

The Effect of the 2014 EU Public Procurement Directives on Tender Outcomes

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Abstract

The EU procurement directives of 2014 aimed to improve transparency through increased electronic bidding, to liberalize the international procurement market by removing ‘buy local’ policies, and to increase competition and international participation in procurement, leading to an overall more efficient public procurement process. One of the implicit channels through which they hoped to achieve higher efficiency is through the number of bidders (the ‘competition effect’ in auction theory). Using a differences-in-differences framework with interacted fixed effects, this paper analyzes whether the 2014 EU directives, which were supposed to be translated into national laws by April 2016, had the intended effect on competitive auction procedure usage, number of bidders, cross-border procurement, and market concentration. Furthermore, in addition to the fixed effects estimation within the DD framework, I apply a Lasso-type method of variable selection that has been shown to provide uniform inference. I do not find statistically significant results on the likelihood that a contract is tendered under the most open procedure or on the likelihood of an international bidder winning. I do find a statistically significant positive effect on the likelihood a tender is modified ex-post (in line with literature) and a negative effect on numbers of bidders.

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2 Introduction

Public procurement comprises a large proportion of GDP, representing about 14% of the EU’s GDP in 2013 (Cernat and Kutlina-Dimitrova 2015). Public auctions have been used in order to address potential problems in the acquisition of suppliers for public needs, including non-competitive and expensive contract procurement outcomes. In most developed countries, public auctions are regulated under procurement legislation. Most recently, international public procurement directives were passed in 2014, by both the World Trade Organization and the European Union, and these directives have since been translated into law in most member states.

These directives were aimed at improving market efficiency, increasing the usage of environmentally friendly or “green” procurement, promoting conditions for business innovation, and opening up the procurement market to be more available EU-wide. Additionally, special aims were to increase flexibility of procurement, encourage greater participation from small and medium-sized enterprises (SMEs), and to ensure transparency (“Directive 2014/24/EU of the European Parliament and of the Council” 2014-02-26).

However, despite the new arrangements in place to encourage competition and transparency, some lawmakers have been concerned that the auction mechanisms affected by these new laws are not working as planned, in part due to a noticeable lack of competing suppliers: In Sweden, as in many EU countries, the numbers of reported bidders has generally been decreasing over time, with only one bidder being reported for an increasing amount of contract award notices (Tukiainen and Halonen 2020). This decline in competition has potential ramifications for lost efficiency and transparency, as the lack of competition can restrain an auction market’s efficient resource allocation.

Though several EU member states and other EEC countries have passed new public procurement legislation as a result of the 2014 EU directive on Public Procurement, not many studies have yet explored the effect of the new procurement regulations on key auction outcomes, including contract openness and level of competition. In the following paper, I will adapt a differences-in-differences methodology, originally used by Duguay et al. (2020), to determine the impact of open data initiatives on procurement outcomes, to assess the EU Procurement Directives’ outcomes along several dimensions. First, I evaluate the effect on two outcome variables of Duguay et al: the use of Open procedure procurement and the likelihood of tender modifications. Then, I extend the analysis to evaluate additional goals of the Procurement Directives, including the likelihood that over two bids were received (a measure competition), the likelihood of cross-border or international procurement, and the likelihood that a top-4 or top-8 winning supplier wins the contract (an approximate measure of market concentration). In addition, I extend their fixed effects specification, which included interactions for country-industry-time period, to incorporate a “post-double-selection” method of variable selection.

My findings will be compared to those of Duguay et al. and be contextualized within the objectives of the EU legislation and basic auction theory models.

2.1 Research Question

This paper investigates the effect of the 2014 EU Procurement Directives, which were translated into national law between 2015 and 2018, on procurement outcomes, focusing on some of the purported goals of the original initiative. Specifically, I use a differences-in-differences framework with fixed effects to investigate whether the new policies opened up the procurement process, as indicated by an increased use in “Open” procedure tendering.

In addition, I evaluate whether cross-country suppliers were more likely to win, whether the procurement was more likely to be altered ex-post (indicating greater complications), and whether the contract was more likely to have more than 2 bidders (indicating greater participation). In this specification, the treatment group consists of contracts that were subject to the new EU directive (i.e. contracts with values above the threshold for mandatory reporting to the EU body) in a time period after the directive began to be translated into national law for the given tender country.

In this paper I will show that, broadly speaking, the 2014 directives did not have the direct impact on tender outcomes that they stated they were targeting. In line with previous research of Duguay et al (2020), I do not find a statistically significant effect of the passage of new procurement legislation on the use of open tendering. Significant results are found for other measured outcome variables, but they are contrary to the desired effects of the legislation: Ex-post contract modifications increase following the treatment, while numbers of bidders decrease, indicating potential loss of efficiency and lower competition in procurement.

To my knowledge, this paper is the first to causally investigate the effects of the 2014 EU Procurement Directives on tender outcomes that were pointedly targeted by the directives. Evidence in this paper suggests that this direct legislative channel may not have led to the hoped-for outcomes, while bolstering Duguay et al’s findings that the publication of open data is a more promising channel for impacting public procurement (2020).

3 Background

3.1 Legislative Background: Procurement in EU

Public procurement makes up a large percentage of government expenses, taking between 10 and 20% GDP within the EU (Cernat and Kutlina-Dimitrova 2015). In order to maintain transparency and ensure sufficient competition, the procurement process is regulated. In the EU, one way competition has been encouraged is through Directives 2014/24/EU, 2014/25/EU, and 2014/23/EU, which correspond to the Public Contracts Directive 2014, the Concessions Contracts Directive 2014, and the Utilities Directive 2014. These directives set new EU procurement and concession rules that were to be transposed into national laws of its member states by no later than 18 April 2016, though actual compliance was imperfect. A table in the Appendix under “EU Member Procurement Laws” indicates when the Directives began to be translated into national law.

The stated goals of the EU directive are to coordinate national procurement procedures and open up public procurement to competition (“Directive 2014/24/EU of the European Parliament and of the Council” 2014-02-26). These objectives would be achieved by simplifying procedures, increasing usage of electronic bidding processes, and encouraging SME participation through smaller lot size and lower turnover requirements, among other provisions. Opening up the public procurement market also allows for greater cross-border competition and international participation, which the EU encourages. Prior to the 2014 directives, the last major EU legislation for procurement was the 2004 Sector Directive and Classical Directives, which the 2014 policy supplanted.

Furthermore, in the broader world market, the World Trade Organization (WTO) originally passed the Agreement on Government Procurement (GPA) in 1979, which was renewed on 30 March 2012 and went into effect in July 2014. The establishment of the GPA by members of the WTO similarly aimed to open up the procurement market across member states. Specifically, this legislation was passed in order to encourage “open, fair and transparent conditions of competition” in government procurement (Verheij et al., n.d.). By removing barriers and liberalizing the procurement market across national borders, GPA hoped to promote efficiency and productivity and incentivize innovation in procurement. These effects would also largely take place through the channel of increased competition (Carboni et al. 2017).

However, EU and WTO policies that encourage transnational procurement competition might not be as effective as hoped, however, because the number of contracts that are awarded to international firms remains small. Carboni et al note a continued pattern of discrimination against foreign firms despite these international policies (2018). Thus, these transnational agreements—the GPA and the EU Public Procurement directives—might not open up the international procurement market as much as desired.

Goals of EU 2014 Procurement Directive

This section more specifically outlines the relevant features of the EU 2014 Procurement Directive that may be drivers in the final econometric estimation of public auction outcomes.

The EU's Public Contracts Directive 2014 explicitly provides procedures that procuring agencies must observe when certain criteria for public procurement are met. All public procurements above a set threshold (save for specific exceptions such as defense or national security purchases) are subject to the conditions of the directive. The general goals of the policy are to:

- improve conditions for businesses to innovate
- increase green public procurement (GPP) as a potential policy instrument
- ensure most efficient use of public funds
- keep procurement markets open EU-wide

Though covering the features of the EU 2014 directives in deep detail is out of scope for this paper, a few articles that are relevant to the outcomes analyzed in this study are summarized below here (OECD 2014):

Article 22: Rules applicable to communication. This article emphasizes the equal and fair access to electronic communication, including the e-submission of tenders. Importantly, contracting authorities must store and maintain quality data on tenders and requests. The EU directives' renewed focus on e-Procurement both makes the submission of tenders easier and more accessible, lowering barriers to entry, as well as improves the quality of data collected from the contracting agencies. The increased use of e-tendering can be noted in the increased availability of data.

Article 26: Choice of procedures. This section summarizes the five different competition procedures that procuring agencies may choose between: 1) Open procedure, 2) restricted procedure, 3) competitive procedure with negotiation, 4) competitive dialogue, or 5) innovation partnership. The first two procedures may be freely implemented. The procurement must meet particular requirements in order for the agency to be able to use a "Competitive procedure with negotiation," but these requirements have been relaxed between 2004 and 2014. (Details about these conditions, and how they might promote international trade, can be found in Recital 42 of the 2014 directives). This article also adds new procedures "innovation partnership" and "competitive procedure with negotiation," and expanded the option of "competitive dialogue." Thus, we might expect the most competitive procedure—"Open" procedure—to decrease in usage with the availability of these new options.

Article 27: Open procedure. This section outlines Open Procedures, which have a decreased minimum statutory period of time over which tenders can be submitted by suppliers compared to the earlier 2004 directives (from 54 days to 35 days). If contracting authorities release a prior information notice (PIN), or if there are conditions of urgency, the minimum time decreases even further, to 15 days. This new relaxed requirement gives procurers increased discretion and may incentivize an unintended use of PINs in order to limit competition. This policy change also complicates the interpretation of the results, as the definition of an "Open" tendering process changes.

Article 33: Framework agreements. This section gives details about framework agreements, the frequently multi-supplier agreements that determine the terms for purchasing yet-undecided quantities of goods or services. Article 33 ascribes a greater transparency to such agreements: Contracting authorities must now more clearly identify the parties to the agreement and state the criteria on which contract award decisions are made under such an agreement. Notably, in the data set, this policy has caused the increased use, or at least the increased reportage, of framework agreements. This paper's specification controls for out framework agreements due to its changed treatment before and after 2016 policy and the differences in its data quality before and after treatment.

Article 41: Prior involvement of candidates or tenderers. This section of the EU directives requires that contracting authorities make sure that suppliers that participated in an earlier information-gathering stage of procurement have not distorted competition in the ensuing procurement process. Furthermore, procuring agencies cannot exclude supplier participants who were previously involved unless there is no other way to promote equal treatment. This article arguably limits the "reputation" mechanism in the the auction theory below.

Article 46: Division of contracts into lots. The new EU policy encourages procuring agencies to divide contracts into multiple smaller-sized lots in order to encourage the participation of SMEs. Any decision to *not* split a larger contract into lots should now be specified in procurement documents (OECD 2014).

Taken as a whole, the articles of the 2014 EU Directives thus impact several auction design elements simultaneously, as well as the actual data collection and storage method. Thus, it is difficult to isolate any single element’s effect in the following specification, but knowing which legal changes occurred, and what the auction theory suggests might happen, is useful context. The next section provides auction theory background.

3.2 Theoretical background: Auction theory

Though this paper is not theoretical in nature, some background from auction theory is helpful in understanding the motivation of the 2014 EU Public Procurement Directives and in contextualizing the results. A more specific literature review with a focus on the auction characteristics that apply to the public procurement process follows.

Early advances in auction theory were pioneered by William Vickrey, who earned the Nobel Memorial Prize in Economic Sciences in 1996 for his contributions to practical applications of economics (e.g. (Vickrey 1961)). Vickrey rejected the strong neoclassical approach focusing on conditions of supply and demand, instead shifting his focus to the rules of the market. As such, he was one of the early innovators of auction market design, a field that has exploded in recent years due to technological developments that allow for faster transactions among broader groups of bidders: For example, the modern auction has new practical applications in spectrum auctions (Cramton 2013) and internet ad auctions with real-time bidding (Edelman and Schwarz 2010).

The literature around auction theory has further grown in recent decades, first with the expansion of game theoretical approaches taking hold in economic theory, and again as computational methods using increased computing power allowed for the estimation of auctions with a non-parametric approach. More specifically, recent developments in auction theory provide valuable insights into specific parameters of interest in public procurement auctions, including the number of bidders, the entry decisions of bidders, and the winning bid value.

The following section gives a brief overview in auction theory and the forms auctions can take, including relevant parameters that may impact the final equilibrium. This theoretical background should inform the estimation applied later and support the intuition behind the procurement directives’ intended results: How opening up the auction procedures and increasing competition should be expected to affect outcomes (i.e. drive procurement prices down).

General solution (SIPV FPA)¹

While EU public procurement auctions can be judged by other criteria that don’t award the lot to the lowest bidder, the theoretical results are still of interest, and the general solution of a standard First Priced sealed bid auction is given below (Wolfstetter 1996).

Wolfstetter outlines a simple parametric solution to the bidder’s problem in a Dutch or First Price sealed bid auction (1996). Given a strictly monotonically increasing bidding strategy (a function that all opponent players use) $b^*(v)$ that translates a private valuation v into a final bid b , an individual bidder i bids an amount b . A bidder i wins only if her bid is above all opposing bids, which happens only when opposing bidder’s valuations are below $b^{*-1}(b)$, the inverse of the bidding strategy function (ties are prohibited with a strictly monotone increasing function). The final probability of winning an auction given a bid b , or $p(b)$ based on a continuous variable for private valuation V , is then:

$$\begin{aligned} p(b) &= Pr\{b^*(V_j) < b, \forall j \neq i\} \\ &= Pr\{(V_j) < \sigma(b), \forall j \neq i\} \end{aligned}$$

where $\sigma = b^{*-1}$ is the inverse of the bidding strategy function.

Thus

¹Symmetric independent private value, first-price auction

$$p(b) = F(\sigma(b))^{n-1}$$

Because the bid b represents a best response to opponents' bids, then in equilibrium it must maximize the bidder i 's utility function in the auction:

$$U(b, v) = p(b)(v - b)$$

which has the first-order condition

$$\frac{\partial U}{\partial b} = p'(b)(v - b) - p(b) = 0$$

One can show that this leads to the equilibrium bid strategy

$$b^*(v) = \left(1 - \frac{1}{n}\right)v$$

An important observation from this function is that it is increasing in the number of bidders n . Thus, as the number of participants in an auction increases, bidders make their bid closer to their evaluation (shaving off potential profit $(v - b)$ in order to increase the probability of winning the auction $p(b)$). However, this “standard” case of FPA only shows a simple manifestation of the first price auction, and only the “competition effect” of increasing numbers of bidders is picked up. As other conditions are added to the standard model, another effect appears: the *entry effect*. Under the entry effect, as identified by Li and Zheng (2009), the likelihood of bidder entry may fall under increasing numbers of potential bidders, thus lowering the final auction price (or raising it, in the case of procurement auctions and other reverse auctions). Adding the entry effect can even result in an inverse relationship between the number of bidders and the final price, complicating the relationship between potential bidders and price.

4 Literature Review

Here, I provide some relevant empirical background to situate the aims of the EU Procurement Directives in current procurement research. Stated objectives of the Directives may in fact be at odds with other objectives; for example, the section (1) goal “to ensure that [...] public procurement is opened up to competition” could contradict the section (2) goal of the directives “to increase the efficiency of public spending, facilitating in particular the participation of small and medium-sized enterprises (SMEs) in public procurement, and to enable procurers to make better use of public procurement in support of common societal goals,” as competition and efficiency are not necessarily guaranteed to be correlated in auction outcomes. The empirical research below outlines some of the effects that take place in public auctions.

4.1 Competition in Public Procurement

The preamble of the 2014 EU Directives, citing the Treaty on the Functioning of the European Union (TFEU), emphasizes the importance in complying with particular principles necessary for the success of the union, namely “the free movement of goods, freedom of establishment and the freedom to provide services, as well as the principles deriving therefrom, such as equal treatment, non-discrimination, mutual recognition, proportionality and transparency” (“Directive 2014/24/EU of the European Parliament and of the Council” 2014-02-26). It goes on to mention that procurement procedures for contracts above a given value threshold should be coordinated across EU member states “to ensure that those principles are given practical effect and public procurement is opened up to competition” (2014-02-26). The Directives’ emphasis on competition is therefore clear from the start. However, the role of competition in public procurement is more complicated than in the simple model above.

The role of competition in public procurement

In the basic model presented above, the number of bidders n was predicted to monotonically increase the price of the auctioned object ($p = \frac{n-1}{n+1}$) and thus monotonically increase the seller surplus. However, in practice, the relationship is found to be more complex, and newer theoretical models pick up more than just this competition effect. Some examples of additional characteristics that complicate the model above are *preparation costs*, the *entry effect*, and the loss of *discretion as a tool for the auction*. As a result of these extensions, we might not expect to see a straightforward relationship between the number of bidders and contract outcomes. These extended models and their ramifications for procurement auctions under the new legislation will be briefly discussed below.

The effect of bid preparation

Samuelson builds on the simple auction model to include the cost of preparing a bid (1985): entry thus is not costless as under the simplest auction models. As a result of this barrier to entry, in the new equilibrium procurement prices don't necessarily increase monotonically with the number of potential bidders. Therefore, a policy designed to increase competition might achieve undesirable outcomes and increased costs, and indeed, Samuelson suggests as much in his concluding remarks, writing that "policies to limit the number of bidders (even to a single bidder) may be welfare improving" (1985). The EU Directives likely eased the bid preparation costs with its support for more streamlined bidding procedures and e-Procurement. However, bid preparation costs remain high for some EU countries, and procurements with higher bid preparation scores (as benchmarked by the World Bank) were found to have higher levels of competition (Tas 2020).

The entry effect in IPV and CV models

The effect that the number of bidders has on auction results depends largely on whether the auction is viewed with an Independent Private Values (IPV) or Common Values (CV) paradigm. A CV auction warrants bidders to behave more conservatively as the number of bidders increases, as any bidder does not want to suffer the winner's curse.

Hong and Shum (2002) investigate the winner's curse phenomenon in a new framework that combines IPV and CV perspectives. When they apply this new framework to data about transportation department auctions in New Jersey, they find that the median cost of procurement actually rises with the number of bidders. Therefore, an increase in competition does not lead to lower final costs, as conventional wisdom dictates (assuming a pure competition effect).

Li and Zheng (2009) report that, even in an purely IPV model with endogenous entry, an increasing number of potential bidders can lead to less aggressive bidding and a rise in procurement cost. The channel through which this outcome takes place is that the positive procurement cost arising from the "entry effect" may overpower the lower cost coming from higher competition (the "competition effect"). Therefore, the final effect of an increased number of bidders on procurement costs can still be positive while firmly within an IPV framework.

Similarly, De Silva and Jeitschko (2009) also show that in both IPV and CV theoretical procurement models, an increase in the potential number of bidders can lead to increased costs for purchasers. They run their model on real data from the Texas Department of Transportation to analyze bidder behavior among procurement auctions with differing levels of "common value" or "private value" costs, which might vary between contract descriptions. For instance, they find that encouraging entry (increasing the number of bids) is generally helpful when costs are mostly private, as in the case of asphalt paving. In this case, the competition effect dominates and the procuring agency saves money. However, with more common costs, as in the case of bridge repairs, the results are more ambiguous.

These findings complicate the stated objective of the 2014 Directives: increasing competition may not be in line with their aim of "increas[ing] the efficiency of public spending," as the effect of competition on outcomes and auction efficiency may be industry-dependent.

A counterargument for open auctions: the Discretion and reputation mechanisms

Two additional concepts that need to be discussed when considering legislating public procurement auctions are *discretion* and *reputation*. Discretion is the ability of the procuring agency to use its own criteria in

selecting the winning bidder, while the reputation mechanism works through the (bidding) suppliers’ desire to be selected again after a successful contract completion. Several papers extend auction models to incorporate these mechanisms, with the end result that increasing the number of (potential) bidders does not always lead to the best outcome for procuring agencies (Coviello, Guglielmo, and Spagnolo 2018), (Spagnolo 2012) (e.g.). With these effects in mind, the common goal of procurement directives (EU 2014 and GPA) to focus on increasing the number of bidders may also be ill-advised.

Another reason why increased numbers of bidders might lead to adverse outcomes from the perspective of the tendering organization is that the buyers (or “bid-takers”) might prefer a more selective tendering process of a subset of select bidders. Kim describes the phenomenon of “opportunistic” bidders (who lower the quality of the procurement, or for whom costs overrun) that can arise from excessive bidding competition (1998). With only a select subset of suppliers, Kim argues that the bidders are induced to ‘self-enforce’ a contract for fear of future exclusion from procurement auctions, a threat that is not as credible as the number of bidders rises. Furthermore, Gansler notes that government procurement regulations overemphasize competition. He opts for a system of “a few highly qualified bidders” (Gansler 1989).

A noteworthy feature of EU Policy is that it does not allow for the past quality of suppliers’ services to be used in the judgment of future procurement (unlike the US) (Spagnolo 2012), a policy that was reinforced by the 2014 Directives. Though discretion can appear to be anti-transparent and anti-competitive in nature, the use of discretion and the ability to restrict competition can, through this reputational mechanism, lead to efficient results. Spagnolo considers reputational mechanisms in a theoretical framework, but notes that assessing their effectiveness is limited by the availability of real-world data: while auction outcomes are reported with estimated values and quantities, a reputational mechanism relies on data for *final* real-world prices and quality of service, not just the stated values awarded immediately after winning a contract auction. Furthermore, in a laboratory setting, Spagnolo finds that reputation can be a promoter of entry in procurement, instead of a hindrance.

Beyond such theoretical arguments and modeling, discretion has been studied in the real world many times, often by comparing open and closed auctions. In one study, Coviello et al. use data from the Italian Authority for the Surveillance of Public Procurement (AVCP) between 2000 and 2005 in a regression discontinuity design (RDD) framework to analyze the causal effect of letting procuring agencies exercise discretion (i.e. make private decisions through a closed auction) in their procurements (Coviello, Guglielmo, and Spagnolo 2018). By looking at procurements around the 300,000 euro threshold for open auctions, they found that though the likelihood of an incumbent winner increases, there is no loss in any of their performance variables (work length, delay, cost overrun, etc). Therefore, they estimate that giving purchasing agents discretion over procurements—contrary to some of the underlying ideas of the EU’s 2014 procurement directives—can lead to more efficient outcomes.

4.2 An alternative channel for efficient procurement: the Role of Open Data

The primary identification strategy of this paper is an adaptation of a working paper by Duguay et al. investigating the role of open data on public procurement outcomes (Duguay, Rauter, and Samuels 2020). Previously, procurement data was available in less accessible formats, before a July 2015 open data initiative allowed the bulk download of this data in csv format. Thus, instead of looking at the EU Procurement legislation itself as a driving force, they argue that the availability of open data and the public scrutiny that comes with it affected auction outcomes, including the increased usage of competitive bidding processes and increased tender corrections.

In their paper, they implement a differences-in-differences (DD) design, where the “treatment” group consists of contracts above the value threshold for mandatory reporting to the the European Union’s public tendering portal, called Tenders Electronic Daily (or “TED”). The control group are contracts below the threshold, which largely stay outside of the TED database and therefore were not subject to the increased scrutiny of the treatment, the July 2015 publishing of bulk TED data in csv format. This DD design takes fixed effects into consideration, controlling for interactions between the tendering country, contract type (i.e. industry), and quarter-year.

Another interesting, but perhaps not unexpected (in light of findings from (Coviello, Guglielmo, and Spagnolo 2018)), result from their analysis is that the increased competition leads to more delays and price renegotiations ex-post (2020). They conclude, that while open data initiatives do increase competition and lower stated contract prices, these costs do not necessarily remain lower due to increased inefficiencies and ex-post alterations of procurement.

In the empirical design that follows, I adapt the DD design of Duguay et al, substituting the open data treatment for the national passing of new procurement legislation. The original working paper does consider the role of the new legislation in their design, but only in its effect on likelihood of Open tendering. Furthermore, the Duguay et al. study uses the Post-EU Directives as a standalone variable, not within a DD structure. I define the passage of new procurement legislation as the new treatment to reevaluate likelihood of using Open tendering and likelihood of post-award tender modification, in addition to investigating new outcomes not tested in Duguay et al (e.g. number of bids on tenders, international procurement).

Furthermore, I implement a LASSO variable selection methodology described by Belloni et al, known as the post double selection method of covariate selection (Belloni et al. 2016). This was done with the aim of relaxing the fixed effect specification without losing valid inference, as my data includes fewer observations (after filtering for additional variables to be complete) and there was concern over having sufficient variation in the tightest specification.

This paper thus builds on that of Duguay et al, but explores the direct effect of the 2014 EU Procurement Directives rather than focusing on the role of public data and the channel of public scrutiny. I believe this paper to be the first to causally investigate the effects of the 2014 directives on specific tender outcomes mentioned as goals of the legislation.

The theoretical background suggests auction characteristics can have an ambiguous effect on outcomes. However, there are some predictions I believe to be conservative. First, I expect the primary result—the legislation’s effect on usage of Open tendering—to corroborate Duguay et al, as they provide a control for the new legislation and show it to have an insignificant impact on Open procedure procurement. Second, the directives provide guidance to break up larger tenders into smaller lots and increase the use of e-Procurement, theoretically making public procurement more accessible; thus, I would expect a greater amount of participation by SME bidders (not “top-4” bidders, e.g.) and a greater participation by international bidders. On the other hand, because of the decreased amount of discretion afforded to public buyers as a result of the changing legislation, there may be an ambiguous or negative effect on efficiency: I expect similar results to Duguay et al, where increased use of Open tendering was connected to a increased level of post-award tender modification.

5 Data

The data used in this study is comprised of almost 250,000 contracts, spanning 2012 to 2017, inclusive, and covers 31 European countries. This section introduces the data set used, provides descriptive tables, and notes potential shortcomings, which will be expanded upon in the Discussion section.

5.1 Data collection and usage

This paper uses European procurement data from TED and national procurement databases from two sources.

The primary data source for this paper is DIGIWHIST, the “Digital Whistleblower” data project aimed at increasing fiscal transparency. Specifically, the DIGIWHIST product called “Opentenders” gathers procurement contracts and makes visualizations and data downloads publicly available online. Because DIGIWHIST collects their data from both TED and national procurement portals, they provide data that is both above and below mandatory value thresholds for reporting to the EU, which is key to this paper’s analysis (while TED

mostly publishes above-threshold contracts, with few exceptions). The Opentenders portal was launched in January of 2018.

In addition, supplementary data for this paper comes from TED, the European Union’s public tendering portal. As a result of EU directives 2014/24/EU, 2014/25/EU, and 2014/23/EU, (and, prior to these policies, directives Directive 2004/18/EC and Directive 2004/17/EC). European procuring organizations are required to submit information on all public procurements in excess of published value thresholds. Thus, a subset of the Opentender data can also be found in TED and will be subject to EU regulation. TED submissions are formatted using standardized electronic forms on the EU website called “Information System for Public Procurement” (SIMAP). The data is then submitted in extensible markup language (XML) format through either the official EU application “eNotices” or through an independent “eSender” service (e.g. Visma TendSign). Finally, the procurement data is made publicly available on the TED website (ted.europe.eu), the online version of Supplement to the EU Official Journal (OJS). This data is available on the online service “EU Open Data Portal” (<https://data.europa.eu>), a website managed by the EU Publications Office and open to the public. TED data was made accessible in and easily-read csv format in July of 2015.

It should be noted that the publication of these two data sources itself presents a challenge to identification, as any effects we might expect to see from the 2014 Procurement Directives may actually be from the increased publicity and transparency coming from either of these two open data projects. Duguay et al. argue that the channel of “increased scrutiny” from the publication of open data is the driving force behind the evolving public procurement market in Europe (Duguay, Rauter, and Samuels 2020). In contrast, I investigate the role of the new procurement legislation itself. Therefore, in my specification, I try to control for these alternative channels by incorporating a dummy variable for the open data initiative (*Post Open Data*, equal to one if after July 2015) and limiting the sample to be before the January 2018 launch of Opentender. However, if we do not expect awareness of the new data source to be an “instantaneous” treatment, we might not perfectly separate effects of the new procurement Directives from the effects of increased scrutiny from the open data initiative. This issue is discussed later.

Data coverage and handling

The unit of observation in this study is the contract. In public procurement, tenders can be subdivided into several lots, which may have separate values, separate numbers of bidders, and separate final winners. Across most public procurement data sources, data is stored at the lot-level, with each row indicating unique numbers of bidders and values for lots. Thus, contracts themselves may take up several rows, with tender-level data repeated across these rows. Unfortunately, the EU Directives—the focus of this paper—made the division of contracts into separate lots easier, thus complicating the data structure and making identification more difficult. Therefore, throughout this study, data has been aggregated on the tender-level, with new variables capturing grouped statistics across the lots: For instance, the sum of lot values across the tender, the average number of bidders across lots, whether at least one lot was won by an international supplier, etc.

A sample of five rows and select columns can be seen here:

	Country	Size	Procedure	CPV.Industry.	TED_Contract	Post_Directive	Is_Open	Over_2_Bidders	Is_Corrected	Is_Crossborder
1	RO	ABOVE_THE_THRESHOLD	OPEN	72	1	0	1	0	0	0
2	UK	ABOVE_THE_THRESHOLD	OPEN	60	1	1	1	0	0	0
3	PL	ABOVE_THE_THRESHOLD	OPEN	60	1	0	1	1	0	0
4	AT	ABOVE_THE_THRESHOLD	NEGOTIATED	71	1	0	0	1	0	0
5	ES	BELOW_THE_THRESHOLD	OPEN	33	0	0	1	1	0	0

(a) Data Sample

Five sample rows.

The countries covered by the data set consist of the EU countries, as well as countries in the greater European Economic Area (EEA) and Switzerland from the time period between January 1, 2012 and December 31, 2018. The csv files are separated by country and are large in size. In order to facilitate data handling, the csv files were imported into a MySQL database, which could more efficiently handle the ~59 million rows and 130 columns of the procurement data available within Opentender.

Procurement data is supplied to the TED and national databases in the source of standardized forms. Opentender project, in gathering data from multiple sources, combines various structures into one format.

Thus, the structure is in a standard format, allowing for easy merging, but human error from filling out the forms incorrectly still results in anomalies throughout the data. This can result in, for instance, misspelled or missing supplier names, missing contract award values, or outlier contract award values that range from contract values of 0.01 euros to contract values that are greater than the combined GDP for all EU member states. Thus, some data cleaning and filtering is required prior to analysis.

Opentender data has been collected by the DIGIWHIST project from the TED portal, as well as data scraped from the national public procurement portals of twenty European countries. Thus, it contains values that are both above and below the mandatory threshold for reporting to TED. The data collection process used to create and synthesize Opentender data was complex, so describing it in detail is outside the scope of this paper. However, a detailed explanation of the data scraping and merging can be found on the Opentender data download page ("<https://opentender.eu/download>").

Irregularities in the Data

The data consists of almost 250,000 contracts that spans nearly a decade, covers 31 countries, and is the result of numerous entities inputting data. Therefore, there are a number of issues that make analysis complicated. These will be expanded on in the Discussion. Here, I introduce the biggest issues:

1. *Many fields are missing.* Because the data is subject to human error, there are often missing fields, even in key columns. Before estimating the equations below, I filter out the contracts that have complete information for the key variables of interest. Out of 922,333 contract awards that were initially sampled, only 248,321 (27%) contracts were in the time period of interest (2012-2018) and had complete columns. However, this sampling method poses a potential selection bias problem, especially if procurement authorities that supply better data are systematically different and would respond to new legislation differently than “messier” contracting authorities
2. *The 2014 policy affected the data collection process itself.* Instead of merely affecting the circumstances around the data, the 2014 policy studied includes articles that impact the data-collection and data-storage process itself. As we can see in later tables, there is a marked increase in how many tenders are reported to TED and in the availability of certain variables. This might pose a challenge to identification: Was the outcome a real-world result from the directive, or are the findings complicated by the changing data collection process?
3. *The availability of data may have impacted reporting.* The data sets analyzed here were made available within the treatment time period: TED data began to be available in csv files in July 2015 and Opentender data became available in January 2018. The working paper by Duguay et al. notes that increased transparency and publicity from these open data projects led to statistically significant changes in the usage of open procedures for European contracts, among other outcomes (2020). Data quality might also have been improved when the data was made more public, as procurement officials might have felt more monitored. This alternative channel is controlled for by an indicator for Post Open Data initiative (post July 2015).
4. *Contract award values are unreliable.* Though it is legally required by the EU Directives and national laws to report the winning contract value to TED, this data is simply missing for a significant chunk of the data. Other values are nonsensical, including placeholder values (“0.01 Euro”) to values that are greater than the GDP of large countries. As a simple control, we filter out values below 25,000 and above 1,000,000,000 Euros. Legitimate micro- and macro-procurements are likely quite different than the group we are interested in analyzing: This methodology follows Duguay et al. (2020), who argue that such small procurements are not a good control group, being “fundamentally different” from the international contracts listed on TED.
5. *Entity names are not consistent.* In the data, we can find multiple spellings of the same winning suppliers, making some analysis difficult. For instance, when we aggregate the data on supplier names in the market concentration analysis, we can underestimate the number of distinct suppliers (e.g. making “SWECO” and “SWECO AB” two different suppliers), thus understating the market concentration level. I attempted fuzzy merging names, using different string distance algorithms (e.g. Levenshtein

distance), but there are too many similarly named companies; other variables (e.g. company id and address) could be included for proper entity matching and name correction, though these other variables also have quality issues. Future research should focus on cleaning organization names and id numbers, merging the many permutations that exist in the data.

5.2 Variable description and summaries

The outcome variables are intended to capture tender qualities that were targeted by the directives: tender competition, international participation, and procurement efficiency. The outcome variables I estimate in the following models are:

- *Open Procedure*: an indicator equal to one if an “open” procedure was used in the procurement. This is equal to one if “Open,” or zero if one of the other procedures: Competitive Dialog, Innovation Partnership (post 2016), Negotiated, Negotiated with Publication, Negotiated without Publication, Outright award, or Restricted.
- *Corrected*: an indicator equal to one if the procurement had at least one ex-post correction (indicating potential execution complications)
- *Cross-border*: an indicator variable equal to one if at least one lot of the contract lots was won by a supplier with a different listed country than the buyer’s country (indicating international procurement)
- *Over 2 Bidders*: an indicator equal to one if there were greater than two bidders on the contract. If there are multiple lots, this covers whether the average number of bidders across the lots was greater than 2. (Also, in the appendix, I include alternative competition measures of “Over 3 Bidders” and “Is Single Bidder”).
- *Top 4 Supplier Winner*: an indicator equal to one if the highest-ranking winning bidder on the contract award is in the top 4 suppliers for that country-industry-year “market” (e.g. having a Common Procurement Vocabulary, or CPV, code “45” in Sweden in 2015). This can be seen as a proxy for a CR4-type market concentration indicator. Additionally, a similar variable “Top 8 Supplier Winner” is constructed for winning bidders being one of the 8 most winning companies for the given contract’s sector.

To isolate the effect of the policies on interesting tender outcomes, other tender characteristics—including value, visibility, and coverage from other monitoring sources (from EU funding or coverage by the WTO through GPA)—must be controlled for. Specifically, the list of controls includes:

- *Ln(Value)*: the log value of the entire contract (the sum of all lots on the contract)
- *Works Contract*: an indicator equal to one if the contract is a Public Works, or 0 if Supplies or Services. These different classifications have different mandatory reporting thresholds according to EU law
- *Post Open Data*: an indicator equal to one if the contract was tendered after the Open Data Initiative that increased scrutiny of TED data by making it more accessible in csv format
- *GPA Coverage*: an indicator equal to one if the procurement is covered by the wider Agreement on Government Procurement (GPA)
- *Number CPVs*: an integer reporting how many CPV codes are listed in the published tender notice. This variable affects how visible the contract notice is in tendering portals, as companies are able to search by relevant CPV codes to find tender opportunities. Intuitively, a tender with only one listed

CPV code is less likely to be seen than a similar one with several codes.

- *Is Framework*: an indicator equal to one if the procurement is in a framework agreement or is covered by a dynamic purchasing agreement
- *Is EU Funded*: an indicator equal to one if the contract is provided funding by the EU. Below-threshold contracts can be EU-funded

In addition, Fixed Effects will be made for the interactions between:

- *Country*: The country of the tendered contract
- *Industry*: As indicated by the first two digits of the main CPV code (e.g. “45” for “45000000”)
- *Qtr-Year*: A time fixed effect

Descriptive tables of these variables follows.

Summary table

In Table 1 below, I show some summary statistics of the variables of interest, dividing the sample into above-threshold (Panel a, corresponding to being in the treatment group reported to the EU’s TED, or $Treat = 1$) and below-threshold groups (Panel b, corresponding to the $Treat = 0$ group). Summary statistics are generally similar between the groups. On average, between 86 and 90 percent of contracts are tendered with an “Open” procedure, the most competitive procedure available. Contract Values in the sample range from 25,000 to 1 billion euros (the full range of the cutoffs chosen for the sample), with a median value of 760,000 euro in the EU TED Treatment group and 240,000 euro in the control group (contracts only available on national portals and not subject to the new directives). The median number of bids (averaged over all lots for a contract) is 3, but due to the high variability and potentially unrealistic upper tail, I create a variable for having over two bidders to capture “competitive” contracts: On average, about 60% of contracts have over two bidders.

Other outcome variables are much lower in magnitude across treatment and control groups: Only ~3% of contracts have at least one lot that is won by an international supplier. Between 8.7-10.6% of tendered contracts were subject to at least one correction. Interestingly, these effects appear to be opposing the goals of the EU directive: For instance, the above-threshold contracts have a *lower* mean value for average cross-border procurement, when a primary goal of the policy is to promote international procurement.

	Variable	Mean	SD	Min	Q1	Median	Q3	Max
1	Post Directive	0.37	0.48	0.00	0.00	0.00	1.00	1.00
2	Open Procedure	0.86	0.35	0.00	1.00	1.00	1.00	1.00
3	Cross-Border	0.03	0.18	0.00	0.00	0.00	0.00	1.00
4	Tender Corrected	0.11	0.31	0.00	0.00	0.00	0.00	1.00
5	Over 2 Bidders	0.59	0.49	0.00	0.00	1.00	1.00	1.00
6	Contract Value (million EUR)	4.90	28.73	0.03	0.40	0.76	2.12	1000.00
7	Works Contract	0.07	0.26	0.00	0.00	0.00	0.00	1.00
8	Post Open Data	0.57	0.50	0.00	0.00	1.00	1.00	1.00
9	GPA Coverage	0.59	0.49	0.00	0.00	1.00	1.00	1.00
10	Number CPVs	0.81	2.21	0.00	0.00	0.00	1.00	28.00
11	Is Framework	0.20	0.40	0.00	0.00	0.00	0.00	1.00
12	Is EU Funded	0.08	0.28	0.00	0.00	0.00	0.00	1.00
13	Avg Number Bids (per lot)	4.28	8.43	1.00	2.00	3.00	5.00	999.00

(a) Above Threshold Contracts

	Variable	Mean	SD	Min	Q1	Median	Q3	Max
1	Post Directive	0.43	0.50	0.00	0.00	0.00	1.00	1.00
2	Open Procedure	0.90	0.30	0.00	1.00	1.00	1.00	1.00
3	Cross-Border	0.03	0.18	0.00	0.00	0.00	0.00	1.00
4	Tender Corrected	0.09	0.28	0.00	0.00	0.00	0.00	1.00
5	Over 2 Bidders	0.60	0.49	0.00	0.00	1.00	1.00	1.00
6	Contract Value (million EUR)	0.64	6.18	0.03	0.17	0.24	0.36	1000.00
7	Works Contract	0.25	0.44	0.00	0.00	0.00	1.00	1.00
8	Post Open Data	0.60	0.49	0.00	0.00	1.00	1.00	1.00
9	GPA Coverage	0.57	0.50	0.00	0.00	1.00	1.00	1.00
10	Number CPVs	0.89	2.56	0.00	0.00	0.00	1.00	28.00
11	Is Framework	0.13	0.34	0.00	0.00	0.00	0.00	1.00
12	Is EU Funded	0.09	0.29	0.00	0.00	0.00	0.00	1.00
13	Avg Number Bids (per lot)	4.21	5.49	1.00	2.00	3.00	5.00	683.00

(b) Below Threshold Contracts

Table 1: Descriptive statistics for contracts above and below the mandatory reporting value thresholds.

Data availability

Because the EU Directives both made e-Procurement easier and increased the requirements for contracting authorities to report and store data, we might expect the number of contracts in our data sample to increase. This is indeed what we find, as seen in the plot below. In Figure 1, I show the number of contracts in the treatment (TED Contracts) and control (non-TED) groups over time. The numbers of both groups increases dramatically beginning in 2015. I plot two vertical lines to represent two potential treatments. The solid line (July 2015) represents when TED data began to be publicly available in easy-to-read csv format. Duguay et al. argues that this open data treatment was key to the changing outcomes in European public procurement in the 2010s (Duguay, Rauter, and Samuels 2020). The dashed line (April 2016) represents a visual proxy for the treatment argued in this paper: the national passing of procurement regulations in line with the 2014 EU Directive. In reality (and in the creation of the Post variable used in this analysis), the treatment date is dependent on the implementation date for the tendering country, ranging from 2015 to 2018, but for the purpose of visual comparability, I simply plot the line when the EU Directive required members to pass the legislation.

It should be noted that the sharp increase in availability is *not* due to the EU Directives' push for easier contract divisibility into multiple lots on a single tender. Tenders being more divided into lots would certainly create more observations in the original dataset, since Opentender and TED both provide data on the lot level and not contract level. However, in the following plots and analysis, the data has been aggregated to

the contract level, so that it can be more readily compared to pre-directive data.

Furthermore, this expansion in contract numbers should not be problematic to the differences-in-differences identification strategy that follows, as both treatment group and control group see similar trends, and time trends will be controlled for with time and other fixed effects. However, as Duguay et al note in their working paper (2020), a changing *composition* of the two groups *can* be an empirical concern to identification. This might be the case if procurement watchdogs increase their monitoring efforts, which would increase the availability of complete data in the Post period and cause contract observations that *should* be in the pre-period to be missing.

To account for a potentially changing composition in data completeness between the treatment (TED) and control (non-TED) groups, Duguay et al aggregate the data on the *Treatment x Country x Industry x Quarter-Year* level and use the same differences-in-differences specification to assess whether the *number* of contracts in each group has changed around their treatment date (“Post Open Data Initiative”). They report that the coefficient is not statistically significant, and thus their sample is not subject to changes in data completeness. I include a similar regression, also finding insignificant effects on changing composition, in the Appendix.

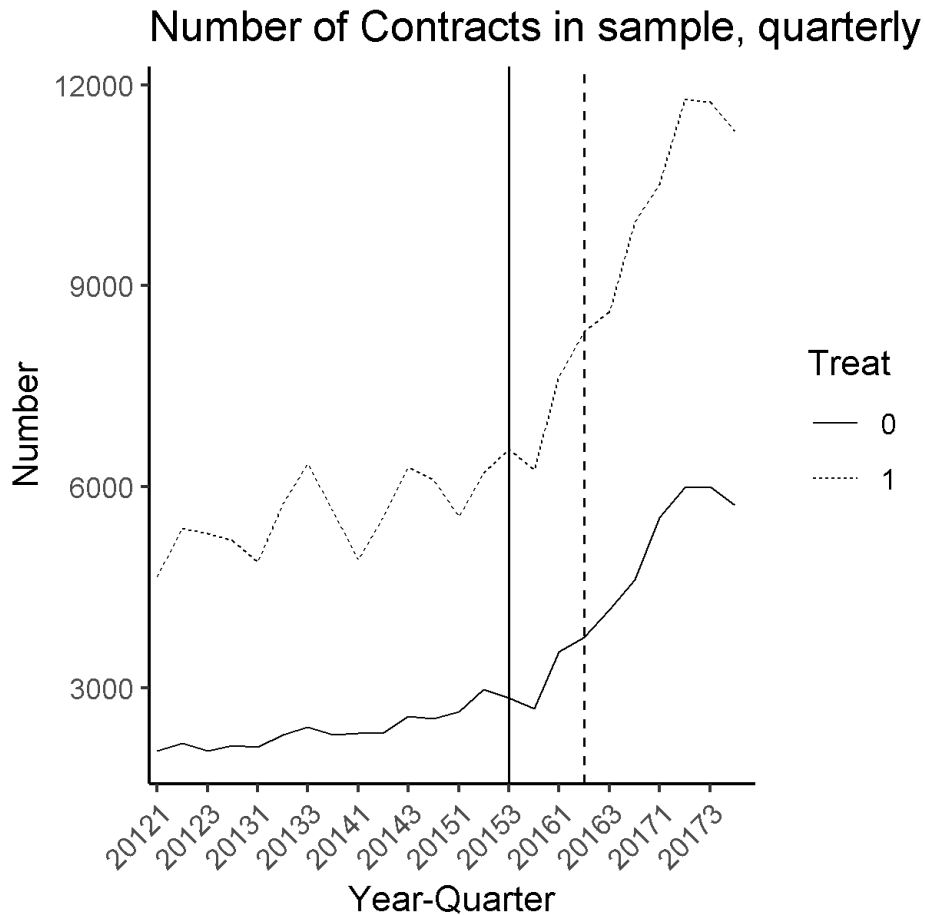


Figure 1: Change in data availability over time: Note that the number of contracts with complete data increases over time, with a sharp increase after one of the potential treatment dates: EU Open Data publication (solid) or EU Directive enactment (dashed). It is also important to note that, while the directives made it easier to split up contracts into multiple lots, these data have been aggregated on the *contract* level, so the increase observed is not driven by contract divisibility.

6 Identification Strategy

6.1 Differences-in-differences estimation

The 2014 procurement directives were wide-reaching, affecting nearly every European country directly or indirectly in the years after their passing. Thus, its broad scope and varying date of passage into national laws complicate the evaluation of the directives’ impacts. Using a differences-in-differences methodology allows for identification by analyzing how differently EU-monitored procurements respond after the directives are translated into national law. The differences-in-differences method applied here is of the standard econometric form, and adapts equation (1) of Duguay et al:

$$Y_{it} = \beta_0 + \beta_1(Treat_{it}) + \beta_2(Post_{it}) + \beta_3(Treat_{it} \times Post_{it}) + X_{it} + FixedEffects + e_{it} \quad (1)$$

Treat is a binary variable equal to 1 if a contract is in the treatment group (i.e. above threshold values that cause the contract to be subject to the 2014 Procurement Directive) or 0 if in the control group (below threshold, or not subject to the new directive). *Post* is a binary variable equal to 1 if the contract observation is after the date when its country began to translate the EU directive into national law, or 0 if before these dates (See Table X in the appendix for the list of dates when countries began translating the EU directives into state law). *Treat* × *Post* is the interaction term capturing the effect of interest: being an above-threshold contract subject to the new legislation after that legislation came into effect. *Y* is the outcome variable of interest (whether the contract is tendered under “Open” procedure, and indicator for the number of bidders, e.g.).

X_{it} is a vector of covariate controls, including the log of contract size and a variable controlling for whether the contract came after two open data initiatives: the EU Open data initiative of July 2015 (after contracts became more available in csv format) or DIGIWHIST’s Opentender project (January 2018). Additional controls include whether the contract was covered by GPA, the number of listed CPV codes (more codes allows more suppliers to search), whether or not the contract is a framework agreement, and whether or not a contract is subcontracted.

In addition to a list of covariate controls, this specification allows for different interacted groups to vary by incorporating interacted fixed effects. First, it controls for Country × Quarter-year fixed effects allowing for changes in the economic and institutional makeup of countries that might affect the baseline. Fixed effects for Country × Industry are also added, controlling for time-invariant differences between country-industries. I include Industry × Quarter-year fixed effects to allow for different time trends in the outcome variable across different industries. Standard errors are clustered at the country level.

In the above equation, β_0 represents the average baseline (the control country before the treatment), β_1 reflects the average difference between the treatment and control countries *before* the policy goes into effect, and β_3 estimates the treatment effect in the differences-in-differences framework (i.e. the effect of the policy on the treatment group after treatment assuming the counterfactual given by the parallel trends assumption).

As previously discussed, the chosen outcome variable Y_{it} will represent two outcomes studied in the original Duguay paper:

1. an indicator equal to one if the procedure used was “Open” – the most competitive procedure available
2. an indicator equal to one if the procurement underwent at least one correction, suggesting potential contract execution problems

In addition, two further auction outcomes that were explicitly or implicitly outlined in the 2014 EU directives will be analyzed using the same framework:

3. an indicator equal to one if the winning bidder’s country is different than the buyer’s country, suggesting cross-border procurement

4. an indicator equal to one if more than two bidders participated (with additional competition outcomes—i.e. a single bid indicator and over-three bidder indicators—in the Appendix)

These outcome variables help answer the main research question of whether or not the 2014 EU Procurement Directives caused any change in procurement outcomes (i.e. the level of openness, level of competition, and level of international procurement). These directives had a goal to open up the public procurement market, so looking at the β_3 coefficient on the interaction term will help evaluate the success of the directives in these objectives.

Assessing the parallel trends assumption

One of the key assumptions for a differences-in-differences estimation to hold is that the outcome variable follow parallel trends between the treatment group and the control group in the period leading up to the treatment. A quick visual check allows us to see whether using DiD will lead to valid inference. In order to determine whether the parallel trends assumption holds, I compute the quarterly average of the outcome variables and plot them by treatment group over time to assess whether they are approximately parallel.

Figure 2 below shows the quarterly averages in these four outcome variables: the likelihood of a contract being listed under an “Open” procedure, the likelihood that at least one lot winner on the contract is international (relative to the buyer), the likelihood that the tender experiences at least one ex-post modification, and the likelihood that the contract had over two bidders (averaged over lots for multi-lot contracts). These outcome variables are binary and are averaged over treatment and non-treatment groups (where Treat=1 refers to a tender that is above the EU threshold). The blue lines show the smoothed conditional means.

In all of the plots of the panel, the trends between the treatment and control group appear to be approximately parallel, supporting the usage of the differences-in-differences methodology. However, the assumption of parallel trends is perhaps weakest for the Cross-border outcome variable, as the quarterly averages appear to cross just before the treatment. In addition, there appear to be strong seasonal trends, which will be captured by the fixed effects estimation that follows.

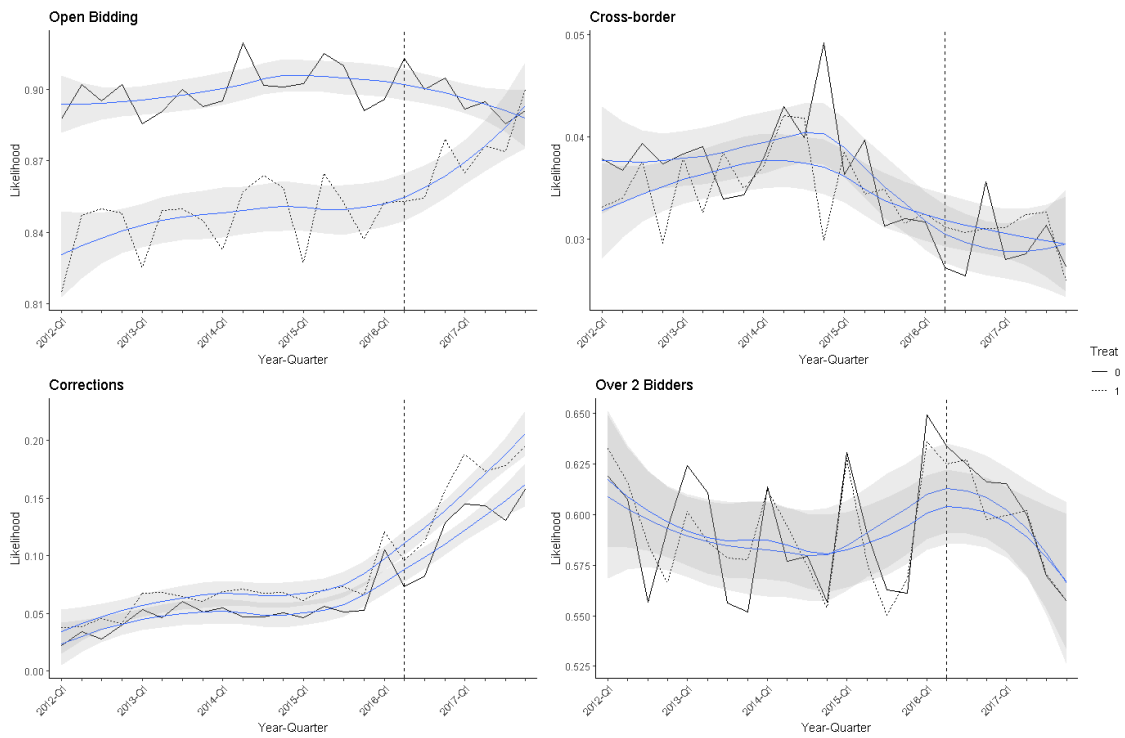


Figure 2: Parallel Trends in outcome variables: The y-axes show the averages of the outcome variables, plotted across quarters. The dashed line represents when the EU Procurement directive required member countries to transpose the legislation into national law. Note the actual POST variable used in the specification uses different dates for different countries

Contract value is also an important variable in this analysis, as it determines whether or not a contract is subject to EU regulation (and thus be in the “Treated” group). Furthermore, if there are strong period variations in contract value, the specification would require additional covariates to ensure this variation isn’t attributed to the treatment. For completeness, Figure 3 below depicts the change over time for average contract values, categorized by Treatment group and whether or not the contract is a Public Works, or Supplies and Services. The value *Treat* is equal to one if a contract is above the thresholds, thus reported to TED and subject to the new Procurement directives. The graph is divided in two, one of which shows aggregated Works contracts values, while the other shows Supplies and Services values. This distinction is important, because Works contracts have different mandatory TED publication thresholds, which are shown in a segmented horizontal line across each graph. Also, while the values determine whether or not a contract is subject to EU publication and different regulation, I do not generate the *Treat* variable from the contract values themselves, but rather use Opentender’s variable indicating whether the contract is above the minimum threshold for EU/TED reportage.

Though there are definite differences in average values between Works/non-Works and Treatment/non-Treatment contracts, there are no troubling trends in any one group that might be concerning for identification using a differences-in-differences methodology. The specifications that follow will control for log contract values.

6.2 Market Concentration

One goal of this paper is to analyze the level of market concentration in public procurement. Unfortunately, the quality of public procurement data is lacking, as previously discussed. This data quality issue is especially problematic for studying market concentration, which requires quality data about winning bidder names and contract values, both of which are notably lacking fields in public procurement data.

Nevertheless, in an additional model with the same difference-in-differences specification, I use a proxy for market concentration. This market concentration variable was created by aggregating the existing winning bidder names within each country-industry-year bucket into a separate table of “top winners.” This aggregated table was joined back onto the original data set, using a join key of supplier name + year + industry + country; thus, columns are added to the original data set that indicate how many tenders the given winning bidder has won within the given procurement sector, as well as the relative rank of that bidder in that country-industry-year (by number of contracts won). An excerpt of this top winning bidder table can be seen below.

	Country	Year	CPV	Winning.Bidder	Count	Rank
1	UK	2015	45	Keepmoat Regeneration Ltd	54	1
2	UK	2015	45	CR Reynolds Limited	41	2
3	UK	2015	45	Seddon Construction Limited	40	3
4	UK	2015	45	Forrest	37	4
5	UK	2015	45	Kier Services Limited	35	5
6	UK	2015	45	Wates Living Space	34	6
7	UK	2015	45	Mears Limited	33	7
8	UK	2015	45	Colas Limited	29	8
9	UK	2015	45	Lakehouse Contracts Ltd	27	9
10	UK	2015	45	Sustainable Building Services (Uk) Ltd	27	9

(a) Data Sample

Sample contract winner aggregation.

Then, in line with the frequently used indexes of market concentration, the CR4 and CR8 (see Appendix), I create contract-level indicator variables for whether or not a tender had a lot that was won by a “top 4” or

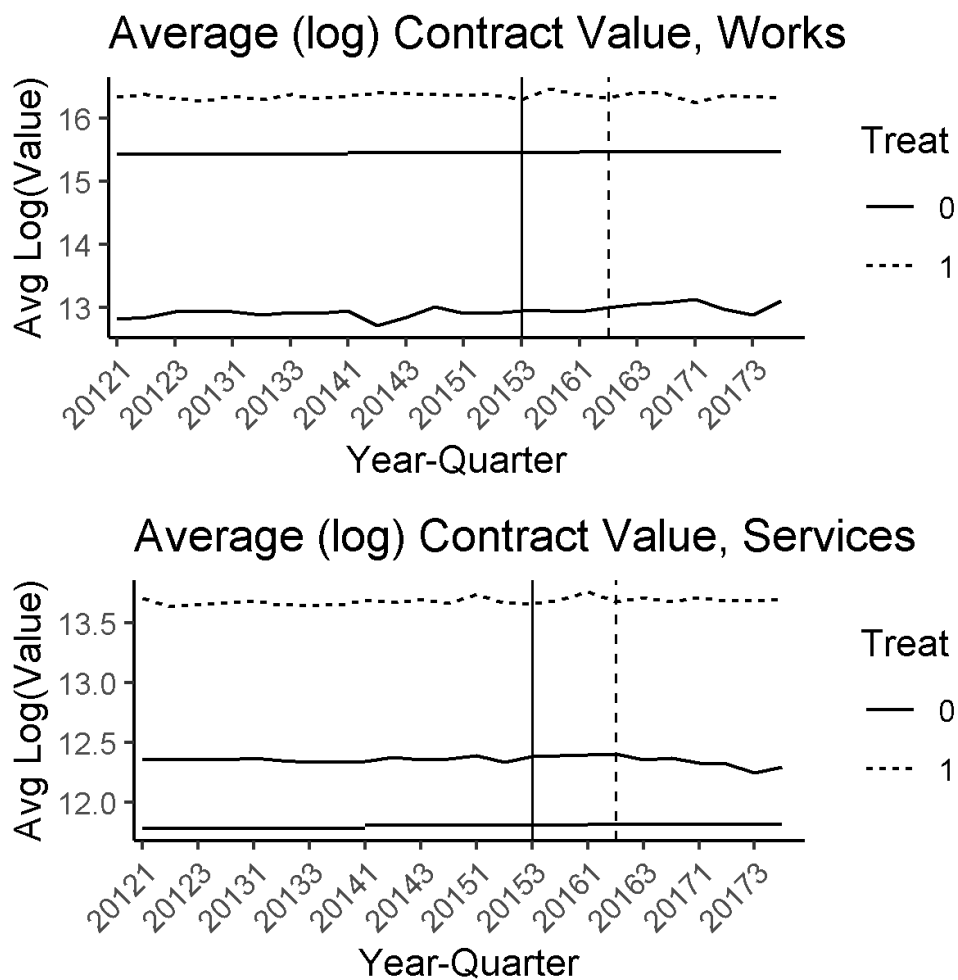


Figure 3: Trends in average values: Average Value appears relatively stable over time between the treatment groups (whether a TED contract) and between Works vs. Supplies/Services contracts. The broken horizontal lines represent the changing thresholds of mandatory contract reporting to TED, which are different for Works contracts, and which are updated every two years.

“top 8” supplier. Procurement markets that are dominated by only a few firms will of course see a greater number of “1”s for these CR4 and CR8 proxy columns.

Ideally, whether or not a supplying company should be counted in the CR4 should be determined by total contract values per winning bidder, but the number of documents with quality data for tender values and bidder names was limiting. The given “winning bidder count” proxy for market concentration makes an assumption that tender contract values within years, countries, and industries are comparable. Furthermore, as previously discussed, the variations in company name spellings cause the company’s wins to be aggregated under different names, which complicates (and likely underestimates) the true level of concentration.

6.3 Post Double Selection with LASSO

Finally, this paper proposes an alternative specification to the relatively restrictive country-industry-period fixed effects implemented in the original paper.

Because the number of controls increases quite dramatically in the tightest fixed effect specification, there was some concern that the number of observations wouldn’t allow enough variation within the country-industry-period buckets, and indeed, Duguay et al note that singleton observations drop out of the sample. Ultimately, the results do remain statistically significant. However, in this paper, an alternate specification based on Belloni et al’s method of post-double selection was implemented to select for control terms without changing inference and maintaining consistent standard errors (Belloni, Chernozhukov, and Hansen 2014).

One method of variable selection is known as the “least absolute shrinkage and selection operator,” or LASSO. Whereas, in a standard OLS regression, a fit can be made by minimizing the squared sum of residuals (SSR), with this regularization, we minimize the sum of the SSR and an additional penalty term in a new cost function (Tibshirani 1996). For LASSO, this additional penalty term (λ) is an absolute value function of the estimated fit β . In the process of training a regression model, the “best” λ below is found after running repeated cross sections with a vector of different λ s E.g.:

Standard OLS: $\min\{SSR\}$

LASSO: $\min\{SSR + \lambda(|\beta_1| + |\beta_2| + \dots)\}$

Using LASSO to manage covariates in a single selection step, however, is not suitable for inference, as they will not necessarily include particular variables that relate to bias-covariates that correlate to both the treatment and dependent variable (Athey and Imbens 2017). Thus, selection methods have arisen in the past ten years that measure the relationship between covariates and the dependent variable, as well as the relationship between covariates and the treatment, and then combine the two.

This paper implements the double selection procedure outlined by Belloni, Chernozhukov, and Hansen (Belloni, Chernozhukov, and Hansen 2014), in which the LASSO method is applied to select variables in two steps rather than one. In the first selection step, a LASSO regression is used to identify covariates that are correlated to the treatment. A second step correlates covariates to the outcome variable using LASSO. Variables with nonzero coefficients in either LASSO regression are identified, and the union of these two sets of covariates is then used in an OLS regression of the treatment on the outcome.

7 Results

7.1 Competitive Contract Procedure (Open)

The primary research question of this paper is to investigate whether the enactment of national policies in response to the 2014 EU Procurement Directive led to an increased likelihood of the most competitive procedure (“Open”) being used in public procurement. The results of the regressions from the main specification found in equation (1) above can be found in the table here. Column 1 gives the baseline OLS estimation, without any controls for different changes within the entities over time, while Columns 2 adds fixed effects

for the three interactions between country, industry (as represented by the first two CPV digits), and year-quarter. Column 3 uses the triple-interacted fixed effect model of all three country-industry-quarter. Column 4 applies the post double selection method to select covariates from the fixed effect regression.

For the regression with the greatest number of controls, the coefficient on *TED x Post* is positive but statistically insignificant, failing to reject the null hypothesis of no change in usage of “Open” procedures after the new national procurement regulations were passed. This is perhaps not surprising, since Duguay et al. run a similar specification—albeit using slightly different data and a different set of controls—and also fail to find a significant effect coming from national legislation. The *Post Open Data* variable is positive and significant at the 1% level, suggesting 6 percentage point increase in likelihood of the most competitive procedure (Open) being used after data became more public and scrutiny increased.

Other coefficients of interest indicate a statistically significant negative relationship between contract value and Openness of tendering procedures: Open contracts, when controlling for all covariates in this regression, tend to be lower in final contract value. In addition, framework agreements and whether or not the contract received EU funding are also statistically significantly correlated to higher likelihood of Open Tendering being used in the full fixed effects models.

Table 2: Effect of New Procurement Laws on Usage of Open Tendering Procedure

	Fixed Effects			
	Likelihood of Open Tendering			
	Pooled OLS	FE 1	FE 2	Post-LASSO
	(1)	(2)	(3)	(4)
TED Contract x Post	0.0083 (0.0325)	0.0185 (0.0167)	0.0148 (0.0167)	0.0159 (0.0167)
TED Contract	0.0097 (0.0292)	0.0051 (0.0072)	0.0058 (0.0082)	-0.0399*** (0.0116)
Post	-0.0087 (0.0247)	0.0323** (0.0119)	0.0325** (0.0124)	0.0371*** (0.0129)
Ln(Value)	-0.0390*** (0.0105)	-0.0346*** (0.0040)	-0.0340*** (0.0039)	
Works Contract		-0.0386 (0.0504)	-0.0408 (0.0524)	-0.0964 (0.0610)
Post Open Data		0.0604*** (0.0156)	0.0619*** (0.0164)	0.0157*** (0.0035)
GPA Coverage		0.0088 (0.0107)	0.0085 (0.0106)	0.0034 (0.0107)
Number CPVs		-0.0011 (0.0008)	-0.0010 (0.0009)	-0.0019* (0.0011)
Is Framework		0.0313* (0.0161)	0.0335* (0.0165)	0.0181 (0.0165)
Is EU Funded		0.0327*** (0.0118)	0.0320*** (0.0108)	0.0283** (0.0114)
Constant	1.3896*** (0.1242)			0.9621*** (0.0121)
Fixed Effects:				
Country x Industry	No	Yes	No	No
Country x Qtr-Year	No	Yes	No	No
Industry x Qtr-Year	No	Yes	No	No
Country x Industry x Qtr-Year	No	No	Yes	No
Post Double Selection	No	No	No	Yes
Observations	248,321	248,321	248,321	248,321
R ²	0.0244	0.3043	0.3720	0.2892
Adjusted R ²	0.0244	0.2964	0.3211	0.2852

Note:

*p<0.1; **p<0.05; ***p<0.01

Note: This table presents the results of the OLS regressions estimating the impact of the new public procurement directives on the likelihood that contracts are tendered with an 'open' procedure. Data comes from the DIGIWHIST Opentenders project, and is filtered to contracts published between 2012 and 2017, with values between 20,000 EUR and 1 billion EUR, inclusive. TED Contract is a binary variable equal to one for contracts that are listed as above EU reporting thresholds. Post is an indicator equal to one if the contract is published after the date when the directive began to be translated into national law. Post Open Data is an indicator equal to one if after the open data initiative (July 2015). Other controls are described in the Data section.

7.2 Tender Corrections

Second, I estimate the likelihood of tender corrections, again estimating an outcome variable found in Duguay et al. The differences-in-differences framework was used to estimate the likelihood of ex-post tender modifications as a result of the new procurement directives. The results are given in Table 3 below. As before, Column 1 provides a baseline OLS estimation, while Columns 2-3 include fixed effects for interactions between country, industry, and year-quarter. Column 4 gives the double selected method.

For the regression with tightest fixed effect specification, the coefficient on *TED x Post* is positive and statistically significant at the 1% level, suggesting a 2.7 percentage point increase in tender documents being modified ex-post.

This finding doesn't exactly corroborate those of Duguay et al, which reports a significant increase in contract modifications as a result of *both* the new directives as well as the increase in procurement data transparency. Table 3 reports that only the directives had a significant effect. Furthermore, the magnitude of the effect is lower in this table. However, my specification includes a range of (significant) covariates not included in their estimation, so some of the variation could likely have been picked up by these additional variables.

Table 3: Effect of New Procurement Laws on Tender Corrections

	Fixed Effects			
	Likelihood of Corrections			
	Pooled OLS	FE 1	FE 2	Post-LASSO
	(1)	(2)	(3)	(4)
TED Contract x Post	0.0211 (0.0158)	0.0327*** (0.0061)	0.0272*** (0.0049)	0.0330*** (0.0062)
TED Contract	-0.0074 (0.0072)	-0.0084** (0.0032)	-0.0068** (0.0031)	-0.0082*** (0.0031)
Post	0.0938*** (0.0237)	0.0832*** (0.0165)	0.0848*** (0.0150)	0.0830*** (0.0161)
Ln(Value)	0.0184*** (0.0035)	0.0170*** (0.0025)	0.0169*** (0.0026)	0.0168*** (0.0025)
Works Contract		0.0276** (0.0126)	0.0258** (0.0110)	0.0220** (0.0102)
Post Open Data		0.0055 (0.0048)	0.0041 (0.0041)	0.0076* (0.0041)
GPA Coverage		0.0173** (0.0075)	0.0196** (0.0077)	0.0166** (0.0072)
Number CPVs		0.0026** (0.0011)	0.0029** (0.0011)	0.0025** (0.0011)
Is Framework		-0.0043 (0.0036)	-0.0046 (0.0036)	-0.0050 (0.0033)
Is EU Funded		0.0257*** (0.0078)	0.0280*** (0.0084)	0.0252*** (0.0072)
Constant	-0.1843*** (0.0333)			-0.2049*** (0.0356)
Fixed Effects:				
Country x Industry	No	Yes	No	No
Country x Qtr-Year	No	Yes	No	No
Industry x Qtr-Year	No	Yes	No	No
Country x Industry x Qtr-Year	No	No	Yes	No
Post Double Selection	No	No	No	Yes
Observations	248,321	248,321	248,321	248,321
R ²	0.0388	0.1546	0.2074	0.1514
Adjusted R ²	0.0388	0.1450	0.1431	0.1474

Note:

*p<0.1; **p<0.05; ***p<0.01

Note: This table presents the results of the OLS regressions estimating the impact of the new public procurement directives on the likelihood of there being at least one ex-post tender modification. Data comes from the DIGIWHIST Opentenders project, and is filtered to contracts published between 2012 and 2017, with values between 20,000 EUR and 1 billion EUR, inclusive. TED Contract is a binary variable equal to one for contracts that are listed as above EU reporting thresholds. Post is an indicator equal to one if the contract is published after the date when the directive began to be translated into national law. Post Open Data is an indicator equal to one if after the open data initiative (July 2015). Other controls are described in the Data section.

7.3 Number of Bidders

In addition to the two outcomes above, which were in the original Duguay et al paper, I estimate other dependent variables of interest to the EU directives.

As a measure of competition, I estimated the likelihood of there being over 2 bidders as a result of the new procurement directives, aggregated on the contract level. The results of these regressions can be found in Table 4. As before, Column 1 gives the baseline Pooled OLS estimation, without any controls for different changes within the entities over time, while Columns 2-3 add fixed effects for interactions between country, industry (as represented by the first two CPV digits), and year-quarter, and column 4 provides the same estimation with variable selection.

For the regression with tightest fixed effect specification, the coefficient on *TED x Post* is negative and statistically significant at the 1% level, suggesting a 1.5% percentage point decrease in the likelihood that the contract receives over 2 bidders (on average, across lots).

Additional regressions estimating competition with other outcome variables can be found in the appendix. Tables 8 and 9 show the likelihood that a tender has a single bidder (on average across all lots) or greater than 3 bidders (averaged across lots). In both regressions, the outcome remains the same: the new procurement directives were associated with a surprising decrease in competitive bidding (or an increase in single-bid tenders). However, these indicators are not without problems, as mentioned in the Discussion below.

Table 4: Effect of New Procurement Laws on Number of Bids

	Fixed Effects			
	Likelihood of Contract Having > 2 Bids			
	Pooled OLS	FE 1	FE 2	Post-LASSO
	(1)	(2)	(3)	(4)
TED Contract x Post	-0.0291 (0.0319)	-0.0149* (0.0075)	-0.0139** (0.0067)	-0.0153** (0.0075)
TED Contract	-0.0349 (0.0536)	0.0253** (0.0092)	0.0266*** (0.0089)	0.0256*** (0.0093)
Post	0.0229 (0.0293)	-0.0174** (0.0069)	-0.0210*** (0.0072)	-0.0166** (0.0066)
Ln(Value)	0.0325*** (0.0050)	0.0019 (0.0034)	0.0017 (0.0034)	0.0019 (0.0033)
Works Contract		0.1565*** (0.0283)	0.1578*** (0.0282)	0.1562*** (0.0283)
Post Open Data		-0.0039 (0.0089)	-0.0086 (0.0099)	-0.0071 (0.0076)
GPA Coverage		0.0187* (0.0101)	0.0186* (0.0102)	0.0183* (0.0100)
Number CPVs		0.0015** (0.0006)	0.0014* (0.0007)	0.0015** (0.0006)
Is Framework		0.0418*** (0.0143)	0.0401** (0.0146)	0.0405*** (0.0137)
Is EU Funded		-0.0083 (0.0150)	-0.0028 (0.0154)	-0.0096 (0.0146)
Constant	0.1778 (0.1196)			0.5299*** (0.0345)
Fixed Effects:				
Country x Industry	No	Yes	No	No
Country x Qtr-Year	No	Yes	No	No
Industry x Qtr-Year	No	Yes	No	No
Country x Industry x Qtr-Year	No	No	Yes	No
Post Double Selection	No	No	No	Yes
Observations	234,753	234,753	234,753	234,753
R ²	0.0071	0.2010	0.2658	0.1988
Adjusted R ²	0.0071	0.1914	0.2039	0.1923

Note:

*p<0.1; **p<0.05; ***p<0.01

Note: This table presents the results of the OLS regressions estimating the impact of the new public procurement directives on the likelihood that there are more than two bidders on tender lots (on average). Data comes from the DIGIWHIST Opentenders project, and is filtered to contracts published between 2012 and 2017, with values between 20,000 EUR and 1 billion EUR, inclusive. TED Contract is a binary variable equal to one for contracts that are listed as above EU reporting thresholds. Post is an indicator equal to one if the contract is published after the date when the directive began to be translated into national law. Post Open Data is an indicator equal to one if after the open data initiative (July 2015). Other controls are described in the Data section.

7.4 Cross-border Procurement

Another new question analyzed by this paper was whether the new procurement directives led to an increased likelihood of (at least one lot of) a contract being won by an international supplier; that is, a supplier whose country was listed as different than the procuring agency's listed country. This was one goal of the EU Directives, so evaluating its success in this regard is sensible.

Table 5 below presents results of the above estimation where the outcome variable is the likelihood of a tender being won by a foreign buyer. As above, column 1 gives the baseline OLS estimation, without any controls for different changes within the entities over time, while Columns 2-3 add fixed effects and additional covariates, and column 4 allows for double selection of significant variables.

For the tightest regression, the coefficient on *TED x Post* is negative but not statistically different than zero, so there is no strong evidence that the new procurement directives affected international procurement as it was defined.

A few other coefficients are statistically significant, though, and these perhaps make intuitive sense: Public works contracts and framework agreements are both negatively correlated with cross-border procurement, at a 1% statistical significance level. Framework agreements consist of the dynamic purchasing of yet-unknown quantities of a service (e.g. nurses, IT solutions) over several years from the winning supplier, so that supplier being located nearby within the country perhaps makes intuitive sense, given the uncertainty and contract length. Public works are frequently large, years-long contracts that also make sense to execute within the supplier's own country. EU funding, on the other hand, is positively correlated with the likelihood of international buyers winning.

Table 5: Effect of New Procurement Laws on Cross-border Procurement

	Fixed Effects			
	Likelihood of Cross-border Procurement			
	Pooled OLS	FE 1	FE 2	Post-LASSO
	(1)	(2)	(3)	(4)
TED Contract x Post	0.0065 (0.0049)	-0.0016 (0.0023)	-0.0006 (0.0022)	0.0015 (0.0026)
TED Contract	-0.0089 (0.0067)	-0.0058*** (0.0013)	-0.0059*** (0.0014)	-0.0089*** (0.0017)
Post	-0.0116*** (0.0035)	-0.0009 (0.0028)	-0.0004 (0.0031)	-0.0040 (0.0027)
Ln(Value)	0.0040*** (0.0012)	0.0071*** (0.0012)	0.0069*** (0.0012)	0.0066*** (0.0012)
Works Contract		-0.0264*** (0.0052)	-0.0271*** (0.0046)	-0.0214*** (0.0056)
Post Open Data		-0.0045 (0.0041)	-0.0031 (0.0039)	0.0022 (0.0025)
GPA Coverage		0.0006 (0.0016)	0.0007 (0.0015)	0.0034* (0.0019)
Number CPVs		-0.0009* (0.0005)	-0.0008* (0.0005)	-0.0006 (0.0004)
Is Framework		-0.0090*** (0.0024)	-0.0085*** (0.0024)	-0.0060** (0.0028)
Is EU Funded		0.0218*** (0.0058)	0.0212*** (0.0058)	0.0220*** (0.0056)
Constant	-0.0120 (0.0168)			-0.0519*** (0.0150)
Fixed Effects:				
Country x Industry	No	Yes	No	No
Country x Qtr-Year	No	Yes	No	No
Industry x Qtr-Year	No	Yes	No	No
Country x Industry x Qtr-Year	No	No	Yes	No
Post Double Selection	No	No	No	Yes
Observations	248,321	248,321	248,321	248,321
R ²	0.0012	0.1038	0.2137	0.0817
Adjusted R ²	0.0012	0.0936	0.1499	0.0785

Note:

*p<0.1; **p<0.05; ***p<0.01

Note: This table presents the results of the OLS regressions estimating the impact of the new public procurement directives on the likelihood that at least one contract lot is awarded to an international buyer. Data comes from the DIGIWHIST Opentenders project, and is filtered to contracts published between 2012 and 2017, with values between 20,000 EUR and 1 billion EUR, inclusive. TED Contract is a binary variable equal to one for contracts that are listed as above EU reporting thresholds. Post is an indicator equal to one if the contract is published after the date when the directive began to be translated into national law. Post Open Data is an indicator equal to one if after the open data initiative (July 2015). Other controls are described in the Data section.

7.5 Market Concentration proxy

Finally, a new variable capturing one measure of market concentration is whether or not the contract was awarded to a top 4 or top 8 supplier for the given market, where the market is identified by industry-country-year. Aside from logged contract value, no estimates are significant in the “top 4” variable. However, in the “top 8” specification, being EU-funded is significantly correlated to a decrease in the likelihood that the winning bid goes to a top-8 winning supplier. As discussed above, these measures of procurement market concentration are imperfect and subject to data quality issues.

Both tables 6 and 7, corresponding to “top 4 winner” and “top 8 winner,” can be found in the Appendix.

8 Discussion

First, this paper corroborates the primary finding reported by Duguay et al using an updated methodology and slightly different data. I did not find a statistically significant effect of the passing of new legislation in line with the EU procurement directives on the likelihood that a contract would be tendered with the most competitive procedure. In contrast, the coefficient on being Post Open Data initiative remains statistically significant and positive, similar to the effect found in the Duguay paper, albeit of a smaller magnitude. Thus, their conclusion that it was the availability of Open Data that caused a shift in Open tendering, and not the passing of the new procurement laws, appears to hold true even under an altered specification and with additional covariates added.

This result has ramifications for future legislation concerning public procurement: the effect of public scrutiny is perhaps a more important channel in changing the openness of public procurement than actual legal recourse. (This may be because, as Duguay et al. argue, the availability of open data allows the media to monitor procurement processes and put pressure on procurement authorities.) Therefore, future procurement laws should have a focus making this public data more accessible: if procurement law is passed, but the public is unable to monitor it, the impact of the legislation is weakened. Public scrutiny is key to promoting the use of Open procedures.

Furthermore, Duguay et al’s findings connecting the changing procurement landscape to increased ex-post modification are also somewhat corroborated under the new estimation. In the Duguay paper, both being post-legislation and post-open data initiative were significant predictors of contract modification. In my specification, however, being post-open data initiative is not significant. Furthermore, the magnitude of the coefficient on Treatment x Post is much smaller—less than half—of the findings in Duguay et al (2020). This is perhaps because I include controls for contract observables that may absorb much of the variation in likelihood of tender modification, including a control for being a Works contract, being EU-funded, and being covered by GPA. However, the directives were still associated with a 3 percentage point increase in likelihood of ex-post tender modification, which provides some evidence in favor for alternative procurement procedures not vouched for by the EU directives (e.g. the use of restricted or negotiated procedures that allow for greater discretion of buyers). Perhaps there is still room to “increase the efficiency of public spending” in future EU Procurement directive updates.

Interestingly, the EU Directives appeared to have *decreased* the likelihood of there being greater than 2 (or, in the Appendix, greater than 3 or only a single) bidders per lot. This may be the result of the way the indicator variables were generated, averaging the number of bidders across all lots on a procurement. As the procurement became more easily subdivided into lots, then, one might expect the number of bidders across contracts to decrease, though controlling for contract size would mitigate this effect. To test the notion that an increase in lot divisibility led to a decrease in numbers of bidders, the regression was estimated again, only including single-lot contracts (Appendix Table 10). In the new regression, the estimate remains significant, so it appears there is an increase in single-bidding associated with the new EU Directives independent from the increased possibility of dividing contracts into lots. This trend is troubling when considering the fact that opening up European public procurement to competition was item number one in the Directives.

Overall, there are a few shortcomings that hamper validity of this analysis. First, there are serious data quality issues within the sphere of public procurement that require significant additional cleaning in order to strengthen conclusions drawn from that data. As explained above and mentioned in the research, public procurement data is seriously lacking in several reported variables, despite official national and EU policies requiring accurate reporting.

In response to the data sparsity and data quality issues, this analysis has been limited to variables that are complete. However, this filtering of “complete” data might introduce selection bias issues, especially if we believe there to be systematic differences in procurement agencies that are likely to prepare good quality data versus agencies that improperly fill out forms and create data that is sparse in the Opentender tables. Because filtering for complete data is a non-random sampling procedure, more robust checks to ensure this subpopulation of contracts is similar to those filtered out should be included in future analysis.

Secondly, a major challenge to identification comes from simultaneous Open Data projects that were pub-

lished over the time period covered by this research paper. Namely, complications arise with the contemporaneous Opentender (January 2018) and EU Open Data Portal (July 2015) initiatives that made public procurement data more available to the public. Thus, it becomes slightly more difficult to disentangle precisely where any effects are coming from, since national policies from various countries were implemented within this time frame (from the UK starting its transposition of the EU directives in February 2015 to Austria doing so in August 2018). Though the analysis includes a dummy variable capturing whether a contract was published after the 2015 open data “treatment,” suppliers’ and tenderers’ reactions to the increased transparency projects may not be instantaneous.

Similarly, though the national laws executing the EU directives are legally enforceable and thus the treatment should be considered “strong,” there is no assurance that procurement agencies did not alter their behavior in response to the original 2014 EU directives or in anticipation of the new national legislation being passed: If this were the case, then they may be “treated” before the specific treatment date listed for their country. Thus, there are potential compliance issues within this differences-in-differences design.

The generated variables for competition may also be problematic. There is no clear cutoff for what constitutes a sufficiently competitive number of bids on a contract, as that is dependent on many factors, from industry to geographical area of procurement. Sometimes 3 bidders may be considered sufficiently competitive, while other times 8 bidders is not competitive enough. Thus, using a binary with an arbitrary cutoff is perhaps not the strongest measure of competition on that procurement. Single-bid tenders certainly constitutes a lower bound for the competitiveness of procurement, as can be seen in the Appendix.

The “market concentration” variables, capturing whether or not the awarded bidder was one of the most winning 4 or 8 companies in that market, are unreliable given the aforementioned data quality issues. In addition, due to the unreliability of the contract value field, the usage of simple numbers of won contracts was necessitated for this analysis; the Appendix includes a brief look at how a concentration ratio might be used.

9 Conclusion

This paper investigates the changing public procurement market of Europe between 2012 and January 2018. Specifically, I examine the effect of the 2014 EU Procurement Directives on a set of outcome variables, including the likelihood that a contract is tendered with an “open” procedure, the likelihood that a tender is modified ex-post, the likelihood that a contract is awarded to an international supplier, and the likelihood that a contract is bid on by over two bidders.

Similar to Duguay et al. (2020), I do not find any strong effects on likelihood of Open tendering from the new legislation. I also fail to reject the null hypothesis that there was no impact on cross-border procurement in TED contracts in countries after the directives were translated into national law.

Additionally, this paper corroborates the evidence that tender modification ex-post increases as a function of the Procurement Directives, albeit with a lower magnitude than the effect size that Duguay et al. report. This finding underscores the complicated relationship between public procurement and efficient auction outcomes: While the new legislation and open data initiatives may intuitively imply more efficient outcomes from higher competition and scrutiny, there are indeed costs and benefits with increasing transparency and opening up the procurement market, and these exact costs should be studied in greater detail (in this analysis I was limited to the indicator “Is Corrected,” but having data with, say, the overrun value of contracts would be more interesting to study).

Interestingly, the passage of new legislation appears to have a statistically significant *negative* effect on the likelihood of there being over two bidders on a contract (averaged over lots). When the definition of ‘competitive tenders’ is changed to having more than 3 bidders or being a single-bid contract, the effect size remains the same direction and of a similar magnitude, and remains significant at the 0.05 level. This seeming decrease in competitiveness could be the result of the way the outcome variable was defined and how the EU legislation made it easier to subdivide lots. However, an alternate specification using only single-lot contracts suggests this trend is not explained away by lot divisibility, as the estimate remains significant.

One avenue for future research is to look at the EU Directives’ effects on the likelihood of SME suppliers winning the contract. Though I would have liked to investigate the legislation’s impact on SME winnings, since that was one of the primary goals of the directives, no reliable field existed in the data set that could provide an indicator for SME status (There is a variable “lot_smeBidsCount” in the Opentender dataset, but its coverage is poor).

A deeper look at how market concentration changed in public procurement as a result of the policy would also be interesting for further research. The EU directive aimed at opening up the procurement process (to SMEs, to international suppliers) in order to increase competition, so investigating the market-wide level of competition would be a logical extension. The appendix provides a sample graph looking at the procurement market concentration (using CR4 scores) for Sweden’s top 5 procurement industries. From this illustration, different levels of concentration can be observed in the public procurement market across industries over time. For tenders with non-blank named winners, there is a potentially troubling trend of oligopolistic behavior in the procurement market, but whether this observation holds true under deeper analysis with improved data quality remains to be seen. (Note that Sweden does not have a national procurement portal, so the Opentender data is relatively sparse before 2016).

Lastly, perhaps the most important takeaway from this paper is underscoring the necessity of quality public procurement data. Further work is needed in assuring quality public procurement data. Primarily, extensive work to uncover actual bid amounts that are not as widely available in the TED data or in data from the national portals as provided would improve any analysis done on public procurement markets.

10 Appendix

10.1 Additional regression tables

10.1.1 Market concentrations

Table 6: Effect of New Procurement Laws on Likelihood of Top 4 Supplier Winner

	Fixed Effects			
	Likelihood of Winning Bid to top 4 Supplier			
	Pooled OLS	FE 1	FE 2	Post-LASSO
	(1)	(2)	(3)	(4)
TED Contract x Post	0.0145 (0.0166)	-0.0011 (0.0036)	-0.0010 (0.0027)	-0.0010 (0.0036)
TED Contract	0.0161 (0.0243)	0.0016 (0.0045)	0.0023 (0.0046)	0.0015 (0.0045)
Post	-0.0288*** (0.0112)	-0.0022 (0.0054)	0.0011 (0.0053)	-0.0019 (0.0054)
Ln(Value)	0.0007 (0.0029)	0.0060*** (0.0019)	0.0053*** (0.0018)	0.0060*** (0.0019)
Works Contract		-0.0099 (0.0120)	-0.0073 (0.0127)	-0.0107 (0.0110)
Post Open Data		-0.0031 (0.0040)	-0.0092* (0.0047)	-0.0025 (0.0030)
GPA Coverage		0.0025 (0.0019)	0.0028 (0.0017)	0.0023 (0.0020)
Number CPVs		0.0004 (0.0004)	0.0006 (0.0005)	0.0003 (0.0004)
Is Framework		0.0042 (0.0070)	0.0038 (0.0075)	0.0037 (0.0068)
Is EU Funded		-0.0081 (0.0048)	-0.0092* (0.0048)	-0.0077 (0.0047)
Constant	0.0872*** (0.0335)			-0.0027 (0.0244)
Fixed Effects:				
Country x Industry	No	Yes	No	No
Country x Qtr-Year	No	Yes	No	No
Industry x Qtr-Year	No	Yes	No	No
Country x Industry x Qtr-Year	No	No	Yes	No
Post Double Selection	No	No	No	Yes
Observations	248,321	248,321	248,321	248,321
R ²	0.0025	0.2311	0.3468	0.2284
Adjusted R ²	0.0025	0.2224	0.2938	0.2228

Note:

*p<0.1; **p<0.05; ***p<0.01

Note: This table presents the results of the OLS regressions estimating the impact of the new public procurement directives on the likelihood that a winning supplier is within the top 4 for that country-industry-year sector. Data comes from the DIGIWHIST Opentenders project, and is filtered to contracts published between 2012 and 2017, with values between 20,000 EUR and 1 billion EUR, inclusive. TED Contract is a binary variable equal to one for contracts that are listed as above EU reporting thresholds. Post is an indicator equal to one if the contract is published after the date when the directive began to be translated into national law. Post-Open Data is an indicator equal to one if after the open data initiative (July 2015). Other controls are described in the Data section.

Table 7: Effect of New Procurement Laws on Likelihood of Top 8 Supplier Winner

	Fixed Effects			
	Likelihood of Winning Bid to Top 8 Supplier			
	Pooled OLS	FE 1	FE 2	Post-LASSO
	(1)	(2)	(3)	(4)
TED Contract x Post	0.0205 (0.0238)	-0.0021 (0.0042)	-0.0007 (0.0033)	-0.0020 (0.0042)
TED Contract	0.0228 (0.0349)	0.0013 (0.0059)	0.0012 (0.0061)	0.0013 (0.0060)
Post	-0.0445*** (0.0159)	-0.0021 (0.0056)	-0.0005 (0.0053)	-0.0029 (0.0053)
Ln(Value)	0.0015 (0.0037)	0.0088*** (0.0022)	0.0081*** (0.0021)	0.0087*** (0.0022)
Works Contract		-0.0186 (0.0186)	-0.0187 (0.0193)	-0.0196 (0.0180)
Post Open Data		-0.0039 (0.0056)	-0.0067 (0.0062)	-0.0007 (0.0047)
GPA Coverage		0.0038* (0.0021)	0.0040** (0.0019)	0.0034 (0.0023)
Number CPVs		-0.0002 (0.0006)	0.00003 (0.0007)	-0.0002 (0.0006)
Is Framework		0.0066 (0.0073)	0.0068 (0.0081)	0.0062 (0.0073)
Is EU Funded		-0.0151** (0.0060)	-0.0151*** (0.0055)	-0.0146** (0.0058)
Constant	0.1297*** (0.0452)			0.0291 (0.0289)
Fixed Effects:				
Country x Industry	No	Yes	No	No
Country x Qtr-Year	No	Yes	No	No
Industry x Qtr-Year	No	Yes	No	No
Country x Industry x Qtr-Year	No	No	Yes	No
Post Double Selection	No	No	No	Yes
Observations	248,321	248,321	248,321	248,321
R ²	0.0040	0.2678	0.3658	0.2658
Adjusted R ²	0.0039	0.2595	0.3143	0.2600

Note:

*p<0.1; **p<0.05; ***p<0.01

Note: This table presents the results of the OLS regressions estimating the impact of the new public procurement directives on the likelihood that a winning supplier is within the top 4 for that country-industry-year sector. Data comes from the DIGIWHIST Opentenders project, and is filtered to contracts published between 2012 and 2017, with values between 20,000 EUR and 1 billion EUR, inclusive. TED Contract is a binary variable equal to one for contracts that are listed as above EU reporting thresholds. Post is an indicator equal to one if the contract is published after the date when the directive began to be translated into national law. Post-Open Data is an indicator equal to one if after the open data initiative (July 2015). Other controls are described in the Data section.

10.1.2 Alternative measures of bidder competition

Here, I include additional regression tables, with alternative indicators of competition in public procurement. The results corroborate the usage of “above 2 bidders” in the main section:

- *Single Bidder*: Binary variable equal to one if all lots on a contract have 1 bidder
- *Over 3 Bidders*: Likelihood of there being more than 3 bidders for a contract, when averaged over the lots.
- *Single Bidder (Single lots ONLY)*: Binary variable equal to one if all lots on a contract have 1 bidder, but limited to a sample of contract awards with only one lot.

Table 8: Effect of New Procurement Laws on Likelihood of Single bidders

	Fixed Effects			
	Likelihood of Single Bidder			
	Pooled OLS	FE 1	FE 2	Post-LASSO
	(1)	(2)	(3)	(4)
TED Contract x Post	0.0133 (0.0179)	0.0102* (0.0050)	0.0122** (0.0057)	0.0104** (0.0050)
TED Contract	0.0142 (0.0299)	-0.0221*** (0.0068)	-0.0245*** (0.0071)	-0.0223*** (0.0068)
Post	-0.0778*** (0.0211)	-0.0159** (0.0075)	-0.0159* (0.0078)	-0.0199*** (0.0073)
Ln(Value)	-0.0171*** (0.0029)	0.0005 (0.0022)	0.0003 (0.0022)	0.0004 (0.0022)
Works Contract		-0.0794*** (0.0209)	-0.0793*** (0.0209)	-0.0791*** (0.0208)
Post Open Data		-0.0328* (0.0167)	-0.0295* (0.0164)	-0.0113 (0.0082)
GPA Coverage		-0.0377*** (0.0115)	-0.0360*** (0.0109)	-0.0365*** (0.0112)
Number CPVs		-0.0024*** (0.0008)	-0.0024*** (0.0008)	-0.0024*** (0.0008)
Is Framework		-0.0252*** (0.0083)	-0.0234** (0.0087)	-0.0242*** (0.0080)
Is EU Funded		-0.0052 (0.0100)	-0.0068 (0.0097)	-0.0049 (0.0100)
Constant	0.4958*** (0.0755)			0.2726*** (0.0254)
Fixed Effects:				
Country x Industry	No	Yes	No	No
Country x Qtr-Year	No	Yes	No	No
Industry x Qtr-Year	No	Yes	No	No
Country x Industry x Qtr-Year	No	No	Yes	No
Post Double Selection	No	No	No	Yes
Observations	248,321	248,321	248,321	248,321
R ²	0.0088	0.1489	0.2188	0.1471
Adjusted R ²	0.0088	0.1392	0.1555	0.1411

Note:

*p<0.1; **p<0.05; ***p<0.01

Note: This table presents the results of the OLS regressions estimating the impact of the new public procurement directives on the likelihood that there is only one bidder on the tender. Data comes from the DIGIWHIST Opentenders project, and is filtered to contracts published between 2012 and 2017, with values between 20,000 EUR and 1 billion EUR, inclusive. TED Contract is a binary variable equal to one for contracts that are listed as above EU reporting thresholds. Post is an indicator equal to one if the contract is published after the date when the directive began to be translated into national law. Post Open Data is an indicator equal to one if after the open data initiative (July 2015). Other controls are described in the Data section.

Table 9: Effect of New Procurement Laws on Number of Bids

	Fixed Effects			
	Likelihood of Contract Having > 3 Bids			
	Pooled OLS	FE 1	FE 2	Post-LASSO
	(1)	(2)	(3)	(4)
TED Contract x Post	-0.0365 (0.0347)	-0.0160** (0.0078)	-0.0162** (0.0071)	-0.0164** (0.0076)
TED Contract	-0.0497 (0.0620)	0.0201** (0.0090)	0.0218** (0.0088)	0.0205** (0.0089)
Post	0.0121 (0.0294)	-0.0159* (0.0085)	-0.0199** (0.0083)	-0.0147* (0.0085)
Ln(Value)	0.0343*** (0.0048)	0.0002 (0.0035)	-0.0003 (0.0035)	0.0004 (0.0035)
Works Contract		0.1903*** (0.0374)	0.1933*** (0.0376)	0.1887*** (0.0372)
Post Open Data		-0.0047 (0.0101)	-0.0089 (0.0100)	-0.0090* (0.0051)
GPA Coverage		0.0171* (0.0093)	0.0181* (0.0095)	0.0164* (0.0092)
Number CPVs		0.00005 (0.0006)	0.0001 (0.0006)	-0.00001 (0.0006)
Is Framework		0.0582*** (0.0176)	0.0566*** (0.0180)	0.0564*** (0.0172)
Is EU Funded		-0.0079 (0.0179)	-0.0028 (0.0187)	-0.0079 (0.0174)
Constant	-0.0026 (0.1173)			0.3309*** (0.0414)
Fixed Effects:				
Country x Industry	No	Yes	No	No
Country x Qtr-Year	No	Yes	No	No
Industry x Qtr-Year	No	Yes	No	No
Country x Industry x Qtr-Year	No	No	Yes	No
Post Double Selection	No	No	No	Yes
Observations	234,753	234,753	234,753	234,753
R ²	0.0082	0.2026	0.2648	0.2006
Adjusted R ²	0.0082	0.1930	0.2029	0.1944

Note:

*p<0.1; **p<0.05; ***p<0.01

Note: This table presents the results of the OLS regressions estimating the impact of the new public procurement directives on the likelihood that there are more than three bidders on tender lots (on average). Data comes from the DIGIWHIST Opentenders project, and is filtered to contracts published between 2012 and 2017, with values between 20,000 EUR and 1 billion EUR, inclusive. TED Contract is a binary variable equal to one for contracts that are listed as above EU reporting thresholds. Post is an indicator equal to one if the contract is published after the date when the directive began to be translated into national law. Post Open Data is an indicator equal to one if after the open data initiative (July 2015). Other controls are described in the Data section.

Table 10: Effect of New Procurement Laws on Likelihood of Single bidders (single lot)

	Fixed Effects		
	Likelihood of Single Bidder		
	Pooled OLS	FE 1	FE 2
	(1)	(2)	(3)
TED Contract x Post	0.0199 (0.0192)	0.0153** (0.0061)	0.0175** (0.0070)
TED Contract	0.0279 (0.0348)	-0.0227** (0.0097)	-0.0254** (0.0100)
Post	-0.0767*** (0.0219)	-0.0211*** (0.0067)	-0.0233*** (0.0071)
Ln(Value)	-0.0192*** (0.0032)	0.0016 (0.0023)	0.0011 (0.0024)
Works Contract		-0.0977*** (0.0240)	-0.0981*** (0.0246)
Post Open Data		-0.0288 (0.0180)	-0.0242 (0.0176)
GPA Coverage		-0.0389*** (0.0112)	-0.0364*** (0.0108)
Number CPVs		-0.0015 (0.0009)	-0.0014 (0.0010)
Is Framework		-0.0226*** (0.0077)	-0.0194** (0.0080)
Is EU Funded		-0.0111 (0.0112)	-0.0137 (0.0116)
Constant	0.5257*** (0.0813)		
Fixed Effects:			
Country x Industry	No	Yes	No
Country x Qtr-Year	No	Yes	No
Industry x Qtr-Year	No	Yes	No
Country x Industry x Qtr-Year	No	No	Yes
Post Double Selection	No	No	No
Observations	190,293	190,293	190,293
R ²	0.0085	0.1592	0.2435
Adjusted R ²	0.0085	0.1468	0.1669

Note: *p<0.1; **p<0.05; ***p<0.01

Note: This table presents the results of the OLS regressions estimating the impact of the new public procurement directives on the likelihood that there is only one bidder on the tender, single lots only. Data comes from the DIGIWHIST Opentenders project, and is filtered to contracts published between 2012 and 2017, with values between 20,000 EUR and 1 billion EUR, inclusive. TED Contract is a binary variable equal to one for contracts that are listed as above EU reporting thresholds. Post is an indicator equal to one if the contract is published after the date when the directive began to be translated into national law. Post Open Data is an indicator equal to one if after the open data initiative (July 2015). Other controls are described in the Data section.

Country	Procurement.Directive.Enaction
Austria	2018-08-20
Belgium	2017-06-30
Bulgaria	2016-04-15
Croatia	2017-01-01
Cyprus	2016-04-28
Czechia	2016-10-01
Denmark	2016-01-01
Estonia	2017-09-01
Finland	2017-01-01
France	2016-04-01
Germany	2016-04-18
Greece	2016-08-01
Hungary	2015-11-01
Iceland	2016-10-11
Ireland	2016-05-05
Italy	2016-04-18
Latvia	2017-03-01
Liechtenstein	2018-01-01
Lithuania	2016-01-01
Luxembourg	2018-04-20
Malta	2016-10-28
Netherlands	2016-07-01
Norway	2017-01-01
Poland	2016-07-28
Portugal	2017-08-31
Romania	2016-05-26
Slovakia	2016-04-18
Slovenia	2016-04-01
Spain	2018-03-06
Sweden	2017-01-01
United Kingdom	2015-02-26

10.2 EU Member Procurement Laws

Table depicting when the EU 2014 policy began to be implemented in each country, taken from Duguay et al (Duguay, Rauter, and Samuels 2020). While the EU directive had a deadline, countries’ legislative processes were often slower or faster. The “Post” variable is set equal to 1 when a tender comes from a country and is after the national procurement policy date in the right column. Note that Switzerland is always in the control group.

10.3 Concentration Ratio (“top 4”) visualization:

Since public procurement represents such a large market, having a basic measure of how dominated this market is by just a few firms is valuable. This section provides a brief view into oligopolistic behavior in the procurement market by analyzing CR4 and CR8 proxy variables within procurement, which is reflected in “Top 4” and “Top 8” variables. The “market” in question is comprised of a year, country and two-digit CPV industry code (e.g. “construction (CPV 45) in Sweden, 2015”).

In addition to simply allowing SMEs greater access to the broad procurement market, the 2014 policy’s effect also worked towards mitigating oligopolistic behavior in procurement markets. A concentrated market

structure is also a potential sign of collusive bidding. The *concentration ratio* measures to what extent a market is dominated by the largest firms.

The concentration ratio can take various equational forms, with the HHI, CR4 and CR8 being three of the more common measures. The Herfindahl-Hirschman Index measures the market size of member firms in relation to the size of their industry. CR4 and CR8 are, respectively, the ratio of value that the largest 4 and 8 companies have of the entire market. Thus the three concentrated market indicators take the forms:

$$HHI = \sum_{i=1}^N s_{it}^2$$

$$CR4 = \sum_{i=1}^4 s_{it}$$

$$CR8 = \sum_{i=1}^8 s_{it}$$

The CR4 can be calculated for country-industry-year “markets,” for instance Sweden’s 2008 construction (CPV 45) procurement market, using available procurement winners and contract award value data. However, as noted above, this data is sparse (only ~20% of contracts report value for Sweden), so assuming contract values in an industry are similar (a strong assumption), one can use count data instead. Still, the contract winner field can be misspelled or use abbreviations, making the market appear less oligopolistic than it is when aggregated by the name (one company becomes multiple aliases).

We can plot the concentration ratio for any CPV code “market” over several year. Though imperfect, it can be used to determine if there are broad changes in public procurement market shares over time, to see if any radical changes have occurred in market concentration.

In order to omit problems from unclean data, only rows with a non-blank value for the tender winner name are included. These data are then grouped on the firm level to calculate the total number of awards won within each country and year. These values are divided by the total number of contracts within a country-industry-year, to calculate what percentage of that procurement market that firm represents. Finally, the data are grouped again on the decided market level.

CR4 scores can be interpreted as rough estimates of market concentration. Common thresholds for different levels of market concentrations are that 15%-25% represents a “moderately concentrated” market and that above 25% corresponds to a “highly concentrated” market.

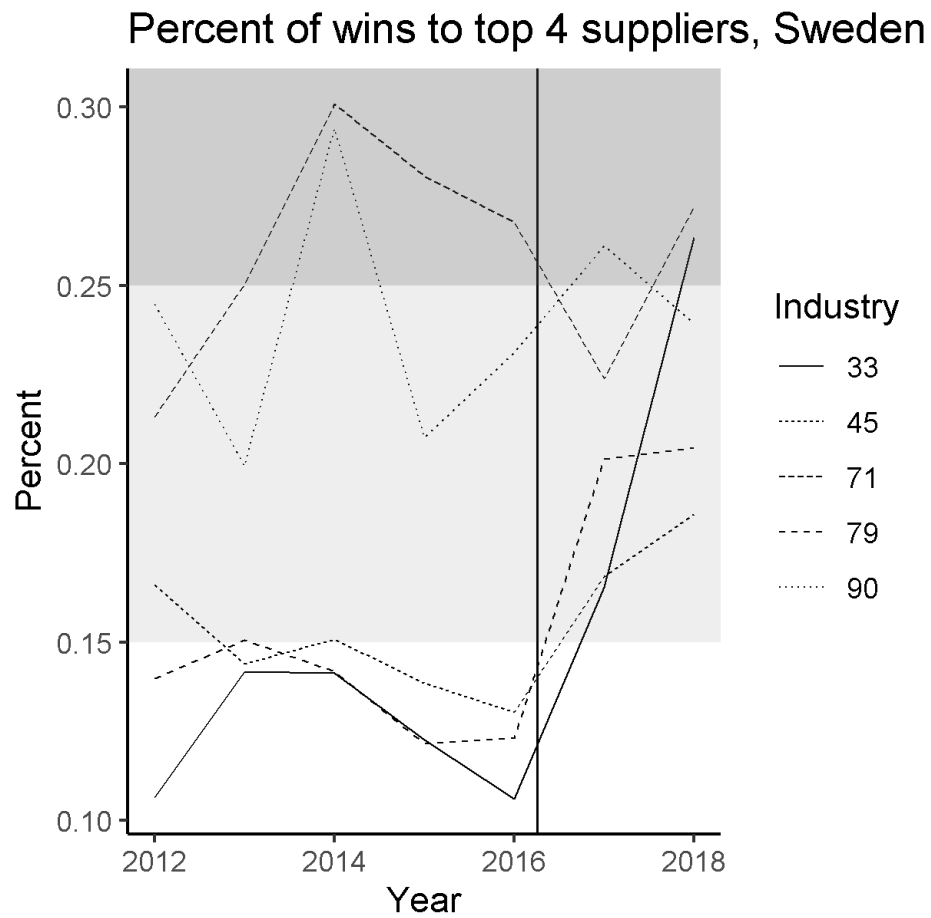


Figure 4: “CR4”: This plot shows the percentage of tenders per year with a non-blank bidder name being awarded to the four most-winning companies in the largest 5 industries, shown by the CPV division codes.

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