuroPAM freedom of information score is below the EU median in 2014. *Weak Political Financing Laws* is a binary indicator equal to one for countries whose EuroPAM political financing score is below the EU median in 2014. Contract Types are defined based on two-digit Common Procurement Vocabulary (CPV) codes. T-statistics, reported in parentheses, are based on standard errors clustered at the country level. ***, **, and * indicate statistical significance at the 1 %, 5% and 10% levels, respectively.

Table 4: Effect of Open Procurement Data on the Intensity of Bidding among Vendors

	Baseline	Sensitivity Analyses		
	Within Country-Contract Type-Quarter (1)	Including Ln(Contract Value) × Quarter-Year Interactions (2)	Excluding Contracts around TED Publication Thresholds (3)	Controlling for Supplier Country Characteristics (4)
Dependent Variable: <i>Ln(Number of Bids)</i>				
<i>TED Contract × Post CSV</i>	0.111*** (2.87)	0.101** (2.70)	0.091*** (2.87)	0.130*** (3.73)
<i>TED Contract</i>	0.050** (2.60)	0.058** (2.67)	0.003 (0.18)	0.043** (2.54)
Control Variables:				
<i>Ln(Contract Value)</i>	0.001 (0.11)	-0.024 (-1.36)	0.007 (1.41)	0.002 (0.29)
<i>EU Procurement Directive</i>	-0.142*** (-3.21)	-0.149*** (-3.16)	-0.078* (-1.84)	-0.155*** (-4.40)
Fixed Effects:				
Country × Contract Type × Quarter-Year	Yes	Yes	Yes	Yes
Supplier Country × Quarter-Year	No	No	No	Yes
Contract Size × Quarter-Year Interactions	No	Yes	No	No
Adjusted R ²	0.380	0.380	0.383	0.382
Contract Observations	219,561	219,561	136,092	199,032

Notes: This table reports the coefficient estimates of OLS regressions estimating the effect of open procurement data on the number of bids received per government contract. The sample is based on contract-level data from Digiwhist. The sample is limited to contracts awarded through an open competitive bidding process. The sample period is from Q1-2009 to Q2-2018. *Number of Bids* is the number of bids received for a given procurement contract. *TED Contract* is a binary indicator equal to one for contracts above TED publication thresholds. *Post CSV* is a binary indicator equal to one for contracts tendered after July 2015. *Contract Value* is the amount of the winning bid in million Euros. *EU Procurement Directive* is a binary indicator equal to one for TED contracts that are tendered after the given EU country transposed the EU Public Procurement Directive into national law. Contract Types are defined based on two-digit Common Procurement Vocabulary (CPV) codes. T-statistics, reported in parentheses, are based on standard errors clustered at the country level. ***, **, and * indicate statistical significance at the 1 %, 5% and 10% levels, respectively.

Table 5: Effect of Open Procurement Data on Market Entry

Dependent Variable:	New Entrant	Foreign Supplier	Foreign Supplier Same Language
	(1)	(2)	(3)
<i>TED Contract</i> × <i>Post CSV</i>	0.087** (2.48)	-0.001 (-0.13)	-0.001 (-1.13)
<i>TED Contract</i>	0.035 (1.14)	0.010** (2.21)	-0.001 (-0.87)
Control Variables:			
<i>Ln(Contract Value)</i>	-0.023*** (-7.09)	0.004*** (6.05)	0.001* (1.88)
<i>EU Procurement Directive</i>	-0.050*** (-4.31)	0.009 (1.32)	-0.001 (-1.22)
Fixed Effects:			
Country × Contract Type × Quarter-Year	Yes	Yes	Yes
Adjusted R ²	0.182	0.167	0.166
Contract Observations	196,646	178,129	178,129

Notes: This table reports the coefficient estimates of OLS regressions estimating the effect of open procurement data on the characteristics of winning suppliers. The sample is based on contract-level data from Digiwhist. The sample period is from Q1-2009 to Q2-2018. *New Entrant* is a binary indicator equal to one if the supplier is awarded a public contract for the first time. *Foreign Supplier* is a binary indicator equal to one if the vendor is headquartered in a different country than the procurement site. *Foreign Supplier Same Language* is a binary indicator equal to one if the vendor is headquartered in a different country than the procurement site and shares the same official language. *TED Contract* is a binary indicator equal to one for contracts above TED publication thresholds. *Post CSV* is a binary indicator equal to one for contracts tendered after July 2015. *Contract Value* is the amount of the winning bid in million Euros. *EU Procurement Directive* is a binary indicator equal to one for TED contracts that are tendered after the given EU country transposed the EU Public Procurement Directive into national law. Contract Types are defined based on two-digit Common Procurement Vocabulary (CPV) codes. T-statistics, reported in parentheses, are based on standard errors clustered at the country level. ***, **, and * indicate statistical significance at the 1 %, 5% and 10% levels, respectively.

Table 6: Effect of Open Procurement Data on Contract Values

	All Contracts	Within Recurring Contracts	Normalized Contract Values
Dependent Variable:	Ln(Contract Value) (1)	Ln(Contract Value) (2)	Contract Value per Day (3)
<i>TED Contract</i> × <i>Post CSV</i>	-0.080*** (-3.72)	-0.161*** (-3.47)	-0.977*** (-4.53)
<i>TED Contract</i>	0.303*** (12.08)	0.131*** (3.42)	2.443*** (9.81)
Control Variables:			
<i>EU Procurement Directive</i>	0.130** (2.06)	0.128** (2.47)	0.112 (0.13)
Fixed Effects:			
Country × Contract Type × Quarter-Year	Yes	Yes	Yes
Contract Size Quintile × Quarter-Year	Yes	Yes	Yes
Recurring Contracts	No	Yes	No
Adjusted R ²	0.886	0.928	0.258
Contract Observations	253,027	33,594	66,659

Notes: This table reports the coefficient estimates of OLS regressions estimating the effect of open procurement data on contract values. The sample is based on contract-level data from Digiwhist. The sample period is from Q1-2009 to Q2-2018. *Contract Value* is the amount of the winning bid in million Euros. *Contract Value per Day* is equal to the *Contract Value* in thousand Euros divided by the estimated contract duration in days. *TED Contract* is a binary indicator equal to one for contracts above TED publication thresholds. *Post CSV* is a binary indicator equal to one for contracts tendered after July 2015. *EU Procurement Directive* is a binary indicator equal to one for TED contracts that are tendered after the given EU country transposed the EU Public Procurement Directive into national law. Contract Types are defined based on two-digit Common Procurement Vocabulary (CPV) codes. T-statistics, reported in parentheses, are based on standard errors clustered at the country level. ***, **, and * indicate statistical significance at the 1 %, 5% and 10% levels, respectively.

Table 7: Effect of Open Procurement Data on Ex-Post Contract Performance

Dependent Variable:	Poor Performance
<i>TED Contract</i> × <i>Post CSV</i>	0.029** (2.13)
<i>TED Contract</i>	-0.037 (-1.18)
Control Variables:	
<i>Ln(Contract Value)</i>	0.003* (1.97)
<i>EU Procurement Directive</i>	0.032* (1.94)
Fixed Effects:	
Country × Contract Type × Quarter-Year	Yes
Adjusted R ²	0.174
Contract Observations	236,983

Notes: This table reports the coefficient estimates of OLS regressions estimating the effect of open procurement data on the ex-post performance of EU government contracts. The sample is based on contract-level data from Digiwhist. The sample period is from Q1-2009 to Q4-2017. *Poor Performance* is a binary indicator equal to one if the procurement contract is modified ex post. *TED Contract* is a binary indicator equal to one for contracts above TED publication thresholds. *Post CSV* is a binary indicator equal to one for contracts tendered after July 2015. *Contract Value* is the amount of the winning bid in million Euros. *EU Procurement Directive* is a binary indicator equal to one for TED contracts that are tendered after the given EU country transposed the EU Public Procurement Directive into national law. Contract Types are defined based on two-digit Common Procurement Vocabulary (CPV) codes. T-statistics, reported in parentheses, are based on standard errors clustered at the country level. ***, **, and * indicate statistical significance at the 1 %, 5% and 10% levels, respectively.

Table 8: Mechanisms - Reconciling Higher Competition with Lower Performance

Dependent Variable:	Price Focus		New Entrants	Project Complexity
	Only Price Matters (1)	Poor Performance (2)	Poor Performance (3)	Poor Performance (4)
<i>TED Contract</i> × <i>Post CSV</i> × <i>Only Price Matters</i>		0.025** (2.70)		
<i>TED Contract</i> × <i>Post CSV</i> × <i>New Entrant</i>			0.011* (1.89)	
<i>TED Contract</i> × <i>Post CSV</i> × <i>High Project Complexity</i>				0.013** (2.18)
<i>TED Contract</i> × <i>Post CSV</i>	0.173** (2.14)	0.018 (1.41)	0.053 (1.12)	0.021* (2.00)
<i>TED Contract</i>	0.014 (0.47)	-0.011 (-0.93)	-0.076 (-1.07)	-0.024 (-1.07)
Control Variables:				
<i>Ln(Contract Value)</i>	-0.013** (-2.67)	0.002 (1.54)	0.007 (1.69)	-0.000 (-0.18)
<i>EU Procurement Directive</i>	-0.288** (-2.58)	0.004 (0.36)	0.025 (1.09)	0.010 (0.53)
Fixed Effects:				
Country × Contract Type × Quarter-Year	Yes	Yes	Yes	Yes
Main Effects and Interactions	No	Yes	Yes	Yes
Adjusted R ²	0.489	0.084	0.185	0.176
Contract Observations	190,719	177,773	101,151	219,736

Notes: This table reports the coefficient estimates of OLS regressions exploring the mechanisms behind the performance effects of open procurement data. The sample is based on contract-level data from Digiwhist. The sample period is from Q1-2009 to Q2-2018. The dependent variable in Column (1) is *Only Price Matters*. The dependent variable in Columns (2) to (4) is *Poor Performance*. *Only Price Matters* is a binary indicator equal to one for contracts awarded solely based on price. *Poor Performance* is a binary indicator equal to one if the procurement contract is modified ex post. *New Entrant* is a binary indicator equal to one if the supplier is awarded a public contract for the first time during the post-treatment period. *High Project Complexity* is a binary indicator equal to one for contract types whose average modification rate prior to Q2-2015 exceeds the median of all contracts. *TED Contract* is a binary indicator equal to one for contracts above TED publication thresholds. *Post CSV* is a binary indicator equal to one for contracts tendered after July 2015. *Contract Value* is the amount of the winning bid in million Euros. *EU Procurement Directive* is a binary indicator equal to one for TED contracts that are tendered after the given EU country transposed the EU Public Procurement Directive into national law. Contract Types are defined based on two-digit Common Procurement Vocabulary (CPV) codes. T-statistics, reported in parentheses, are based on standard errors clustered at the country level. ***, **, and * indicate statistical significance at the 1 %, 5% and 10% levels, respectively.

Internet Appendix to

The Impact of Open Data on Public Procurement

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Internet Appendix A: Sample Composition

Table IA1: Sample Composition by Country

Country	Number of Contracts	Percentage of Contracts	Contract Volume (in mn. EUR)	Percentage of Contract Volume
Austria	1,940	0.767	4,842	1.227
Belgium	3,590	1.419	11,616	2.944
Croatia	2,888	1.141	5,768	1.462
Cyprus	17	0.007	4	0.001
Czech Republic	53,928	21.313	42,825	10.852
Estonia	704	0.278	999	0.253
Finland	2,171	0.858	5,415	1.372
France	21,193	8.376	44,449	11.263
Germany	20,947	8.279	29,728	7.533
Greece	17	0.007	8	0.002
Hungary	5,333	2.108	6,648	1.685
Iceland	24	0.009	17	0.004
Ireland	37	0.015	44	0.011
Italy	10,168	4.019	29,693	7.524
Latvia	8,873	3.507	1,344	0.341
Lithuania	925	0.366	4,749	1.203
Luxembourg	79	0.031	109	0.028
Malta	3	0.001	1	0.000
Netherlands	3,704	1.464	25,566	6.478
Norway	2,511	0.992	11,548	2.926
Poland	50,090	19.796	39,741	10.070
Portugal	881	0.348	1,310	0.332
Romania	3,216	1.271	5,468	1.386
Slovakia	11,069	4.375	16,263	4.121
Slovenia	2,142	0.847	2,708	0.686
Spain	33,828	13.369	21,986	5.571
Sweden	3,841	1.518	10,407	2.637
Switzerland	5,467	2.161	25,413	6.440
United Kingdom	3,441	1.360	45,963	11.647
Sum	253,027	100.000	394,633	100.000

Notes: This table presents descriptive statistics for all government contracts in our sample by country. The sample is based on contract-level data from Digiwhist's Open Tender initiative. The sample period is from Q1-2009 to Q2-2018.

Table IA2: Sample Composition by Contract Type

Contract Type	Number of Contracts	Percentage of Contracts	Contract Volume (in mn. EUR)	Percentage of Contract Volume
Agricultural, farming, fishing, and forestry	898	0.355	218	0.055
Agricultural, forestry, horticultural, aquacultural and apicultural services	4,918	1.944	2,195	0.556
Agricultural machinery	701	0.277	102	0.026
Architectural, construction, engineering and inspection services	13,474	5.325	13,314	3.374
Business services: law, marketing, consulting, recruitment, printing and security	7,497	2.963	11,471	2.907
Chemical products	1,482	0.586	5,024	1.273
Clothing, footwear, luggage articles and accessories	1,850	0.731	817	0.207
Collected and purified water	68	0.027	108	0.027
Construction structures and materials; auxiliary products to construction (excl. electric apparatus)	4,535	1.792	3,970	1.006
Construction work	68,135	26.928	132,321	33.530
Education and training services	253	0.100	3	0.001
Electrical machinery, apparatus, equipment and consumables; lighting	3,088	1.220	4,841	1.227
Financial and insurance services	8,039	3.177	13,856	3.511
Food, beverages, tobacco	4,738	1.873	2,438	0.618
Furniture (incl. office furniture), furnishings, domestic appliances (excl. lighting) and cleaning products	5,061	2.000	2,345	0.594
Health and social work services	79	0.031	2	0.000
Hotel, restaurant and retail trade services	134	0.053	166	0.042
IT services	9,929	3.924	20,263	5.135
Industrial machinery	3,929	1.553	3,660	0.928
Installation services (excl. software)	335	0.132	465	0.118
Laboratory, optical and precision equipments (excl. glasses)	5,902	2.333	3,699	0.937
Leather and textile fabrics, plastic and rubber materials	325	0.128	103	0.026
Machinery for mining, quarrying, construction equipment	752	0.297	1,174	0.297
Medical equipments, pharmaceuticals and personal care products	26,030	10.287	19,846	5.029
Mining, basic metals	748	0.296	394	0.100
Musical instruments, sport goods, games, toys, handicraft, art materials and accessories	669	0.264	111	0.028
Office and computing machinery, equipment and supplies (excl. furniture and software packages)	7,915	3.128	8,585	2.175
Other community, social and personal services	1,378	0.545	4,335	1.098
Petroleum products, fuel, and electricity	9,326	3.686	33,189	8.410
Postal and telecommunications services	1,402	0.554	2,674	0.677
Printed matter	1,678	0.663	1,457	0.369
Public utilities	864	0.341	3,306	0.838
R&D services	959	0.379	569	0.144
Radio, television, communication, and telecommunication	2,910	1.150	4,365	1.106
Real estate services	341	0.135	591	0.150
Recreational, cultural and sporting services	9	0.004	0	0.000
Repair and maintenance services	9,755	3.855	15,658	3.968
Security, fire-fighting, police and defence equipment	702	0.277	633	0.160
Services related to the oil and gas industry	158	0.062	833	0.211
Sewage, refuse, cleaning, and environmental services	15,970	6.312	25,180	6.381
Software package and information systems	4,425	1.749	4,795	1.215
Supporting and auxiliary transport services; travel agencies services	1,007	0.398	3,847	0.975
Transport equipment	15,913	6.289	24,350	6.170
Transport services (excl. waste transport)	4,746	1.876	17,363	4.400
Sum	253,027	100.000	394,633	100.000

Notes: This table presents descriptive statistics for all government contracts in our sample by contract type. We define contract types based on two-digit Common Procurement Vocabulary (CPV) codes. The sample is based on contract-level data from Digiwhist's Open Tender initiative. The sample period is from Q1-2009 to Q2-2018.