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Public procurement and supplier job creation: Insights from auctions *

Stjepan Srhoj† & Melko Dragojević‡

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Abstract

Public procurement contracts (PPCs) of goods, services and works is about one tenth of global gross domestic product. Much research has been conducted on government spending and its aggregate effects, but evidence is scarce at the micro-level. This study exploits sealed-bid PPC auctions of construction works, discontinuity in bidders' win margin and firms' daily employment variation to provide a causal estimate of winning a PPC on firms' employment. Winning a PPC has a small positive impact on a firm's short-run employment. The study investigates mechanisms and heterogeneity that can explain the initial small magnitudes. No compelling evidence is found in favour of political connections, an information leakage channel or PPC size as explanations for the small magnitude. A investigation of longer period shows the impact phases out in less than a year. The lack of a long-term impact is due to runners-up winning more PPCs and runners-up substituting towards more market revenue in the year after closely losing a PPC. Finally, the impacts are concentrated in construction firms that conduct the majority of contracted work *in-house*. The final estimation shows the effect is about four new employees per PPC with a public cost per job created at €45,200 [€34,200 - €66,200].

JEL: H57; D44; D22; M51
Keywords: public procurement; auction; firms; jobs; employment

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1 Introduction

The World Bank estimates that public purchase of goods, services and works (i.e. public procurement contracts, PPC) amount to 12% of the world's gross domestic product (GDP).[1] Macro-research shows that government purchase creates fiscal multipliers and thus fosters economic activity (for a review see Ramey, 2011), and additional evidence shows it can also spur innovation (i.e. key components of iPhone, Mazzucato, 2011) and contribute to achieving social outcomes (i.e. via green procurement, Testa et al., 2016). However, little micro evidence has been collected on how firms behave when faced with a public demand shock.[2] From production function logic, in the short-run, firms behave primarily by adjusting labour inputs. We contribute to the scarce literature estimating the effects of PPC on firms' job creation using exogeneity created by competition in auctions. To our knowledge, this study is the first to *i*) investigate the validity of the auction identification strategy with respect to the political networks and information leakage channel, *ii*) estimate the dose response functions of PPC sizes, and *iii*) estimate the heterogeneity of PPC effects with respect to firms' outsourcing decisions.

From a standard three-sector circular flow model, the firms produce products demanded by households and other firms (i.e. private demand) and by public institutions (i.e. government, regional, local institutions and state owned enterprises, i.e. public demand). Moral hazard issues can occur between profit maximizing firms, and politicians who might not only represent the public interest but also their own (among others see Andreyanov et al., 2017; Lehne et al., 2018; Bosio et al., 2020; Baltrunaite, 2020; Vuković, 2020). To alleviate these moral hazard issues, governments around the world usually have some kind of transparent and competitive procedure, like auctions, to decide which firms will win the PPC. However, even though these procedures exist, their outcomes are rather heterogeneous. A recent macro–level study on a sample of 187 countries found a positive association between perceived country–level corruption and unfavourable procurement processes and outcomes (Bosio et al., 2020). Along this line, at the micro–level, Vuković (2020) suggests PPCs as a tool to buy votes and build a crony winning coalition, Lehne et al. (2018) show politicians can adjust resource allocation in favour of their family members at a great cost to the society, while Andreyanov et al. (2017) and Baltrunaite (2020) suggest resource allocation

[1] Link: https://blogs.worldbank.org/developmenttalk/how-large-public-procurement [Accessed 15th February 2021.]

[2] We use the words '*firms*' and '*suppliers*' interchangeably. As we will discuss later, there are several micro-level studies on PPCs and firms (Ferraz et al., 2015; Fadic, 2019; Gugler et al., 2020) but they are rare compared to macro-level research (for a review see Ramey, 2011).

can work via an information leakage channel between the contracting authority and profit maximizing firms. These political economy studies suggest that selection into PPCs is not random, and it depends not only on which private firms best serve the public interest, but also the self-interest of politicians.

Given a steady market revenue, receiving an additional PPC represents an increase in public revenue and therefore firms' total revenue. Standard short-run product function logic suggests an increase in firms' output leads to an increase in labour inputs (Hart, 2017).[3] Theory has recently started to accumulate empirical support for a positive effect of PPC on employment (Ferraz et al., 2015; Gugler et al., 2020).[4] It is also possible the effect of PPC on firms' labour inputs is larger than the potential effect of similar contracts in the private market as several authors suggest PPCs can be more profitable and less risky (Duggan et al., 2016; Fadic, 2019).

However, co-movement of output and labour is not always observed in the data (Hamermesh, 1989). Co-movement between negative output change and labour adjustment was not found by Hamermesh (1989), while Gugler et al. (2020) does not find co-movement of positive output change and labour adjustment during recession. The main theoretical reason for no co-movement of output and labour is found in labour hoarding (Bertola and Caballero, 1994). Specifically, on the one hand, even when a profit maximizing firm does not acquire a PPC, it might be tempted not to immediately fire their workers due to the hiring and training costs of future hires assuming demand will increase; on the other hand, the new PPC might not be large enough for winners to increase employment, for example because a winning firm has economic slack and then utilizes these unexploited labour inputs in producing newly demanded output, or reallocates workers from recently finished projects to the new PPC (Fadic, 2019).

This study merges eight census datasets to provide several novel findings. The first contribution relates to the auction-based identification strategy. Identifying the impact of PPC on firm employment is difficult because of several endogeneity issues, all stemming from the fact that PPCs are not given at random. To solve endogeneity issues, recent micro-

[3]In other words, we are theoretically embedded in the firms' short-run production theory, where capital is fixed and labour is a variable factor. We are also embedded in the market for inputs and the theory on firms' short-run labour demand. A firm's decision on hiring is based, on the one hand, on the marginal cost of labour (MC_L), and on the other, on the marginal revenue product of labour (MRP_L) which is a product of the marginal product of labour (MP_L) and firms' marginal revenue of the final product (MR_A).

[4]There are also interesting studies quantifying the connection between receiving i) a standard PPCs or newer 'PPCs for innovation' with ii) firm growth and innovation, but these studies do not have a source of exogenous variation nor discuss public costs per job created (e.g. Stojčić et al., 2020).

level studies suggest an auction-based identification strategy (i.e. Ferraz et al., 2015; Gugler et al., 2020). Ferraz et al. (2015) uses instrumental variables approach exploiting the share of close auctions won, while Gugler et al. (2020) uses regression discontinuity design in close auctions and compares the employment growth of auction winners with those of runners-up in the weeks after the auction results. Similar to the previous two studies, this study exploits exogenous variation in a sealed bid auction win margin, and critically, combines it with employer-employee daily hiring and firing data to estimate the effect on jobs in the weeks and months after winning the PPC. Unlike the previous two studies which do not address political economy issues, the present study examines the allocation of PPC with respect to unique political and business network data. Names and surnames of all firms' owners, chief executive officers (CEOs) and supervisory board members are collected, but also the register of firm donations to political parties, as well as names and surnames of about 30,000 politicians at the national, regional and local levels. Multiple first– and second–order political connection proxies are developed to show several interesting findings, from which the most important is that winners and runners-up in close auctions are, on average, similarly politically connected.

The second contribution is the new findings on the causal effects of PPC on firms' employment. This study shows a positive impact on firms' short-run employment in the 10 weeks after being awarded a PPC. This finding is in line with the previous studies in the short-run (during expansion, Gugler et al., 2020; Ferraz et al., 2015), but our results show different magnitude. The initial estimate of cost per job is high at €71,400, considerably higher than the estimates in Austria (€15,351 in Gugler et al., 2020) and Brazil ($58,807 in Ferraz et al., 2015), but smaller than estimates with more aggregate data in the US ($125,000 in Wilson, 2012). Studies investigating the effects of public grants on firm employment find cheaper public cost per job than those reported in this study (among others Criscuolo et al., 2019; Dvouletỳ et al., 2021; Srhoj and Zilic, 2021). The anatomy of new hires shows the majority of new employees are lower-educated male workers already working in the construction sector in professions such as bricklayers, workers without occupations, carpenters and joiners. 40% of winners' new employees have their first employment in the country after the winner receives the PPC, but a non-negotiable share of these first hires are probably foreign workers.

Several new explanations are given for the small magnitude. Runners-up that lose a PPC in a close auction start working more in the private market, thus indicating a substitution of the public for the private market. Relatedly, suggestive evidence is found against the

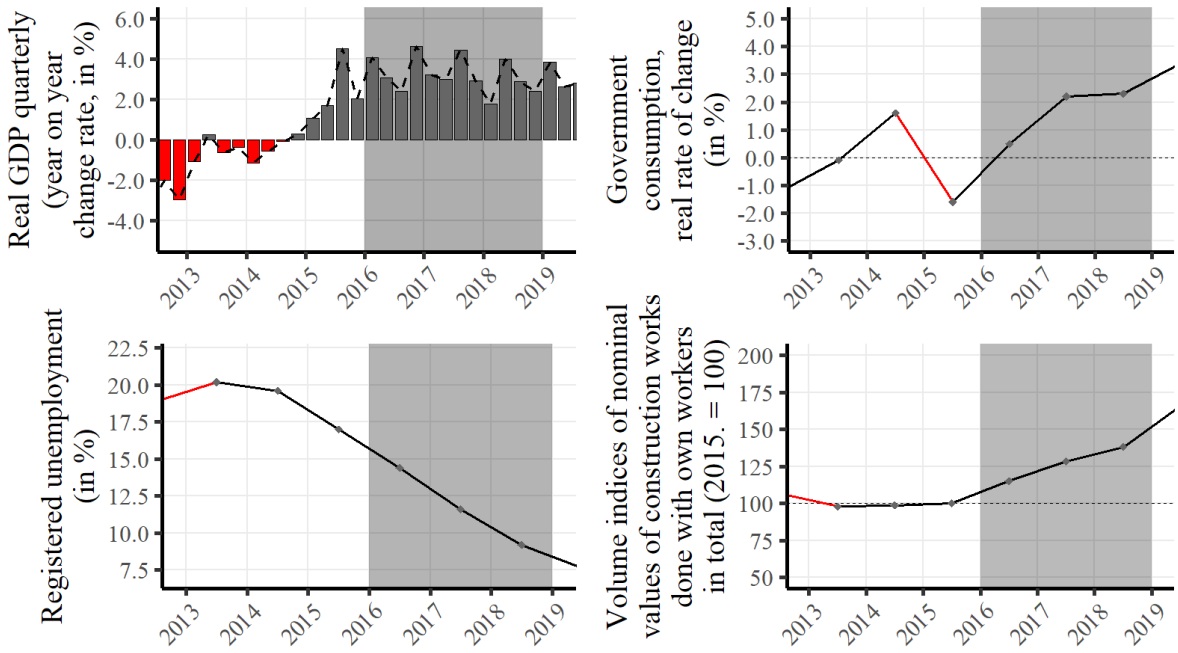
Matthew effect, which departs from previous studies (see Ferraz et al., 2015). The Matthew effect, also termed the Matthew effect of accumulated advantage, suggests that the rich get richer and the poor get poorer, which implies that those firms that win a PPC in a close auction get more and more PPCs. However, the study finds firms winning a PPC in a close auction receive fewer PPCs in the next year. For these two reasons, runners-up continue growing and catch-up to the winner in less than a year and the positive effect phases out in longer term. In the short-run, our study shows new results on dose response functions. No evidence is found for a positive impact of small PPCs (below €100,000), while PPCs above €100,000 show a positive impact with the largest absolute effect of very large PPCs (above €1,500,000). The public cost per job created increases with the PPC size, which is why dose response functions do not explain the initial small magnitude. Finally, our study shows new heterogeneity with respect to construction firms' outsourcing intensity and intensity of using external workers as labour inputs. The study shows the effects are concentrated in firms that conduct the majority of work in-house. Firms employ about 4 new employees per PPC on average, with the public cost per job directly created at €45,200 [€34,200 - €66,200].

The rest of the study is as follows. After the introduction, the second section provides details on the institutional setting, including details on Croatia, the public procurement market, the formal rules of auctions, and data. The third section explains our identification strategy. The fourth section provides the main results, and the fifth section provides results on mechanisms and heterogeneity. The final fifth section concludes.

2 Institutional Setting

The institutional setting is in the Republic of Croatia (hereinafter Croatia). The Great Recession of 2007–2009 spilled over to Croatia in 2009 which then experienced a long recession period (2009–2014). The recession resulted in a cumulative GDP drop of 12% and doubling of the unemployment rate (for policy responses see Srhoj et al., 2020; Srhoj and Zilic, 2021; Srhoj et al., 2021). The expansion period started in the fourth quarter of 2014, about a year after Croatia entered the European Union (July 2013). This study investigates PPCs in the period 2016–2018, which is interesting for several reasons. Figure 1 shows the real GDP quarter–to–quarter change rate in percentages, showing that after the initial full year of recovery (2015), 2016–2018 experienced a stable 4% quarterly GDP growth. This was followed with a sharp decrease in registered unemployment from about 15% to less than 10%, as well as a sharp increase in government consumption.

Figure 1: Macroeconomic indicators in Croatia 2013–2019



Source: Croatian National Bank, Macroeconomic Developments and Outlook No. 9 (p. 4); Croatian Statistics Office, Construction - Orders and Completed Works (sheet 3.1.3.).

The study's focus is on the construction sector, which represents about 4.4% of Croatia's GDP and 6.8% of employment (Buturac, 2019). According to the Institute of Economics Zagreb, the value of construction works was significantly increasing in the analysed periods:

4.1% from 2016 to 2017, and then 9.7% from 2017 to 2018 (Buturac, 2018, 2019) after a strong decline during the recession. Figure 1 also shows a sharp increase in the volume indices of nominal values of construction works from 2016 to 2019. These macroeconomic indicators show that private demand for construction work increased during our analysed period in the expansion.

Finally, Croatia is a country whose Corruption Perception Index is ranked 63rd out of 179 countries, according to the Transparency International. This 63rd position is shared with Cuba, São Tomé and Príncipe, and Belarus.[5] Thus, it does not come as a surprise that Croatia's economic system is sometimes described as crony capitalism, where firms do not thrive based on innovation and risk-taking, but based on political connections and corruption (among others see Vuković, 2020). For the reason above, Croatia is an ideal laboratory for testing the validity of an auction-based identification strategy with respect to the potential political economy confounders in identifying the impact of PPC on employment.

2.1 Institutional Details on Public Procurement

All PPCs with estimated value above 200,000 kuna (approx. €27,000) are awarded to suppliers based on competitive tendering via online auction administered by the Official Gazette.[6] The award process is as follows. The contracting authority publishes the tender via the Official Gazette's online registry of public procurement (i.e. EOJN).[7] Firms (suppliers) are informed of the tender via EOJN and decide whether to bid or not. Interested firms have to place their bid before the pre-specified deadline, after which firms are no longer allowed to place bids. Auction is sealed bid first offer, thus, bidders are not given information on each other's bid, and the PPC is awarded to the best offer. Upon the deadline, the bids are opened and the contracting authority awards the PPC to the supplier with the best offer (bid).

Best-offer (bid) criteria is pre-specified at the start of the auction with the supplier selection method. During the period of 2011-2016, the public procurement market was governed by the Public Procurement Law (NN 90/2011, 143/2013, 83/2013, 13/2014), while from second half of 2017, it was governed by the new Public Procurement Law (NN 120/16). The mandatory supplier selection method of the Public Procurement Law (NN 90/2011, 143/2013, 83/2013, 13/2014) was the lowest price (LP), and thus the private supplier wins if

[5] Link: https://www.transparency.org/en/cpi/2020 [Accessed: 2nd March 2021.]

[6] Table A3 (col. 5) shows such contracts represent more than 75% of all PPCs' value. Other columns of Table A3 provides descriptive statistics of PPCs in Croatia over the period of 2015-2018.

[7] Online registry of public procurement, EOJN, link: https://eojn.nn.hr/ [Accessed: 28th February 2021.]

it submits a valid LP bid.[8] The next Public Procurement Law (NN 120/16) introduced a new mandatory supplier selection method – the most economically advantageous tender (MEAT) which meant simple LP criteria was formally no longer used.[9] The MEAT tender implies that the contracting authority selects the supplier based on a score composed of points gathered on the basis of the price and other quality criteria at the procurer's discretion, such as time of delivery, warranty or quality. The Law (NN 120/16) introduced the 90% cap on the highest possible weight to be placed on price.[10] We later discuss this change in the supplier selection method, but provide evidence that while MEAT was introduced, the contracting authority mostly used 90% weight for the price which made MEAT very similar to the LP tender. Once a supplier wins a construction PPC, under the condition of fulfilling all PPC obligations, it is at the firms' disposal to decide how the contracted works will be carried out (i.e. in-house, outsourcing, or a mix).

The PPC tenders are supervised by the State Commission for Supervision of Public Procurement Procedures (DKOM).[11] Auction participants with a legal interest in winning the PPC and who believe they have suffered damage because of alleged violations of subjective rights (e.g. favourism, inside information) have a ten-day window to initiate a dispute before the DKOM by filing a complaint. When deciding on the disputed legal issue, the DKOM acts within the limits of the appellate allegations while it *ex officio* takes into account the procedural requirements and substantive violations listed in the Public Procurement Act. Decisions are announced publicly on the DKOM website. No appeal is allowed against the decision of the DKOM, but the decision can be challenged in an administrative dispute before the High Administrative Court of the Republic of Croatia.

2.2 Data

Datasets are collected from several institutions in the Republic of Croatia, and are described in subsections 2.2.1, 2.2.2, 2.2.3, and 2.2.4.

[8] Invalid bids are essentially bids that were turned down by the procurement authority, most frequently because the bidder did not fulfil the minimum criteria (in specifications, capabilities, guarantees or other aspects), overpriced the contract, faced other law binding circumstances, etc. If a bid is invalid, the procurement authority notes it in the document '*Bid evaluation minutes*'.

[9] The new Public Procurement Law (NN 120/16) started on January 1st 2017, but it was not until July 1st 2017 that the application of MEAT became mandatory. There were several exceptions to the rule of not applying exclusively LP, but they are not important for our analysis.

[10] As shown in Table A3 col. 8, in years 2015 and 2016 more than 97% of contracts were based on LP.

[11] Official Gazette, International Treaties, No. 14/01.

2.2.1 Auction data

The data on PPC and data on auctions is obtained from the Official Gazette of the Republic of Croatia (2020) and its online registry of public procurement (i.e. EOJN).[12] The PPC data encompass more than 170,000 contracts awarding about 324 billion kuna (€43 billion) with information on contracting authority names and IDs (OIB), their municipal and county IDs, type of PPC, description of the contract, the estimated PPC value, the contracted value of the PPC, the common procurement vocabulary codes (CPV), the number of bidders per PPC, the name and ID (OIB) of the firm winning the PPC, the municipal and county IDs of the firm, and the dates of auction deadlines and auction results. Public procurement data is enhanced with auction data[13] spanning years 2016–2018, and containing information at the public procurement bid-level: name and ID (OIB) of firms losing in auctions along with their financial offers.[14] The focus of the study is on construction-related PPCs, defined as those in which CPV starts with numbers 45, encompassing 800 contracting authorities and 4,239 PPCs in the value of €2,984 million.

2.2.2 Employment data

Daily employment data stems from the Croatian Pension Insurance Institute (HZMO) for the period January 2014 until July 2019 and includes about 6 million observations (employment spells). On the one hand, HZMO tracks any individual employment process in the Republic of Croatia, and thus, when a person is hired and signs a work contract, they become obligatorily insured in HZMO. On the other hand, when their work contract expires or is terminated, their insurance ceases. For both events, dates are documented. HZMO is at the firm-employee level, and firm ID is not anonymised, we can construct variables on employee hires and terminations, their education, age, tenure, sex, and type of current work contract at the firm-day level. In other words, all employment movement within firms and public institutions based in Croatia can be tracked through the HZMO database. Using the work

[12]Link: https://eojn.nn.hr/ [Accessed 28th February 2021]. Auction data is web scraped from the EOJN website and provide the database to other scientists and students with the goal of igniting research in public finance. The data can be accessed via the following website: https://sites.google.com/view/ppc-croatia. We provide an evaluation of data quality with comparison to the Official Annual Statistical Report on Public Procurement 2008–2018.

[13]A thank you goes to the research assistants for typing in the auction data, for numerous random checks of data accuracy and communication with public institutions that did not attach auction-related data at EOJN.

[14]Auction data contains information on the weights used in the MEAT decision criteria (i.e. relative importance of price, quality, or cost) and total MEAT score of each bidder in the auction.

contract dates, together with the auction dates (subsection 2.2.1), it is possible to track employment growth as detailed as in the days before and after auction results.

2.2.3 Financial data

Firms' financial data stems from the Annual Financial Statements Registry (FINA) and encompass profit and loss statements, balance sheets and firm demographic information for all limited liability and joint-stock firms in Croatia for the period of 2015–2019. The FINA dataset is merged with the public procurement auctions data in construction (subsection 2.2.1) based on the year and firm ID. This way it is possible to know each auction participant's financial and firm demographic information (e.g. financial ratios, firm age, municipality or county of firm headquarters) in each year 2015–2019.

Definitions of variables constructed from the public procurement auction, employment, and firm finance data are provided in Table A1.

2.2.4 Political connections data

Previous data are enriched with several datasets capturing the political economy aspect of public procurement.

(1) Court Register for the period of 2005-2019, provides names and surnames of owners, chief executive officers (CEOs), and supervisory board members for each construction firm participating in the public procurement auctions.

(2) State Electoral Commission (DIP) provides information on names and surnames of local, regional and national politicians, their political party and place of elections (i.e. municipal/city, or county-level) covering four local and regional elections during 2005–2017 as well as parliament members over the five elections in the period 2003–2016.[15] This provides us with 22,083 unique politician full names from which we construct 17,434 unique last name ID's at local (city major, deputies, city/municipality hall members), and 1,272 at regional levels (prefect, deputies, county hall members). In addition, 496 unique politicians at the national level (parliament members) are included. The Court Register dataset is merged with politician name lists of DIP in several ways (for details and definitions see Table A2) to obtain proxies, of political connections which are used for the purpose of validating the close auctions research design.

[15]Data from the State Electoral Commission is web scraped: https://www.izbori.hr/arhiva-izbora/index.html#/app/home [Accessed: 12th March 2021.].

(3) GONG provides information on names and surnames of politicians as well as their political party in Croatia. A total of 6,103 unique politicians is in the GONG database. Importantly, our DIP data contain a larger number of politicians than GONG, but there are 3,378 high ranked politicians that are in GONG but not in DIP nor in parliament.[16] These politicians' full names are matched exactly with the full names of firm owners, CEOs and supervisory board members from the Court Register.

(4) Eurostat provides information on the geographical latitude and longitude of each municipality in Croatia. Geographical distances from Eurostat are merged with FINA and public procurement data, and then the standard Haversine formula is used to calculate distances between the contracting authority and the construction firm in kilometres. Distance between the two could capture not only transportation costs, but also information sharing.[17]

(5) Central State Office for Development of Digital Society provides data on 3,957 donations by firms and individuals to political parties preceding the parliamentary elections of 2015 and 2016.[18]

(6) State Commission for the Control of Public Procurement Procedures (DKOM) provides information on 16,089 official complaints on auctions over the period of 2008–2018. DKOM provides information on each firms' complaint to each auction, as well as the timing and the CPV of each official complaint, regardless of the final court ruling.[19] Intuitively, if the main results are not driven by political economy issues, they should be robust to excluding the types of construction works and regions with the most complaints.

Definitions of political connection variables (proxies) are provided in Table A2. In addition, a graphical illustration of the local–level political connections dummy is provided (in Figure 3).

[16] These include individuals such as Ministers or Secretary of State who were not on the party's list at local, regional or national elections, but are members of a party. With DIP and GONG the study includes a total of 50,718 observations, but since politicians are present at multiple elections, the data includes 25,595 unique politicians.

[17] There are 556 municipalities in a population of 4 million in Croatia. The municipality of the firms' headquarters and the municipality of contracting authority are used. Eurostat: https://ec.europa.eu/eurostat/web/gisco/geodata/reference-data/administrative-units-statistical-units/communes#communes13 [Accessed: 20th January 2021]

[18] This data is web scraped from the following link: https://sredisnjikatalogrh.gov.hr/Politicke-stranke-i-izbori [Accessed: 12th March 2021.]

[19] This data is web scraped from the DKOM official website: https://dkom.hr/ [Accessed: 12th March 2021.]

3 Identification Strategy

The goal of the study is to identify the effect of PPC (treatment) on construction firms employment growth (outcome). Several issues underpin the attempt to identify this causal estimate. Selection into PPC is not random, and therefore winners of PPCs could have an unobservable intent to work on additional projects, have proper resources, specific expertise and capabilities to get the work done. The identification strategy applied in this study is the so-called '*winner–runner-up*' identification strategy (applied also in the fields of industrial organization, urban economics or finance by Greenstone et al., 2010; Kawai, 2011; Malmendier et al., 2018; Kawai et al., 2019). Such an identification strategy was applied for estimating the effect of PPC on employment by Gugler et al. (2020).[20] The assumption behind the identification strategy is that auction participants bid competitively. A theoretical framework by Gugler et al. (2015) describes the optimal bidding strategy of an auction participant; it assumes bidder j knows its private cost for PPC project c and provides a bid at an auction. Bidder j knows who other competitors are, but does not know their bids. PPC is awarded to the bidder with LP with the condition of not being below reservation price. The winner of the PPC earns a profit equal to the difference between the bid and the PPC project cost c, other competitors earn zero profits. Thus, optimal bidders' strategy is a function of PPC project cost, number of competitors and their identity such that, competitors bid the true value of the auctioned works minus the shading factor for the estimated bid of other bidders under the condition of the bid being higher than the PPC project costs (see also Maskin and Riley, 2000, 2003). In an ideal bidder scenario, the winner would offer a bid higher than the costs of undertaking the PPC, but that is just below the bid of the runner-up to maximize its PPC project profits.

If auction participants bid competitively, there could still be selection into winning a PPC because more productive firms can place better bids (i.e. Ferraz et al., 2015; Smith, 2017; Gugler et al., 2020). Alternatively, selection might be explained with superb information driven by political connections and favouritism (Bosio et al., 2020; Baltrunaite, 2020), which could then ambiguously confound the PPC effect downward if such connections can impose high mark-ups for construction works or to low productive firms with substantial organizational slack. Conversely, it could confound the PPC effect upward if the political connections open up more opportunities than just the PPC, e.g. unlawful conversion of agricultural to construction land, acquiring permits and securing favourable regulations. To

[20] Another similar example of the identification strategy is Ferraz et al. (2015).

solve this, this study focuses only on the subsample of winners and runners-up in a particular auction, thereby discarding 3rd, 4th, etc. placed. In addition, the study uses only the winners and runners-up in close auctions defined as those with a bid difference below 10%, but it also estimates effects within close auctions defined as those below 8%, 6%, 4%, and auctions between 0.5% and 4%.[21]

Each auction features a date of auction competition results, which is used to define the pre-PPC and post-PPC period. The sample of winners and runners-up is used to construct firms' employment panel data in order to estimate a *difference-in-differences* model. The main dependent variable is the employment growth rate, calculated firstly as: $\frac{(Employment_{i,t} - Employment_{i,base})}{Employment_{i,base}}$, where $Employment_{i,base}$ is the number of employees 84 days before auction i results, and then $Employment_{i,t}$ is employment in each day t from -84 to +84. Thus, daily growth rate in employment is firstly calculated to obtain 338 observations for each auction, 85 for the winner and 85 for the runner-up, but to simplify the model, the mean employment growth for each fortnight[22] is calculated in the second step. This yields 12 fortnights per firm-auction observation, where the base is the 6th fortnight preceding the auction results, zero (0) fortnight is the first 2-weeks after the auction, and the 5th fortnight is the mean employment growth between weeks 11 and 12 (compared to the base at 6th fortnight prior to the auction results). The following equation is estimated:

$$Y_{ijt} = \alpha + \beta T_{ij} + \sum_{t=-5}^{+5} \gamma_t t_{ijt} + \sum_{t=-5}^{+5} \delta_{LATEt}(T_{ij} * t_{ijt}) + X_j^K \zeta_j + \epsilon_{ijt} \tag{1}$$

where Y_{ijt} is the outcome variable (employment growth) for a firm i at an auction j over the period t (i.e. from t-6 to t+5). T_{ij} is a dummy of one if the firm i won a PPC at the auction j, and zero if it is a runner-up. The t_{ijt} is a set of time dummies from -6 to 5, each representing a fortnight (a 14-day block) for a firm i calculated from the date of auction j. The X_j^K is a vector of control variables in the pre-PPC results period, including firm size, and firm–fixed effects, while ϵ_{ijt} is a random, normally-distributed unobserved error term capturing factors that the model omits. The term δ is the *difference-in-differences* estimator,

[21] Win margin in the window between 0.5% and 4% is used to exclude those placing a bid just below the runner-up (below 0.5%) in order to estimate whether results are driven by these auctions. In the study context, this is to show weather potential information leakage drives the results. If there is information leakage, intuitively, a bid participant with confidential information would place their bid just below the winning bid in order to maximize its project's profit. Thus, an estimate with such potentially '*favoured*' firms could be biased.

[22] This approach is from Gugler et al. (2020) in which fortnight is defined as *a period of 2 weeks* (also defined by the Cambridge Dictionary).

the average treatment effect on the treated (ATET) of winning a PPC in the full sample of winners and runners-up, while it is the local average treatment effect (LATE) for the subsample of close auctions. Standard errors are clustered at the firm level.

4 Results

4.1 Public Procurement Auctions

The identification strategy focuses on competitive auctions with multiple bidders, but not all auctions have multiple bidders. Awarding PPCs via auctions with only a single bidder makes obtaining a valid counterfactual behaviour for the analysis notoriously difficult. In general, submitting a bid on an auction signals a firm is interested in undertaking the additional work and is therefore growth oriented.

A reflection on PPCs awarded via single bidder auctions is provided in this subsection. Single bidding is considered as a practice which should be avoided by the European Commission (Fazekas, 2019), and some (notably Vuković, 2020) have suggested single bidding auctions could represent the purchase of votes, insider information, corruption and favourism.[23] However, single bidding practice was not uncommon in the Republic of Croatia over the period of 2016–2018 when about 23.2%[24] of PPCs in construction were awarded based on single bidding auctions, while 76.8% are awarded based on auctions with two and more bidders. In value terms, total single bidder auctions were contracted at €938 million, and multiple bid auctions at €2,792 million (descriptives in Tables A4, A5 and A6). This study uses all auctions to show two descriptive analyses:

(1) The relative cost savings from auction competition;

(2) The value of single bidder auctions marked with political connection variables.

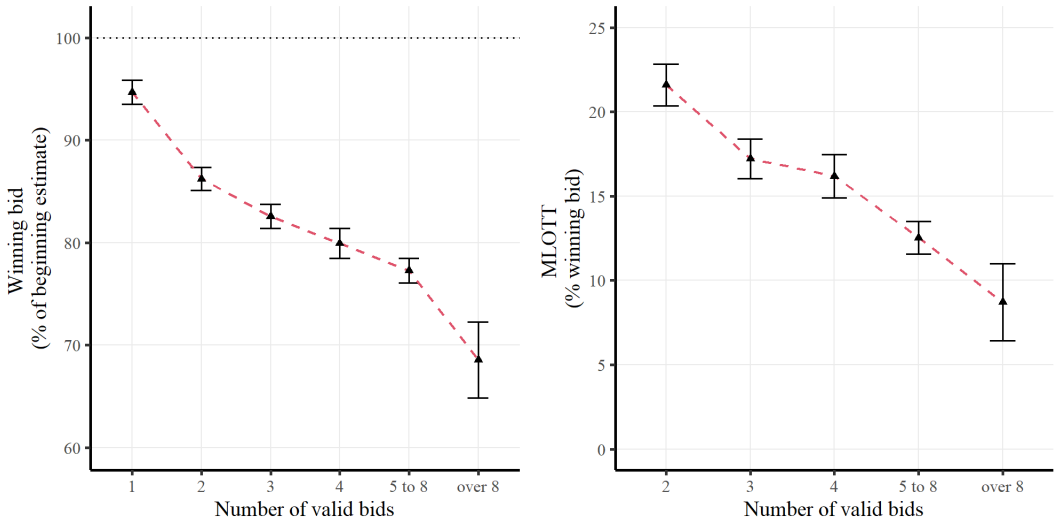
Firstly, the benefits of auction competition for the contracting authority are shown. In particular, Figure 2 left panel depicts the ratio between the contracted price and the

[23] Although considered bad practice, there can be a mix of justifiable reasons for having single bidding auctions. In particular, procured works could be highly specialised and need specialised knowledge and equipment that only some firms are able to provide, while at the same time there could be low supply and low interest for procured works, for reasons such as firms already working at their full working capacity, long geographical distance between firm and the construction site, excessively low estimated value of works, or other reasons.

[24] See Public Procurement Single Market Scoreboard, link: https://ec.europa.eu/internal_market/scoreboard/performance_per_policy_area/public_procurement/index_en.htm [Accessed 12th March 2021.]. This considers auctions with one bid after the exclusion of invalid bids, in the entire dataset we observe 15.33% of true single bid auctions, ones with no exclusions.

estimated PPC value across the number of bidders that applied for the construction works. Table A9 provides descriptive regression results, suggesting that in single bidder auctions, the contracting authority pays for the contract, on average, 5.3% less than it estimates, while in cases in which there are eight bidders and more, the contracting authority pay on average 31.4% less than it estimates.[25] Figure 2 right panel focuses only on auctions with multiple bidders. *Money left on the table* (MLOTT, as in Gugler et al., 2020) is calculated, defined as the difference between the value of the runners-up bid (e.g. second-best option) and the value of the winning bid divided by the winning bid. Similar to the left panel, it shows that the average difference between the two best bids becomes smaller and smaller with the increase in the number of bids, providing suggestive evidence confirming the theoretical model of Gugler et al. (2015), which suggests the bid is a function of the number of competitors, *inter alia* (Subsection 3). Thus, competition in auctions matters for the relative cost of construction works.

Figure 2: The relative costs of procured work by number of bidders



Notes: the left graph displays the winning bid as % of the the auctions estimated value. The data includes auctions awarded via both LP and MEAT criteria. Points represent the means, and the error-bars show the lower and upper bounds of the confidence intervals (both on 95%). The right graph shows MLOTT as % of the auctions winning bid. Note that we look at only valid bids, meaning we do not observe excluded bids. Both graphs exclude the top and bottom 1% of observations, so as to account for outliers.

[25] Other factors might explain this ratio difference in auctions between single vs multiple bidders, including local economic conditions, high level of specialized knowledge, systematic errors in public authority estimation of the PPC value (denominator), or uniqueness of procured works. However, the descriptive regressions do not provide support for this reasoning. Regressing the ratio between the winning bid and beginning estimate on the number of bidders, four digit CPV code, county of the procurer, year of auction, and whether the auction was during the season show similar cost savings as those in Figure 2 and Table A9 and are available upon request.

Secondly, single and multiple bidder auctions are used to show how much PPC value goes to politically connected firms marked by the political connection variables (Subsection 2.2.4 and Table A2). The study differentiates between single bidder and multiple bidder auctions, and marks winning firms based on:

(1) Owners, CEOs or supervisory board members who are politically connected individuals.[26]

(2) Donations to the political parties in power, and

(3) Single bid contract which is more than 70% of the prior year's total revenue or if the firm has no employees.

The first marker identifies direct or indirect family ties of politicians with the firm owners. The general logic of how this marker is constructed at the local level is shown in Figure 3 while definitions are given in Table A2. The second marker provides a revealed preference perspective of firms' strategic networking choice or political stance. The third and final marker is described as *suspicious procurement* in the literature (as developed by Vuković, 2020).[27]

From the €490 million in single bid auctions in construction, our study shows 82.9% of PPC value goes to either donators, politically connected firms or suspicious firms (Table A4).[28] The same exercise is conducted on the sample of €2,792 million awarded in multiple bid construction auctions and shows 47% of value goes to either donators, politically connected firms or suspicious firms (Table A6). In multiple bid auctions, 37.4% (vs 61.1% in single bid) is marked to go to politically connected firms, 13.9% (vs 14.6% in single bid) goes to firms donating to political parties, and 8.4% (vs 35.6% in single bid) goes to suspicious firms.

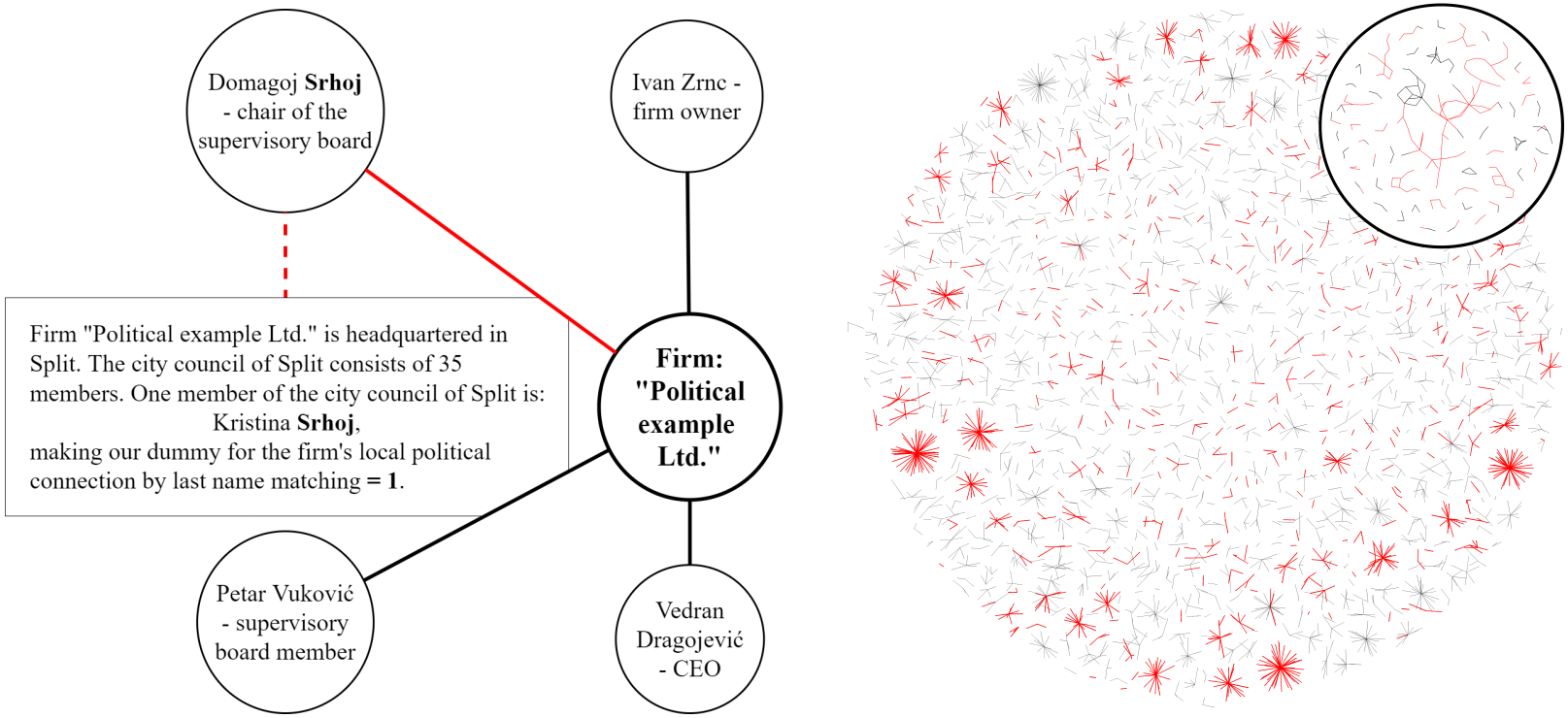
In sum, the study shows competition does both lead to lower relative costs of construction works and to a reduction in the construction works share of value allocated to politically connected firms.

[26] It is elaborated how politically connected individuals are marked in the Table A2.

[27] It should be clearly stated that none of these indicators is evidence of corruption, but an indicator of *suspicious practice*. It should be noted that politically connected firms might be overstated in some cases, for example, in some municipalities or cities, there could be a mayor or council member with the same surname as owners, CEOs or supervisory board members in a local construction firm, but they actually do not have family connections. To solve this, a correction for the 10 most frequent surnames in each municipality and region is conducted (as per Croatian Statistics Office: https://www.dzs.hr/hrv/censuses/census2011/results/htm/h01_01_31/H01_01_31.html [Accessed: 17th August 2021.]).

[28] 68% of value is marked to go to politically connected firms, 14.6% to firms donating to political parties, and 35.9% to suspicious winners (Table A4). The sum of these percentages goes above 100% because the firm could at the same time be a donator, a politically connected firm and a suspicious firm.

Figure 3: Political connections: an overview



Notes: the right graph displays the network of politically connected firms (node) and individuals (edge) in the 2018 construction firms in public procurement data. The left graphic shows how single node relations are formed to develop the full network. The red part of the network represents political connected firms with local connections based on the last name and municipality/city matching (see Table A2). The inner circle shows firms which have common members.
Disclaimer: all names given in the descriptive graphic are entirely fictional.

4.2 Winners versus Runners-up: Balancing Property

In the previous section, it was shown that the competitive auctions matter for the relative costs and decreasing political influence. This section questions whether auction results can be considered a source of exogenous variation. Differences in the bids of auction participants can be an indicator of differences in firms' production possibilities, a result of political influence or collusive behaviour. To shed light on this question, this section provides a balancing property, comparing winners, runners-up and other auction participants on a long set of covariates.

Table A11 compares the means of all winners to all auction losers (9th column), to auction participants with 3rd, 4th and 5th bid (7th column) and to runners-up (5th column). Several insights occur. Compared to all auction losers (9th column), winners are more frequently connected to a regional political party in power ($p<0.001$) and to national politicians ($p<0.01$). Winners are geographically closer to the contracting authority ($p<0.01$), have received more PPCs in the three years prior ($p<0.05$), and are more frequently a state owned enterprise (SOE; 6% vs 4%, $p< 0.001$). Relatedly, winners are slightly less productive ($p< 0.05$), have better financial indicators (EBITDA or profits over assets, $p< 0.01$), outsource less work, use less external labour (both at $p< 0.001$), and have more workers employed on a permanent work contract ($p< 0.001$). Differences decrease when the focus shifts only to winners and runners-up (5th column), but winners are still geographically significantly closer to the public authority ($p< 0.001$) and are more frequently a SOE (6% vs 5%, $p< 0.05$).

Table A12 focuses on the subsample of close auctions (win margin within 10%) and compares the means of all winners to all auction losers (9th column), to auction participants with 3rd, 4th and 5th bid (7th column) and to runners-up (5th column). An improvement in balancing property is shown when the focus shifts only to winners and runners-up (5th column vs 7th and 9th column). In particular, Table A12 shows no statistically significant difference in any of the analysed covariates between the group of winners and runners-up (5th column).

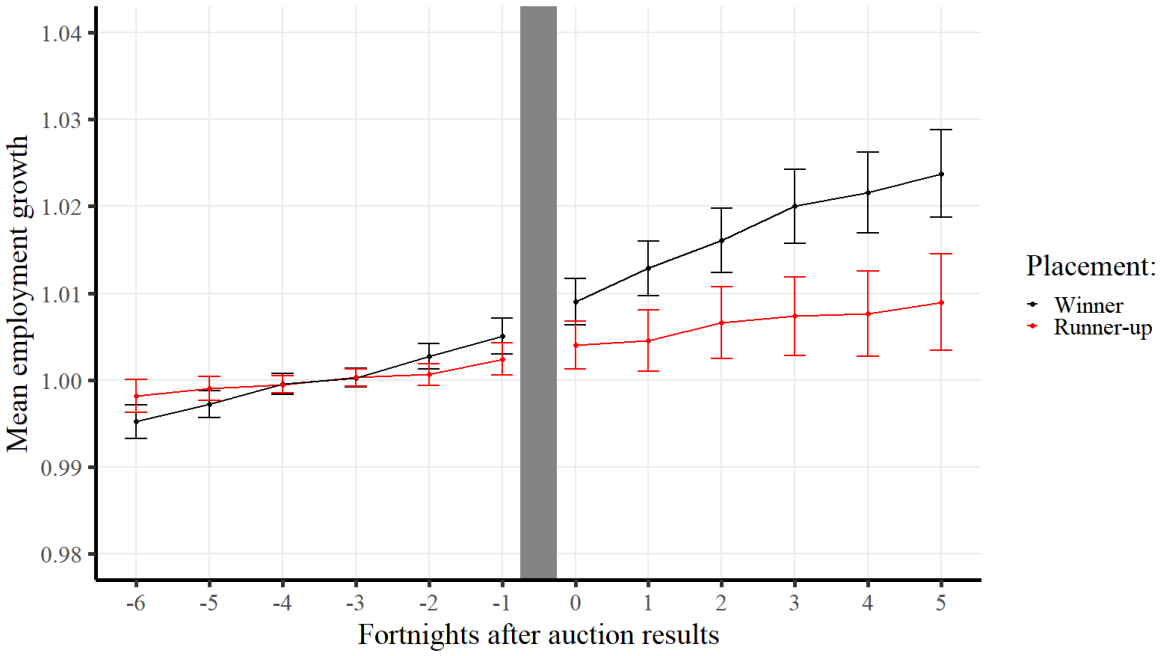
Achieving balancing property does not mean winners are not politically connected, but are, on average, similarly politically connected as runners-up. About 24% of winning firms are connected to regional/county politicians in power (compared to 22% of runners-up), and 26% to local politicians in power (compared to 25% of runners-up). Winners and runners-up groups are, on average, donators to the political party in similar share (16% vs 15%) and are similarly connected to national politicians (19% vs 16%). Winners and runners-up groups are also, on average, similar in size (124 vs. 128 employees), have, on average, about 20

employees with tertiary education, where the average employee tenure is 3.5 years, and the average persons age at the day of employment is 35 years. Both groups have a debt ratio of about 55% and about 31% of total expenses goes to outsourcing, while external workers are about 33% of total labour costs (for details see Table A12, 3rd, 4th and 5th column).

4.3 The Impact of PPC on Firms' Employment

Upon evaluating the balancing property, a visual inspection of the employment growth trends of winners and runners-up is shown in Figure 4. Winning firms increase their employment after receiving a PPC. Table A32 provides descriptive characteristics of the winners' 11,285 new (unique) employees in the fifth fortnight. A lion share of new employees are lower educated (89%). The five most common professions among new employees are masons (9%), carpenters and joiners (7%), workers without occupations (7%), civil engineering workers (6%) and operators of construction and similar machines (6%) (Table A34). Of the 11,285 new employees, 46% worked for the winner firm as their last employment episode, 14% worked for a different firm in their last employment episode, while a substantial 40% are registered to HZMO for the first time. From the 14% of employees that worked for another firm, Table A33 shows the majority come from the construction sector (73%), manufacturing (9%), wholesale and retail trade (7%), and all other sectors (11%). The 40% registered at HZMO for the first time can happen for two reasons: *i*) domestic individuals' first employment, or *ii*) foreign individuals' first employment in Croatia, which does not mean they had not worked before in their country of origin. The dataset does not enable us to identify foreign nationals, but since this group of employees with first registered employment has 34.4 years on average, there is probably a substantial share of employees who are not first time domestic hires, but more probably foreign nationals employed for construction projects. Runners-up also experience employment growth, but at a lower rate compared to winners. The general upward moving trend in employment among the two groups is probably due to the expansion period characterized by a significant decrease in unemployed, and a sharp increase in construction demand and government consumption (see also Figure 1).

Figure 4: Mean employment growth rate before and after receiving a PPC (within 10% close auctions)



Notes: the day-by-day data on firms' number of employees is shown relative to the average number of employees during the 6th fortnights prior to the auction results. That gives us the employment growth rate for each firm. We then aggregate (average) the day-by-day growth rate to fortnights (14 day periods). Confidence intervals are given at 90%.

The visual trends in Figure 4 are quantified with equation (1) and show a positive impact of PPC on firms' employment (Table A13). The full sample of winners and runners-up shows a positive effect of 1.8 employees [+/- 0.6] at the fifth fortnight (70-84 days post PPC; Table A13, 1st column), while the main regression estimates (Table A13, 2nd column) show a somewhat higher positive effect of 2.5 employees [+/- 0.6] at the fifth fortnight. The difference between the full sample and close auctions could be in lower transportation costs and potentially better information, as well as more state owned firms benefiting from the contracts (i.e. Table A11). Winning firms in the full sample might have more organizational slack and therefore less need to hire new employees, while runners-up might be growing more from the private market upon losing the contract. Importantly, the results for the close auction sample are very similar regardless of whether close auctions are defined by the win margin within 8%, 6%, 4% or 0.5% to 4% (3rd, 4th, 5th and 6th column, Table A13).[29]

[29]There is a total of 2,859 auctions (10,232 bids). The close auction 10% win margin has 1,436 auctions (5,591 bids), 8% win margin has 1,250 auctions (4,897 bids), 6% win margin has 994 auctions (3,927 bids), 4% win margin has 737 auctions (2,932 bids), and 0.5% to 4% win margin has 610 auctions (2,470 bids).

The effect starts to be weakly significant already in the first 14 days after the auction results (fortnight 0), and becomes strongly significant from the first fortnight onwards, while the point estimate is highest and highly significant ($p<0.01$) in the fifth fortnight (70-84 days) after the winning notice in all models (columns 1 to 6, Table A13).

In the subsection *Mechanisms and Heterogeneity* 5., the magnitude of estimates and public cost per job directly created is discussed. The next section analyses the robustness of the main model.

4.4 Robustness

The main model is based on several assumptions regarding competitive auctions, supplier selection method and the intention of runners-up to work on more projects. In this subsection, several robustness analyses are conducted to test the stability of the main model estimates.

4.4.1 Auction complaints

If auction participants suspect there might be favourism in connection with the technical documentation of procured work, they can submit a complaint to DKOM. Table A15 shows frequent complaints by the procurements' first 4-digit CPV code and the top 10 contracting authorities that received the most complaints. With regard to the complaints by the procurements' CPV, the code starting with 4523 (which represents procurements related to the construction of highways and roads) received 32% of all construction complaints.[30] For robustness check, two regressions are run. Firstly, regression without auctions of works for 4-digit CPVs with the most frequent complaints show a statistically significant and positive impact of the PPC on firms' employment with a somewhat higher magnitude of 4 employees [+/- 1.1]. Secondly, regression without firms located in City of Zagreb shows the result remains significant and in similar magnitude to the main model estimate (Table A14, column 2 and 3).

4.4.2 Donations to political parties

Donations to political parties have been identified as important in acquiring PPCs (Baltrunaite, 2020). This study examines donations to political parties preceding the parliamentary elections in 2015 and 2016. These donators to the political parties placed 1,507 of

[30]The highest number of complaints are registered for the City of Zagreb (4%), Hrvatske ceste d.o.o. (3%) and other SOE with headquarters in Zagreb (see Figure A2 and Table A15).

10,232 bids (Descriptives in Table A16). A model without firms donating to the political parties is run, and importantly, shows that the main model estimates do not change (Table A14, column 6).

4.4.3 Politically connected firms

With the political connection proxy (for more details see Table A2) 373 politically connected firms are marked that place 1,346 winning bids in auctions. A model excluding all the politically connected firms is run and shows the main model estimates remain robust (Table A14, column 4). A potential limitation of the local and regional–level political connection proxies is its reliance on matching politicians to firms with owners, CEOs and/or supervisory board members holding the same surname within the geographical (municipal/regional) location. To check the robustness of this proxy, all the politically connected firms that have owners, CEOs or supervisory board members whose surnames are on the list of most frequent surnames in the respective municipality or region are recoded as not politically connected.[31] All the recoded politically connected firms are excluded and regression is run to show similar effects as in the main model (Table A14, column 5).

4.4.4 Lowest price and Most economically advantageous tender

The analysis encompasses years 2016-2018. From 1st January 2016 to 1st July 2017 the auctions were governed by the Public Procurement Law (NN 90/2011), while from 1st July 2017 onwards it has been governed by the new Public Procurement Law (NN 120/16). The new law (NN 120/16) introduced mandatory usage of the Most economically advantageous tender (MEAT), which in essence required the selection of suppliers to be not only based on the LP criteria, but in addition, the criteria related to suppliers' quality. To do so, the law capped the maximum share of points a supplier could possibly achieve based on price to 90%.

The descriptive analysis reported in Table A19 shows about 61% of auctions are awarded based on the LP and 39% based on the MEAT criteria. Auctions governed by the law (NN 90/2011) and those governed by the *new* law (NN 120/16) have a similar mean PPC size (€610,000 vs 570,000). After the new law, contracting authorities did combine price criteria with quality criteria, usually operationalized as *quality*, *costs*, and/or *time* of finalizing the construction work. However, two findings emerge. Firstly, time to complete construction is

[31] Based on Croatian Statistics Office: https://www.dzs.hr/hrv/censuses/census2011/results/htm/h01_01_31/H01_01_31.html [Accessed: 17th August 2021.]).

the most commonly used quality criteria.[32] Secondly, while the law introduced a mandatory shift to MEAT, 61% of auctions under the new law use the maximum 90% weight on price criteria, 28% of auctions use price criteria weight between 80-89%, 7% of auctions use price criteria weight between 70-79%, and only 4% with price criteria weight below 70%. Results shown in Table A20 show a positive impact of PPC on firms' employment regardless of whether LP or MEAT criteria is used.

4.4.5 Contamination of evaluation period and seasonality

Contamination of the evaluation period can be important, as winning firms might win multiple PPCs over the evaluation period, and could win more PPCs than the runners-up during the evaluation period (or vice versa). A regression controlling for the number of contracts won by the winner and by the runner-up during the evaluation periods is run, and the results do not change (Table A23). In addition, a model is run on the subsample of close auctions where the winner recieves only a single PPC during the evaluation period and runner-ups recieve no PPC. Table A23 shows that the results do not change.

Finally, the impact of PPC on firms' employment might be driven by seasonality: on the one hand, employment could increase systematically more in those months when the weather is warmer and less rainy, while on the other, employment could decline or stagnate in winter months when construction works are less intensive (Gugler et al., 2020). Seasonality could lead to correlations of seasonal employment change with treatment status. The sample is split to construct in-season and off-season subsamples; the first encompasses April - October, while the second includes November - March. Results in Table A23 (columns 2 and 3) show the effects are of similar magnitude in two different seasons. In addition, a regression with added dummy for the month of the auction results shows results similar to the main model estimates (Table A23).

5 Mechanisms and Heterogeneity

The main model (Section 4.3) estimates a positive impact of PPC on firms' employment in the magnitude of 2.5 employees [+/- 0.6]. On a sample of small firms in retail and manufacturing in Brazil, Ferraz et al. find the effect of 0.63 employees (about 2.2% employment growth, Ferraz et al., 2015), while on a sample of larger construction firms in Austria, Gugler et al. (2020) show growth of about 3% of the winners' workforce or about 80 employees. To better

[32] Which is a relatively easier indicator to obtain points for the majority of construction firms.

understand the magnitude, median PPC size is divided by the absolute effect size to obtain the initial public cost per job directly created at €71,400, which is considerably higher than the point estimates in similar studies in Austria (€15,351 in Gugler et al., 2020) and Brazil ($58,807 in Ferraz et al., 2015), but smaller than PPC estimates with more aggregate data in the US ($125,000 in Wilson, 2012). In a related field on the impact evaluations of public grants for firms, a recent review in the European Union shows public cost per job directly created to range from €189,000, €62,000, €26,000, €14,700 to €6000 (Dvouletỳ et al., 2021, p.256). In Croatia, for self-employment grants, Srhoj and Zilic (2021) estimate €38,800 public cost per job, and for small and medium-sized enterprise grants, Srhoj et al. (2020) estimate €14,525 public cost per job. Therefore, in this subsection, analyses are focused on the mechanisms and heterogeneity that can explain the initial high estimate of cost per job (€71,400).

5.1 Information leakage channel

Figure 4 shows some anticipation of winners, which is statistically insignificant, but worth investigating. Previous research (i.e. Andreyanov et al., 2017; Baltrunaite, 2020) suggests an information leakage channel by which contracting authorities provide confidential information to favourized firms winning the PPCs. If this was so, there could be selection of less productive politically connected firms into PPCs, and they could potentially be charging a higher price for construction work - leading to higher cost per job directly created.[33] Although it is challenging to confidently test information leakage theory, two exercises are conducted to shed some light on whether there is information leakage. Firstly, two experts were interviewed, one a prominent university law professor - an expert on PPC, and one information technology expert on PPC auctions. Both agree that information leakage in auction system is technically impossible without the consent of both sides, the contracting authority and the bidder. This is so because each bid is encrypted via the online auction system and two keys (contracting authority key and bidder key).[34] Thus, the only way to obtain information on a competitor's bid is to enter two keys in the system.[35]

[33]This is quite difficult to document in construction, since every project is, in a sense, unique (because there are no repeating locations).

[34]These safety protocols are certified by multiple certifying authorities, among which also European Union institutions.

[35]In other words, the bidder would have to want to provide such information to other auction participants. Another option could be that it is not the information leakage, but bid rigging, where runners-up place artificial bids slightly more expensive than the winner. Two interviewed experts were asked whether they are aware of such collusive behaviour, and both suggest this would be highly unusual bidding behaviour, as

However, since interviews can be biased, further analysis on the information leakage issue is done by collecting data on the timing of each bid. The difference in timing of the bids between winners and runners-up is visually shown (Figure A3 and A4), while Table A25 shows tests for difference in timing of the bids. A dummy of 1 is coded if the winner places the bid after the runner-up, and vice versa. Results indicate there is no systematic sorting of winners into placing bids after runners-up, which is the same regardless of the characteristics of the auction (i.e. larger contracts) or subgroup of firms (i.e. politically connected firms). The finding of no sorting is different from the analysis in Russia (i.e. Andreyanov et al., 2017). However, during their analysed period in Russia there was no encryption of bids in the auction system. In sum, no compelling evidence is found to explain the high cost per job with the information leakage channel (Table A12).

5.2 Dose response functions

The dose response functions are estimated within the close auction sample. To do so, the sample is split based on PPC size into four dosages (bins). Splits are driven by the sample size and types of usual work in each bin. The first dose is defined as PPCs up to €100,000 including works such as facade and stucco works, installation of carpentry, installation of floor and wall coverings, house painting and glazing works, and remediation works. The second dose includes PPCs from €100,000 to €500,000, such as reconstruction-based concrete and asphalt works. The third dose includes PPCs from €500,000 to €1,500,000 with works such as low rise construction and building adaptations. The final fourth dose consists of contracts above €1,500,000 with works such as bridge, school, and pipeline construction. The equation (1) is run on the four subsamples, taking the winner and runner-up from each auction within a particular dose. Focusing on the fifth fortnight of Table A29, the results show no evidence of a positive impact of the first PPC dose (below €100,000) on firms' employment. This could be because firms can conduct the procured activities of smaller PPC with existing capacities. On the other hand, the second and third doses had a statistically significant positive impact on firms' employment in magnitude of 2.4 [+/- 0.6] and 2.8 [+/- 1.2] employees. Finally, the fourth dose (above €1,500,000) has the statistically significant positive and the highest impact on employment (7.3 [+/- 2.8]) at the fifth fortnight.

The lack of evidence collected for the impact of the smallest dose can partly explain the high costs per job created (and the small magnitude of the effect). However, while the largest

collusion is probably more frequently conducted by not participating in the auction, which is a less costly approach given that participation requires labour hours worked.

PPC dose shows the largest absolute impact on firms' employment, the cost per job is higher than the main estimates (at €270,479; Table A35) which is larger than the estimates in the US ($120,000 Wilson, 2012). Therefore, the small magnitude is not explained by the PPC size.

5.3 Longer term effects

While the effects on employment are small, they could be persistent over time, for example, because winners take fewer workers but over a longer time period to complete the work. A similar regression to equation (1) is estimated:

$$Y_{ijt} = \alpha + \beta T_{ij} + \sum_{t=-5}^{+20} \gamma_t t_{ijt} + \sum_{t=-5}^{+20} \delta_{LATEt}(T_{ij} * t_{ijt}) + X_j^K \zeta_j + \epsilon_{ijt} \quad (2)$$

where the main difference is the length of the panel, which goes to fortnight 20 in equation (2). The results in Table A26 show the PPC impact on firms' employment is persistent a considerable time after the last period of the short-run estimation in equation (1), but starts to fade out from the 17th fortnight onwards (starting days 238–252). Thus, no evidence is found for the longer persistence of the effects.

5.3.1 Matthew effect

The Matthew effect of accumulated advantage (short: Matthew effect) suggests that the rich get richer and poor get poorer. In the study setting, this could be interpreted as those firms that closely win a PPC get more and more PPCs (see Ferraz et al., 2015). The Matthew effect is tested with two models. In both models, the sample of close winners and runners-up is used, and at each auction time t, the number of PPCs received and their value is calculated for each winner or runner-up in 30, 90, 180, 270 and 360 days after the auction j at time t. Tables A21 and A22 show, contrary to the hypothesized, that the winners receive a lower number of PPCs and a lower value of PPCs in the next year. This can be interpreted with two competing arguments. On the positive side, firms are working at their full capacity and are not interested in acquiring new PPCs; alternatively (on the negative side), future research could look into potential circles of bid rigging, whereby a firm wins a PPC and then lets other firms win the next ones (i.e. they switch in circle) in exchange for lower competition.

5.3.2 Substitution

As shown in subsection 5.3.1, if a runner-up loses an auction, it can offset a loss by winning the next auctions (Table A21). Therefore, during a longer period, for example, a year, the winner and runner-up could obtain a similar auction value regardless of the close auctions. Two points emerge.

Firstly, while this is a lesser issue in this study context because the dependent variable is measured at daily level, closely winning or losing a PPC should be an important event for the firm that is not easily offset if it is to provoke a positive firm employment reaction. To shed light on this topic, the total value of PPCs won for each firm-year is calculated. Panel a) of Figure A5 shows a jump in total yearly public amount won among the winners compared to the runners-up. Table A27 shows a statistically significant positive difference between winners and runners-up in the PPC value won.[36] Secondly, even if there is a difference in the value of PPCs received between winners and runners-up, these differences might be substituted by working more for the private market. The value of PPCs from the firms' total revenue is substracted to obtain an estimate of firms' market revenue. The change in market revenue is less obvious. A model is run (in Table A27) to analyse the difference in means of public and of market revenue between the winners and runners-up. Table A27 shows a statistically significant negative difference in the market revenue. The jump in public revenue is larger than the change in market revenue (Panel a vs b, Figure A5).

The above suggests runners-up substitute public revenue for market revenue when they lose a PPC in a close auction. This increase in market revenue of runners-up, however, is not enough to catch up to the winners new PPC value in the current year. In other words, runners-up lose larger PPCs in close auctions, which they partly offset by working more on the market and by winning more PPCs of smaller size.[37]

5.4 Outsourcing practice

Winning firms can fulfil the contractual work obligations in-house, but can also decide to outsource parts of the PPC outside the firm. These activities are usually conducted as a cost–cutting measure or because specialized outside expertise is needed for the project. If firms do outsource, they usually conduct part of the contractual activities in-house and part

[36] Natural logs of PPC value to decrease the influence of very large PPCs is used.

[37] After losing the PPC in a close auction and winning the next PPCs, runners-up still received on average €330,000 fewer public funds. A detailed calculation of the difference in PPC value between the PPC lost by the runner-up and the future PPCs is available to readers upon request.

is outsourced (Arvanitis and Loukis, 2013). The two most usual forms of outsourcing are: firms outsource parts of the PPC to other firms, and firms 'borrow' workers from a firm (i.e. agency workers) specialized for construction work.[38]

Heterogeneous effects with respect to the firms' intensity of using agency workers and intensity of outsourcing construction works to its (sub)suppliers is estimated. Detailed financial statements of all firms in the sample are used to construct *i*) the ratios of outsourcing costs in firms' total costs, and *ii*) the ratios of external labour costs in total labour costs. We then split the sample by the median ratios of firms in close auctions. The sample of firms in close auctions is split by the median ratio of outsourcing costs in total firm costs, and by the median ratio of agency workers' costs in total labour costs. The equation (1) is then estimated. Results in Table A30 show effects are concentrated in those firms that have a less intensive practice of outsourcing (either *i* or *ii*).

External labour is not registered in the database, and thus the unbiased impact of PPC on firms' employment should be in the subsample of firms with low usage of agency workers and low outsourcing. The study delves deeper into the ratio of external labour in total labour costs, and five subsamples are split into five bins. Results (Table A31) confirm the effects are concentrated in those firms with low usage of external labour, but also show that the effect is of higher magnitude when the majority of all works is conducted *in-house* (4.1 [+/- 1.3] employees).[39] This magnitude is taken as the more accurate estimate of the PPC impact on firms' employment. With the new magnitude and the median PPC amount size,[40] the public cost per directly created job is quantified at €45,200 [€34,200 - €66,200].

The magnitude of 4.1 [+/- 1.3] employees is closely related to the estimate in the sample of PPCs without frequent auction complaints (i.e. Table A14). Importantly, while no evidence is found of a positive impact of PPC on the employment of those construction firms with a high share of outsourcing or high usage of agency workers, it does not directly imply there is no effect among these firms, but more probably, that the effect has spilled over to the winners' suppliers and to the higher usage of unregistered agency workers.

[38] Thus, employees are not registered within the winning firm, but are 'borrowed' from a specialized firm for such agency workers.

[39] The point estimate ranges from 3.9 to 4.1.

[40] €186,612 at the median, see Table A35.

6 Conclusions

Macroeconomics has gone a long way in estimating the effects of government spending on GDP growth. However, macroeconomics is based on microeconomics, and micro–level effects of government spending are still under-researched. These micro gaps primarily include the effects of government spending on households and firms. The present study tackled the micro–level effects of government spending on the employment of firms supplying the government with construction works. An examination of PPCs and firms should take into account moral hazard issues that occur between self-interested politicians and profit-maximizing firms. To estimate the effects of PPC on firm employment, this study exploits sealed bid auctions in PPCs of construction works, daily employment variation and discontinuity in bidders' win margin.

Winning a PPC has a positive impact on a firm's short-run employment. New workers are predominantly lower educated men who have been previously employed in the construction sector. A large set of robustness checks (i.e. excluding complaints, politically connected, political donors, analysing changes in supplier selection method, contamination of the evaluation period, and seasonality) confirms that the estimated impact holds. Importantly, this study offers many new insights compared to existing studies (most closely Gugler et al., 2020). The initial estimated magnitude of the effect (2.5 employees [+/- 0.6]) is rather small, and relatedly, the initial cost per job directly created is higher (at €71,400) than the majority of other estimates for PPCs or public grants (Ferraz et al., 2015; Gugler et al., 2020; Dvouletỳ et al., 2021; Srhoj and Zilic, 2021). This motivated further investigation of potential mechanisms and heterogeneity that could explain such high cost per job in the short-run.

This study shows a transparent and competitive auction procedure leads to cost savings and lower political influence. Importantly, while a substantial share of PPCs are allocated to politically connected firms, winners and runners-up are, on average, not statistically different in political connections, and therefore any remaining difference in firms employment growth is due to PPC. The present study does not find compelling evidence for information leakage as an explanation for the lower estimates. Next, contrary to Ferraz et al. (2015), the investigation of the longer-term effects finds evidence that the effects phase out in less than a year, suggesting the longevity of effects or later-increasing effects do not explain the lower short-term magnitude.

However, the study finds four factors that can explain the lower estimates. The first two relate to the counterfactual behaviour of the runners-up. On the one hand, runners-up

win more PPCs over the months after losing a close auction. These new PPCs won by the runners-up are smaller on average and do not provide enough public revenue for the runner-up to reach the winner's level of public revenue received. On the other hand, runners-up engage in *substitution* of the public for market revenue, as this study documents runners-up start working more with households and private firms (i.e. private demand). However, both the *substitution* and winning additional smaller PPCs do not enable the runner-up to reach the closely-lost PPC. Dose response functions are estimated, and the results indicate non-linearity in the effects of PPC on firms employment with respect to the PPC size. No evidence is found for a positive impact of small PPCs on firms' employment, and positive effects are documented for larger PPCs, particularly for the largest PPCs. While the estimated effect is increasing with the PPC size, the cost per job becomes more expensive. This suggests chopping the PPCs into smaller contracts might not be beneficial for maximizing the effect on firms' employment; however, with larger PPCs, after a threshold, the effect per euro decreases, which is why PPC size does not provide an explanation for the high cost per job created. Heterogeneity of effects with respect to firms' outsourcing and hiring decisions is documented. In particular, the effect is concentrated in firms that conduct the majority of work themselves, or firms that use a small share of agency workers. On average, firms employ 3% of the winning workforce, about four new employees per PPC, which gives the public cost per job directly created at €45,200 [€34,200 - €66,200]. Tackling all the interesting questions related to PPCs is beyond the scope of this study, but several future research streams are suggested.

Future research could tackle the impact of PPC on the employment of winners' suppliers. In addition, investigation of PPC effects on other production function variables, i.e. inputs like capital, intermediate inputs and technology; and outputs like value added and sales, could yield interesting findings. Furthermore, research could estimate the effects of PPC on firms in non-construction sectors (e.g. manufacturing, retail or service sectors), as well as the effects of a change in political connections on resource allocation. Local and regional effects of increased government spending (e.g. Nakamura and Steinsson, 2014) could be investigated, as well as the micro-effects of "mega" PPCs (e.g. significant highways or bridges [Holl, 2016]). Future research could also examine the effects of a change in political power on bidders' behaviour, competition and price markups in PPCs. Finally, potential bid rigging activities require more analysis (e.g. Kawai et al., 2019). Extending our analysis to consider these aspects is an exciting, yet difficult, avenue for future research.

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7 Appendix

Table A1: Definition of non-political variables used in the analysis (*continued*)

Category	Variable	Description
Employment	Employees	Number of employees within a firm (6 fortnights prior to the auction results)
	Employees, HE	Number of employees with a higher education level (HE) within a firm (6 fortnights prior to the auction results)
	Employees, LE	Number of employees with a lower education level (LE) within a firm (6 fortnights prior to the auction results)
	Hires	Number of hires within a firm (per day, during the 6 fortnights period prior to the auction results)
	Fires	Number of fires within a firm (per day, during the 6 fortnights period prior to the auction results)
	Tenure	Number of days an average employee is employed in a firm (6 fortnights prior to the auction results)
	Employee age	Age of an average employee (on the day he is employed) that is employed in a firm (6 fortnights prior to the auction results)
	Non-fixed term contracts	Percentage of non-fixed term contracts within a firm (6 fortnights prior to the auction results)
Projects	Backlog extensive	Number of government contracts won by a firm during the 3 years prior to an auction (includes contracts from whole 3 years prior)
	Backlog intensive	Value of government contracts won by a firm during the 3 years prior to an auction (includes contracts from whole 3 years prior) VAT is not included.
	Distance to contracting authority	Distance between contractors' and firms' headquarters (air distance - in kilometers)
Balance sheet	Total assets	Total assets of a firm according to the nearest end-of-year financial reports prior to the auction results
	Current assets	Current assets of a firm according to the nearest end-of-year financial reports prior to the auction results
	Fixed assets	Fixed assets of a firm according to the nearest end-of-year financial reports prior to the auction results

Table A1: Definition of non-political variables used in the analysis (*continued*)

Category	Variable	Description
	Total liabilities	Total liabilities of a firm according to the nearest end-of-year financial reports prior to the auction results
	Non-current liabilities	Non-current liabilities of a firm according to the nearest end-of-year financial reports prior to the auction results
Income statement	Revenue	Revenue of a firm according to the nearest end-of-year financial reports prior to the auction results
	Market revenue	Revenue of a firm (according to the nearest end-of-year financial reports prior to the auction results) subtracted by the "Public revenue"
	Public revenue	Total value a firm won one year prior to the auction results within the PPC's within our database. VAT is not included
	EBITDA	EBITDA of a firm according to the nearest end-of-year financial reports prior to the auction results
	Profit	Profit of a firm according to the nearest end-of-year financial reports prior to the auction results
	Depreciation	Depreciation of a firm according to the nearest end-of-year financial reports prior to the auction results
	Interest paid	Interest paid of a firm according to the nearest end-of-year financial reports prior to the auction results
	Productivity	Revenue of a firm according to the nearest end-of-year financial reports prior to the auction results over the number of employees within a firm 6 fortnights prior to the auction results
	Wage costs	Wage costs of a firm according to the nearest end-of-year financial reports prior to the auction results

Table A1: Definition of non-political variables used in the analysis (*continued*)

Category	Variable	Description
Financial ratios	EBITDA over assets	EBITDA over total assets of a firm according to the nearest end-of-year financial reports prior to the auction results
	Profit over assets	Profit after tax over total assets of a firm according to the nearest end-of-year financial reports prior to the auction results
	Debt ratio	Total liabilities over total assets of a firm according to the nearest end-of-year financial reports prior to the auction results
	LR liabilities over assets	Non-current liabilities over total assets of a firm according to the nearest end-of-year financial reports prior to the auction results
	Outsourcing over total expenses	Total outsourcing (external-work) costs over the total firms costs of a firm according to the nearest end-of-year financial reports prior to the auction results
	External labour over total labour costs	Total cost of student workers, agency workers, subcontractors & other one-off contractors over the total worker expenses of a firm according to the nearest end-of-year financial reports prior to the auction results
Education	(HE) Higher education level	Requirements for a specific job vacancy, containing: specialized doctorate degree, doctorate degree, masters degree (& specialized maters programs), bachelor's degree
	(LE) Lower education level	Requirements for a specific job vacancy, any degree of education below the/not mentioned in the degrees required for an HE classification
	Win margin	$\frac{\lvert 2nd\,best\,bids\,value - winning\,bids\,value\rvert}{2nd\,best\,bids\,value}$
	Dependent variable	$\frac{(Employment_{i,t} - Employment_{i,base})}{Employment_{i,base}}$ Note: the base period is the beginning of the 6th fortnight prior to the day of the auction results.

Table A2: Political connection dummies

Match	Name	Dummies, equal to 1 if:
Last name match	Donators	A firm has ever donated to any political party according to our database of donations.
	Reg. conn. (out of power)	A firm has, within its management/owners, anyone with the same full name as an ex-regional politician (substitutes of-, governors, member of county councils) in the county of the firm's headquarters.
	Reg. conn. (in power)	A firm has, within its management/owners, anyone with the same last name as a current regional politician (substitutes of-, governors, member of county councils) in the county of the firm's headquarters.
	Loc. conn. (out of power)	A firm has, within its management/owners, anyone with the last name as an ex-member of the local political representatives in the municipality of the firm's headquarters.
	Loc. conn. (in power)	A firm has, within its management/owners, anyone with the same full name as a current member of the local pollitical representatives in power in the municipality of the firm's headquarters.
Full name match	GONG/Nat. conn.	A firm has, within its management/owners, anyone with the same full name as an ex- or a current member of the national parliament or the parties representatives.
Final dummies	Any	Any of the previous dummies are 1.
	Any (second order)	Any of the managers/owners within firms where Any = 1 are members of the management/owners.

Notes: "(in power)" refers to the ruling party in the observed part of the state. The elections on the regional & local level took place in 2013 & 2017, meaning we consider a politician "in power" if he was a mayor/deputy mayor/member of the local council.

Table A3: Public procurement in the Republic of Croatia

Year	GDP	PPC	PPC in GDP (%)	PPC – EOJN	Simple PPC	No. of PPC	No. of PPC w. MEAT (%)	Share of PPC value MEAT	Construction PPC's value in PPC's at EOJN (%)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2015	339.7	40.6	11.9	31.1	9.5	15485	2.4	7.8	46.9
2016	351.2	44.8	12.8	34.6	10.3	13838	2.5	6.6	27.7
2017	366.4	40.5	11.0	31.0	9.4	11408	57.1	57.7	42.0
2018	383.0	46.6	12.2	36.6	10.0	18112	95.5	95.4	50.8

Notes: All monetary values are given in billion Kuna. Source: Statistical Reports on Public Procurement, link: http://www.javnanabava.hr/default.aspx?id=3425.

Column (3) shows the total PPC value awarded. (4) shows total PPC value awarded as % of GDP. (5) shows the value of PPCs published at EOJN. (6) gives the value of all PPC which do not legally require a tendering process (all PPC whose final value is under 250,000 HRK [with VAT]). (8) shows % of PPC awarded by MEAT criteria, (9) does the same but comparing values of PPC. (10) simply looks at what % of PPC at EOJN have their CPV start with 45xy.

Table A4: Single bid auctions

	Year	2016	2017	2018	Total
(1) All PPC	Count	1412	1449	1378	4239
(2) Single bid	Count	332	286	32	650
(3) Single bid	Share	0.2351	0.1974	0.0232	0.1533
(4) Single bid	Amount (in mil. €)	142.6631	322.7729	24.6659	490.1019
(5) Winners donating	Share	0.1754	0.1388	0.0604	0.1455
(6) Winners pol. conn.	Share	0.5367	0.7683	0.3626	0.6804
(7) Suspicious winners	Share	0.1049	0.4696	0.3882	0.3593
(8) Ad 5, 6 & 7 Won	Amount (in mil. €)	100.5075	285.874	19.732	406.1134

Notes: 4239 auctions are in the entire sample when we exclude only the auctions for which we do not have the necessary data. Of those 4239, 650 were single bid auctions, however 332 more are excluded, as they become single bid auctions because of invalid and/or excluded bids. Those 332 are not observed in single bid auctions above, they are represented below. VAT is included.

Table A5: Single bid auctions by exclusion

	Year	2016	2017	2018	Total
(1) All PPC	Count	1412	1449	1378	4239
(2) Single bid	Count	52	68	212	332
(3) Single bid	Share	0.0368	0.0469	0.1538	0.0783
(4) Single bid	Amount (in mil. €)	42.1524	225.2118	180.6239	447.9881
(5) Winners donating	Share	0.106	0.0837	0.2303	0.1449
(6) Winners pol. conn.	Share	0.6498	0.9132	0.6713	0.7909
(7) Suspicious winners	Share	0.2479	0.8	0.1095	0.4696
(8) Ad 5, 6 & 7 Won	Amount (in mil. €)	30.4392	214.2173	139.5041	384.1605

Notes: Rows 5, 6 & 7 show the share of values of PPC won by each of the groups of single bidders respectively. Row 5 shows the share of the total value awarded to single bidders with previous donations to a political party, row 6 to single bidders with political connections (see 4.4.3), and row 7 to single bidders which are deemed suspicious (firms formed 1 year or sooner before the auction, firms with no employees, firms which won an auction that surpassed 70% of their last years revenue). The last row shows the value that was awarded to firms in rows 5, 6 & 7 (overlap is accounted for). VAT is included.

Table A6: Multiple bid auctions

	Year	2016	2017	2018	Total
(1) All PPC	Count	1412	1449	1378	4239
(2) Multiple bid	Count	1028	1095	1134	3257
(3) Multiple bid	Share	0.728	0.7557	0.8229	0.7683
(4) Multiple bid	Amount (in mil. €)	921.6257	732.3651	1137.792	2791.7828
(5) Winners donating	Share	0.1811	0.1423	0.1035	0.1393
(6) Winners pol. conn.	Share	0.364	0.5113	0.2946	0.3744
(7) Suspicious winners	Share	0.1041	0.0531	0.0864	0.0835
(8) Ad 5, 6 & 7 Won	Amount (in mil. €)	443.5301	415.659	463.8711	1323.0602

Notes: We observe the 3257 auctions which had multiple valid bids. Of those we later on exclude ones in which a winner or a runner-up is firm for which we do not have the necessary employment data. We are left with 2859 auctions afterwards. VAT is included.

Table A7: Bidder quantity effect on winning bid (as % of beginning estimate)

		Subsamples				
	All	1 vs. 2	1 vs. 3	1 vs. 4	1 vs. (5 to 8)	1 vs. (more than 8)
	(1)	(2)	(3)	(4)	(5)	(6)
2 valid bids	−0.074***	−0.075***				
	(0.008)	(0.009)				
3 valid bids	−0.119***		−0.126***			
	(0.008)		(0.009)			
4 valid bids	−0.147***			−0.150***		
	(0.010)			(0.010)		
(5 to 8) valid bids	−0.178***				−0.177***	
	(0.009)				(0.009)	
(more than 8) valid bids	−0.278***					−0.261***
	(0.022)					(0.023)
Mean beginning estimate	0.78	0.77	0.66	0.57	0.89	1.16
N	4.108	1.971	1.737	1.446	1.663	995
R^2	0.167	0.099	0.154	0.170	0.239	0.186
Adjusted R^2	0.156	0.078	0.132	0.144	0.218	0.148
Residual Std. Error	0.173 (df = 4057)	0.182 (df = 1924)	0.175 (df = 1692)	0.177 (df = 1401)	0.173 (df = 1617)	0.178 (df = 950)

Notes: We observe the entire sample of 4239 auctions, however we exclude 131 auctions as their winning bid (as % of the beginning estimate) is in the top or bottom 1% of observations. Meaning we observe 4108 auctions in column (1), and its subsamples in other columns. Column (2), for example, regresses the ratio on the subsample of auctions which had either 1 or 2 valid bids, & the other remaining columns follow the same principle. Regression is controlled for county, season, year & 4 digit CPV specific effects. Mean beginning estimate is in mil. €.

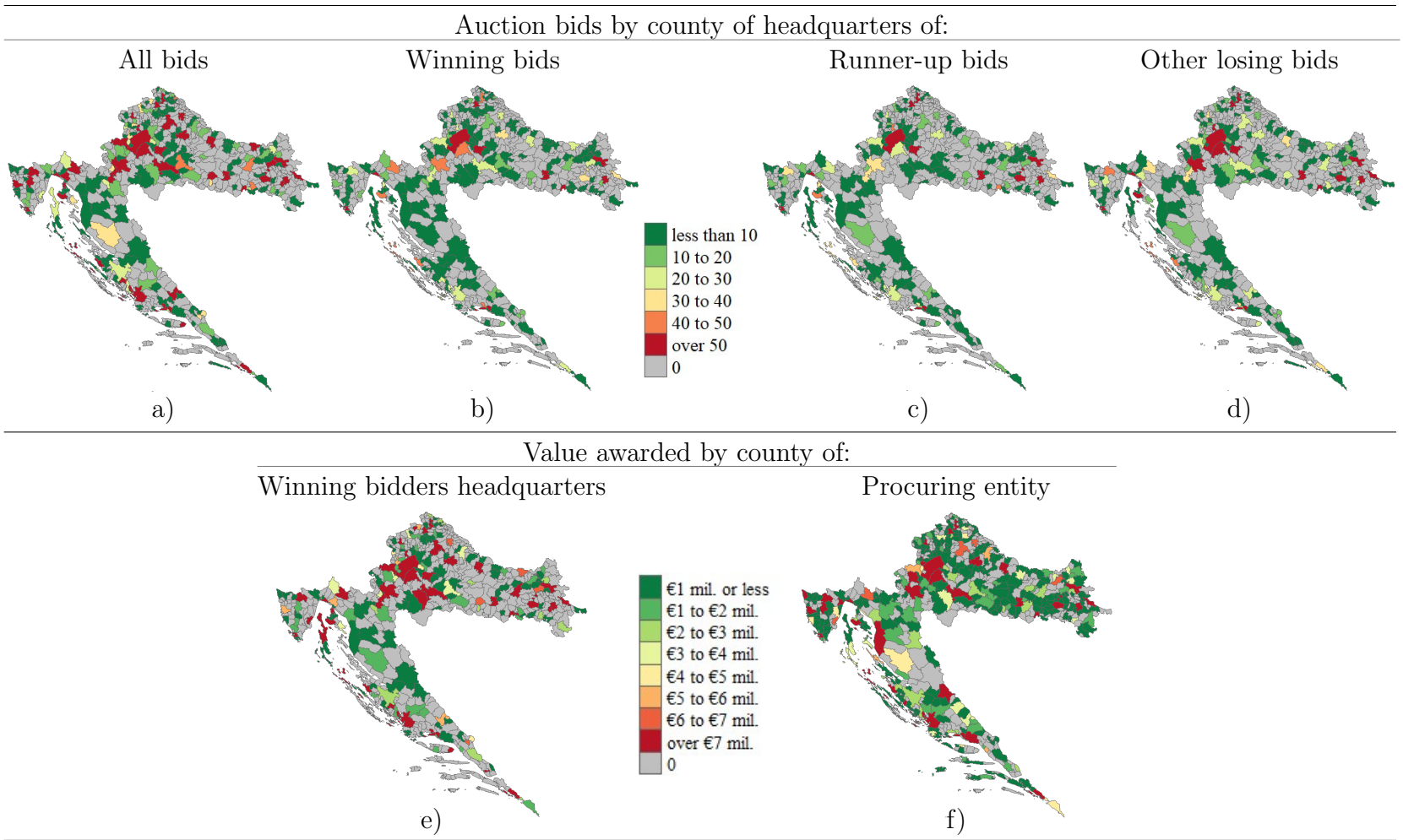
***, **, * Significant at the 1, 5, 10 percent level.

Table A8: Procurement contracts distribution by 6 digit CPV

6 digit CPV	CPV description	No. of Auctions	No. share	Estimated value	Estimated values share	Final value	Final values share	Mean final value	Median final value
452331	Works on building highways and roads	614	0.14	447.08	0.13	356.11	0.12	0.58	0.18
450000	Building (unspecified)	269	0.06	225.41	0.06	182.79	0.06	0.68	0.21
454540	Reconstruction and renovation	201	0.05	117.36	0.03	97.25	0.03	0.48	0.2
452313	Works on constructing water and sewer pipelines	191	0.05	228.83	0.07	212.03	0.07	1.11	0.26
452330	Construction works, works on building foundations and works on constructing surface highway roads	165	0.04	154.72	0.04	112.3	0.04	0.68	0.17
452310	Works on constructing pipelines, communication, energy and water supply.	143	0.03	71.92	0.02	61.98	0.02	0.43	0.17
452332	Different works on surface layer	136	0.03	43.59	0.01	35.94	0.01	0.26	0.12
454531	Maintenance	128	0.03	92.9	0.03	74.68	0.03	0.58	0.13
452000	Works on buildings or parts of high-rise and low-rise buildings	122	0.03	84.59	0.02	68.32	0.02	0.56	0.16
452321	Works on water supply pipelines	93	0.02	53.85	0.02	40.09	0.01	0.43	0.19
	In top 10	2062	0.49	1520.25	0.44	1241.49	0.42	0.6	0.19
	Total	4239	1.00	3476.19	1.00	2983.9	1.00	0.7	0.18

Notes: All values are given in mil. €. The CPV distribution encompasses all 4239 auctions in the sample.

Figure A1: PPC value & auctions awarded in auctions with multiple bidders



Notes: VAT is included.

Table A9: Auction summary

	All auctions			Close auctions (Within 10%)			Close auctions (Within 6%)			Close auctions (Within 4%)		
	Mean	St. Dev.	Median	Mean	St. Dev.	Median	Mean	St. Dev.	Median	Mean	St. Dev.	Median
Auction estimate	808.42	5957.64	220	902.82	5413.83	237.56	982.62	6373.25	233.33	923	6618.41	240
Winning bid	721.42	6467.31	178.51	804.7	5182.35	206.29	887.15	6121.14	203.4	832.5	6332.67	212.97
(Winning bid / Auction estimate)	0.83	0.25	0.81	0.88	0.28	0.88	0.89	0.29	0.9	0.9	0.32	0.91
Runner-up bid	826.3	7672.3	209.88	837.57	5279.28	213.21	911.32	6222.02	209.45	844.13	6361.98	214.59
(Runner-up bid - Winning bid)	104.88	1391.39	20.53	32.87	165.72	7.08	24.16	174.47	4.58	11.63	46.54	3.31
(Run.-up bid - Win. bid) /Runner-up bid	0.1389	0.1657	0.0994	0.0423	0.0289	0.0388	0.0262	0.0175	0.0241	0.018	0.0118	0.016
Number of bidders	4	2.01	3	4.31	2.19	4	4.38	2.24	4	4.43	2.26	4

Notes: All monetary values are in thousands of euro. VAT is excluded. We observe only auctions for which both the employee data & financial data is available.

Table A10: Auction distribution by geographic region of contracting authority

Geographic region of contracting authority	All auctions				Close auctions (Within 10%)				Close auctions (Within 6%)				Close auctions (Within 4%)			
	Auctions		Value		Auctions		Value		Auctions		Value		Auctions		Value	
	No.	Share	Sum	Share	No.	Share	Sum	Share	No.	Share	Sum	Share	No.	Share	Sum	Share
Dalmatia	380	0.13	247.95	0.12	212	0.15	132.84	0.11	133	0.13	97.94	0.11	94	0.13	38.75	0.06
City of Zagreb	1228	0.43	1243.96	0.6	582	0.41	722.54	0.63	401	0.4	563.86	0.64	298	0.4	408.31	0.67
Istria, Kvarner, Gorski Kotar & Lika	420	0.15	200.1	0.1	222	0.15	117.48	0.1	163	0.16	78.79	0.09	122	0.17	61.27	0.1
Central Croatia (w/o City of Zagreb)	434	0.15	191.82	0.09	221	0.15	84.83	0.07	152	0.15	63.04	0.07	117	0.16	40.92	0.07
Slavonia	396	0.14	178.62	0.09	199	0.14	97.99	0.08	145	0.15	78.3	0.09	106	0.14	64.42	0.1
Number of auctions	2859	1	2062.45	1	1436	1	1155.68	1	994	1	881.93	1	737	1	613.67	1

Notes: All monetary values are in millions of euro. VAT is excluded. We observe only auctions for which both the employee data & financial data is available.

Table A11: Comparison of winners, runner-ups & others before the auction results

Category	Variable	Winners	Runners up	Diff. (3)-(4)	Ranks > 2	Diff. (3)-(6)	Ranks > 1	Diff. (3)-(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Employment	**Observations**	**2859**	**2859**		**4514**		**7373**	
	Employees	115.43	124.82	−9.39	125.19	−9.76	125.05	−9.62
	Employees, HE	18.23	19.22	−0.99	18.57	−0.34	18.82	−0.59
	Employees, LE	97.2	105.6	−8.4	106.62	−9.42	106.22	−9.03
	Hires	0.14	0.15	−0.01	0.16	−0.01	0.15	−0.01
	Fires	0.14	0.15	−0.01	0.15	−0.01	0.15	−0.01
	Tenure (in days)	1232.42	1246.32	−13.9	1169.29	63.13*	1199.14	33.28
	Employee age (in years)	35.15	35	0.15	35.18	−0.03	35.11	0.04
	Non-fixed term contracts (in %)	41.97	41.04	0.93	39.47	2.5***	40.08	1.89***
Projects	Backlog extensive	22.98	25.53	−2.55**	26.24	−3.26***	25.97	−2.98***
	Backlog intensive	12.67	13.39	−0.72	13.21	−0.54	13.28	−0.61
	Distance to contracting authority	68.45	77.17	−8.72**	72.28	−3.83	74.18	−5.73**
Political connections	Public firm	0.07	0.05	0.02**	0.04	0.03***	0.04	0.02***
	GONG/National match	0.17	0.15	0.01	0.15	0.02*	0.15	0.02*
	Regional match (in power)	0.24	0.22	0.02	0.2	0.04***	0.21	0.03**
	Local match (in power)	0.26	0.25	0.01	0.24	0.02	0.24	0.02
	Any match	0.47	0.47	0.01	0.46	0.01	0.46	0.01
	Any match (second order)	0.73	0.74	−0.01	0.73	0	0.74	0
	Donator	0.14	0.14	0	0.15	−0.01	0.15	−0.01
Balance sheet	Total assets	11.32	12.57	−1.24	11.98	−0.65	12.2	−0.88
	Current assets	5.73	5.85	−0.12	5.76	−0.03	5.79	−0.06
	Fixed assets	5.59	6.72	−1.13	6.22	−0.62	6.41	−0.82
	Total liabilities	5.17	6.1	−0.93	6.27	−1.1	6.2	−1.03
	Non-current liabilities	1.18	1.89	−0.7	1.88	−0.7	1.88	−0.7
Income statement	Revenue	12.17	12.29	−0.12	12.37	−0.21	12.34	−0.17
	EBITDA	1.17	1.09	0.08	0.96	0.21	1.01	0.16
	Profit	0.42	0.42	0	0.34	0.07	0.37	0.05
	Depreciation	0.51	0.43	0.08	0.36	0.15	0.39	0.12
	Interest paid	0.15	0.17	−0.02	0.18	−0.04	0.18	−0.03
	Wage costs	1.59	1.74	−0.15	1.7	−0.11	1.72	−0.12
	Productivity	0.11	0.12	−0.02	0.13	−0.02	0.12	−0.02*
Financial ratios	EBITDA over assets	0.13	0.12	0.01	0.12	0.01***	0.12	0.01**
	Profit over assets	0.06	0.05	0.01	0.05	0.01***	0.05	0.01*
	Debt ratio	0.55	0.63	−0.08	0.55	0	0.58	−0.03
	LR liabilities over assets	0.11	0.12	0	0.11	0	0.11	0
	Outsourcing over total expenses	0.3	0.31	0	0.32	−0.02***	0.32	−0.01**
	External labour over total labour costs	0.33	0.33	−0.01	0.36	−0.04***	0.35	−0.03***

Notes: The first row represents the data after we exclude any auction in which the winner/runner-up is a firm for which we do not have the necessary employment data. The second notion of observations is a subset of those auctions, the one for which we have data on other financial data. For an explanation of all the variables see Table A1. All monetary values are given in mil. Euro.

***, **, * Significant at the .1, 1, 5 percent level.

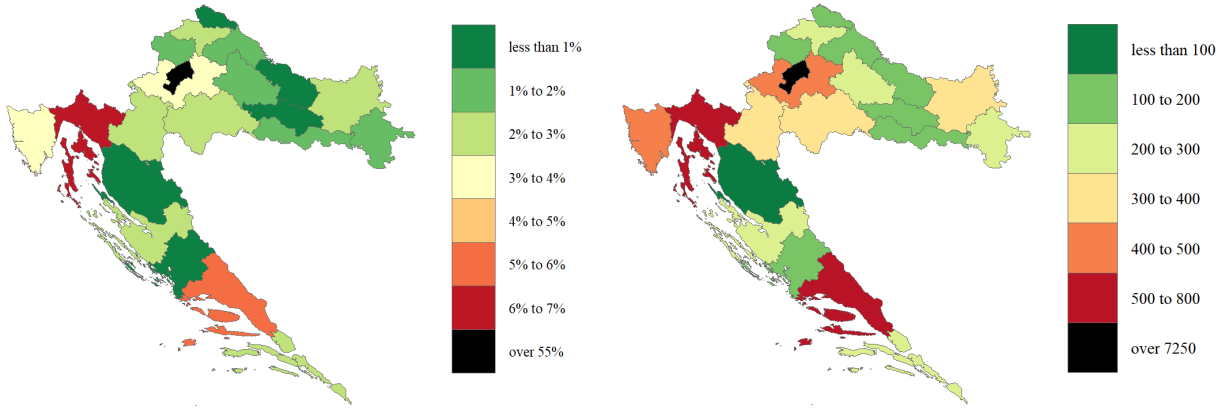
Table A12: Comparison of winners, runner-ups & others before the auction results - in close auctions (within 10%)

Category	Variable	Winners	Runners up	Diff. (3)-(4)	Ranks > 2	Diff. (3)-(6)	Ranks > 1	Diff. (3)-(8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Employment	**Observations**	**1436**	**1436**		**2719**		**4155**	
	Employees	123.93	128.12	−4.19	123.28	0.65	124.95	−1.02
	Employees, HE	18.19	20.2	−2.01	18.84	−0.64	19.31	−1.12
	Employees, LE	105.74	107.91	−2.17	104.45	1.29	105.65	0.09
	Hires	0.16	0.16	0	0.16	0	0.16	0
	Fires	0.16	0.16	0	0.16	0	0.16	0
	Tenure (in days)	1279.07	1257.69	21.38	1203.43	75.64	1222.14	56.93
	Employee age (in years)	35.14	35.23	−0.09	35.33	−0.19	35.29	−0.15
	Non-fixed term contracts (in %)	39.15	40.07	−0.92	38.03	1.11	38.74	0.41
Projects	Backlog extensive	25.7	26.34	−0.64	27.75	−2.06	27.26	−1.57
	Backlog intensive	14.42	13.72	0.7	13.74	0.67	13.73	0.68
	Distance to contracting authority	69.58	73.65	−4.07	72.03	−2.46	72.59	−3.01
Political connections	Public firm	0.07	0.06	0.01	0.04	0.02**	0.05	0.02**
	GONG/National match	0.19	0.16	0.03	0.15	0.04**	0.16	0.03**
	Regional match (in power)	0.24	0.22	0.02	0.21	0.03*	0.21	0.03*
	Local match (in power)	0.26	0.25	0.01	0.26	0.01	0.26	0.01
	Any match	0.49	0.47	0.02	0.47	0.02	0.47	0.02
	Any match (second order)	0.75	0.73	0.02	0.74	0.01	0.74	0.01
	Donator	0.16	0.15	0.01	0.15	0.01	0.15	0.01
Balance sheet	**Observations**	**1399**	**1370**		**2639**		**4009**	
	Total assets	11.87	14.18	−2.31	11.43	0.44	12.37	−0.5
	Current assets	5.82	6.32	−0.49	5.88	−0.06	6.03	−0.21
	Fixed assets	6.05	7.86	−1.81	5.55	0.5	6.34	−0.29
	Total liabilities	5.87	6.71	−0.84	6.22	−0.35	6.39	−0.52
	Non-current liabilities	1.27	2.21	−0.94	1.73	−0.46	1.9	−0.62
Income statement	Revenue	13.19	12.49	0.7	12.6	0.58	12.56	0.62
	EBITDA	1.11	1.22	−0.11	0.92	0.18	1.02	0.08
	Profit	0.34	0.44	−0.1	0.31	0.03	0.36	−0.01
	Depreciation	0.51	0.5	0.01	0.35	0.15	0.4	0.11
	Interest paid	0.17	0.2	−0.03	0.19	−0.02	0.19	−0.02
	Wage costs	1.69	1.76	−0.07	1.64	0.05	1.68	0.01
	Productivity	0.11	0.13	−0.01	0.13	−0.01	0.13	−0.01
Financial ratios	EBITDA over assets	0.13	0.11	0.02	0.12	0.01***	0.11	0.01
	Profit over assets	0.05	0.04	0.01	0.05	0.01*	0.04	0.01
	Debt ratio	0.55	0.57	−0.02	0.55	0	0.56	−0.01
	Outsourcing over total expenses	0.31	0.3	0	0.32	−0.02**	0.31	−0.01
	External labour over total labour costs	0.33	0.32	0.01	0.36	−0.03**	0.35	−0.02

Notes: The first row represents the data after we exclude any auction in which the winner/runner-up is a firm for which we do not have the necessary employment data. The second notion of observations is a subset of those auctions, the one for which we have data on other financial data. For an explanation of all the variables see Table A1. All monetary values are given in mil. Euro.

***, **, * Significant at the .1, 1, 5 percent level.

Figure A2: Complaints by county



Notes: the data encompasses the entire database of complaints. It shows the distribution of less than 16,089 complaints by county of the procuring entity (for which we have the data on their location). a) shows the % of complaints, b) shows the total number of complaints by county of procuring entity.

Table A13: Main regression estimates

	All	Within 10% (main)	Within 8%	Within 6%	Within 4%	4% to 0.5%
	(1)	(2)	(3)	(4)	(5)	(6)
-5	0.131	0.183	0.300	0.145	0.265	0.327
	(0.649)	(0.551)	(0.571)	(0.636)	(0.733)	(0.798)
-4	0.206	0.390	0.488	0.379	0.533	0.638
	(0.649)	(0.551)	(0.571)	(0.636)	(0.733)	(0.798)
-3	0.165	0.384	0.391	0.286	0.478	0.445
	(0.649)	(0.551)	(0.571)	(0.636)	(0.733)	(0.798)
-2	0.325	0.678	0.695	0.515	0.780	0.551
	(0.649)	(0.551)	(0.571)	(0.636)	(0.733)	(0.798)
-1	0.382	0.797	0.730	0.500	0.839	0.662
	(0.649)	(0.551)	(0.571)	(0.636)	(0.733)	(0.798)
0	0.635	1.110**	1.014*	0.728	1.029	0.939
	(0.649)	(0.551)	(0.571)	(0.636)	(0.733)	(0.798)
1	0.934	1.495***	1.421**	1.056*	1.135	1.065
	(0.649)	(0.551)	(0.571)	(0.636)	(0.733)	(0.798)
2	1.170*	1.602***	1.482***	1.183*	1.168	1.105
	(0.649)	(0.551)	(0.571)	(0.636)	(0.733)	(0.798)
3	1.716***	2.008***	1.853***	1.624**	1.592**	1.495*
	(0.649)	(0.551)	(0.571)	(0.636)	(0.733)	(0.798)
4	1.820***	2.236***	1.960***	1.801***	1.925***	1.875**
	(0.649)	(0.551)	(0.571)	(0.636)	(0.733)	(0.798)
5	1.794***	2.450***	2.180***	1.947***	2.064***	2.167***
	(0.649)	(0.551)	(0.571)	(0.636)	(0.733)	(0.798)
Won (dummy)	−0.336	−0.272	−0.161	0.017	−0.238	−0.082
	(0.463)	(0.395)	(0.410)	(0.458)	(0.531)	(0.579)
Log. of employees	−19.073***	−20.258***	−17.254***	−15.041***	−13.078***	−14.506***
	(0.470)	(0.451)	(0.460)	(0.491)	(0.553)	(0.651)
Mean employees	119.4382	124.2338	120.9359	122.4989	123.4156	122.0153
N	62.544	31.872	27.720	21.912	16.140	13.332
R^2	0.294	0.394	0.396	0.432	0.466	0.497
Adjusted R^2	0.283	0.381	0.382	0.416	0.449	0.480
Residual Std. Error	16.555 (df = 61638)	10.037 (df = 31207)	9.694 (df = 27094)	9.603 (df = 21346)	9.507 (df = 15657)	9.398 (df = 12897)

Notes: Column (1) shows the estimates for the full sample. Other columns - subsamples of close auctions are constructed according to the win margin. The win margin of 10%, 8%, 6%, 4% and 4% to 0.5% based on the win margin definition (see method).
The dependent variable is employment growth at firm-auction level in each fortnight period (from -6 to 6). The model is estimated with the equation (1). The independent variables are the fortnight periods, the 'Won (dummy)' for auction winner, 'Log. of employees' is the natural log of the firms' number of employees -6 fortnights before the auction and firm specific fixed effects are included. The estimates are calculated using the package ('lfe', Gaure, 2013) and show the LATE, difference in employment growth rates between winners and runner-ups in close auction sample. The point estimates and standard errors are transformed to absolute employment increase based on the coefficients and the mean number of employees (given in 'Mean employees') at the beginning of the -6th fortnight.

***, **, * Significant at the 1, 5, 10 percent level.

Table A14: Robustness checks

	Main	No CPVs with most comp.	No region with most comp.	No pol. connections	No pol. conn. (robust surnames)	No pol. donators	No suspicious firms
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
-5	0.183	0.672	0.214	0.057	0.088	0.132	0.285
	(0.551)	(1.128)	(0.626)	(0.440)	(0.390)	(0.525)	(0.563)
-4	0.390	0.998	0.508	0.068	0.133	0.324	0.529
	(0.551)	(1.128)	(0.626)	(0.440)	(0.390)	(0.525)	(0.563)
-3	0.384	0.967	0.436	0.054	0.123	0.309	0.451
	(0.551)	(1.128)	(0.626)	(0.440)	(0.390)	(0.525)	(0.563)
-2	0.678	1.230	0.777	0.251	0.295	0.606	0.702
	(0.551)	(1.128)	(0.626)	(0.440)	(0.390)	(0.525)	(0.563)
-1	0.797	1.380	0.848	0.246	0.279	0.727	0.778
	(0.551)	(1.128)	(0.626)	(0.440)	(0.390)	(0.525)	(0.563)
0	1.110**	1.961*	1.108*	0.558	0.552	1.044**	1.038*
	(0.551)	(1.128)	(0.626)	(0.440)	(0.390)	(0.525)	(0.563)
1	1.495***	2.286**	1.523**	0.798*	0.758*	1.433***	1.288**
	(0.551)	(1.128)	(0.626)	(0.440)	(0.390)	(0.525)	(0.563)
2	1.602***	2.651**	1.554**	0.903**	0.799**	1.542***	1.295**
	(0.551)	(1.128)	(0.626)	(0.440)	(0.390)	(0.525)	(0.563)
3	2.008***	3.605***	1.754***	1.270***	1.101***	1.845***	1.708***
	(0.551)	(1.128)	(0.626)	(0.440)	(0.390)	(0.525)	(0.563)
4	2.236***	3.664***	2.017***	1.394***	1.238***	2.023***	1.888***
	(0.551)	(1.128)	(0.626)	(0.440)	(0.390)	(0.525)	(0.563)
5	2.450***	4.049***	2.131***	1.467***	1.295***	2.164***	1.953***
	(0.551)	(1.128)	(0.626)	(0.440)	(0.390)	(0.525)	(0.563)
Won (dummy)	−0.272	−0.675	−0.108	−0.205	−0.202	−0.241	−0.286
	(0.395)	(0.829)	(0.453)	(0.317)	(0.281)	(0.377)	(0.404)
Log. of employees	−20.258***	−45.128***	−18.127***	−9.368***	−9.588***	−16.298***	−36.388***
	(0.451)	(1.435)	(0.479)	(0.301)	(0.279)	(0.403)	(0.626)
Mean employees	124.2338	116.0818	122.621	63.4487	61.3261	104.6671	129.7528
N	31.872	7.776	23.364	16.740	18.768	26.964	29.856
R^2	0.394	0.556	0.368	0.355	0.353	0.405	0.421
Adjusted R^2	0.381	0.536	0.353	0.338	0.336	0.391	0.409
Residual Std. Error	10.037 (df = 31207)	0.153 (df = 7441)	9.765 (df = 22810)	5.805 (df = 16315)	5.457 (df = 18307)	8.793 (df = 26352)	9.932 (df = 29253)

Notes: Column (1) shows the estimates for the full sample. Columns (2) and (3) show estimates without frequent complaints. The top 5 CPV 4-digit codes with most complaints are 4523, 4521, 4545, 4500 and 4526, which are excluded from the regression in column (2), and the county with most complaints is the City of Zagreb, which we exclude and show the estimates in column (3). Column (4) uses only the firms which are not in any way politically connected (first-order). Column (5) excludes firms which donated to any political party. Column (6) excludes any suspicious firm (see Table A4).
The dependent variable is employment growth at firm-auction level in each fortnight period (from -6 to 6). The model is estimated with the equation (1). The independent variables are the fortnight periods, the 'Won (dummy)' for auction winner, 'Log. of employees' is the natural log of the firms' number of employees -6 fortnights before the auction and firm specific fixed effects are included. The estimates are calculated using the package ('lfe', Gaure, 2013) and show the LATE, difference in employment growth rates between winners and runner-ups in close auction sample. The point estimates and standard errors are transformed to absolute employment increase based on the coefficients and the mean number of employees (given in 'Mean employees') at the beginning of the -6th fortnight. ***, **, * Significant at the 1, 5, 10 percent level.

Table A15: Complaints – occurrence and distribution

Complaint distribution				Complaint distribution		CPV's within our database	
Procuring entity	No.	Share	4 digit CPV code	No.	Share	No.	Share
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Grad Zagreb	615	0.04	4523	662	0.32	1314	0.4
Hrvatske ceste d.o.o.	408	0.03	4521	205	0.1	422	0.13
HAC d.o.o.	347	0.02	4545	137	0.07	304	0.09
ZG holding d.o.o.	320	0.02	4500	257	0.12	209	0.06
Hrvatske vode	317	0.02	4526	104	0.05	198	0.06
HEP-ODS d.o.o.	284	0.02	4524	137	0.07	143	0.04
HŽ-Infrast. d.o.o.	257	0.02	4531	115	0.06	120	0.04
Hrvatske šume d.o.o.	252	0.02	4522	97	0.05	121	0.04
KBC Zagreb	243	0.02	4520	48	0.02	98	0.03
HP d.d.	235	0.01	4511	74	0.04	82	0.03
In top 10	3278	0.22	In top 10	1836	0.89	3011	0.92
Total	16089	1	Total	2063	1	3257	1

Notes: The table shows the top 10 procuring entities that received the most complaints, as well as the top 10 4 digit CPV codes with the most complaints. (5) & (6) show the occurrence of complaints through the 4 digit CPV codes. (7) & (8) show the CPV distribution through our non-filtered database of auctions. CPV's are ordered by column (8).

Table A16: Overview of all donations to political parties

	Donations							
	To all parties	To ruling parties	No. per party	Val. per party	No. per donator	Val. per donator	No. per donator (in sample)	Val. per donator (in sample)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sum	2937695.86	1931103.91	3957	2937695.86	3957	2922167.79	108	341382.59
Mean	742.4	921.33	63.82	47382.19	1.16	860.22	1.57	4947.57
Std. dev.	1522.58	1868.65	269.59	246989.47	0.43	2097.49	0.88	7459.83
10th	26.67	66.67	1	340	1	26.67	1	400
50th	266.67	266.67	6.5	1897.53	1	266.67	1	1733.33
90th	1992	2400	98.2	44251.93	2	2242.67	3	14133.33
Max	26666.67	26666.67	2095	1929770.58	4	53333.33	4	34786.67
Obs.	3957	2091	62	62	3397	3397	69	69

Notes: The first column (1) shows info on all 3957 donations to any party preceding the parliamentary elections in 2016 & those in 2017, while the second (2) shows donations to the ruling party after the election (HDZ). (3) & (4) examine donations by the party which they target. (5) & (6) do the same but instead by the donation origin (560 donations had no identification number connected to them but none of them was donations by firms, those are excluded, hence the lower observation number). (7) & (8) look at only the donations given by construction firms within our sample of PPC's. All monetary values are in euro.

Table A17: Political connections

		Last name match				Dummies	
	GONG/Nat. conn.	Reg. conn. (out of power)	Reg. conn. (in power)	Loc. conn. (out of power)	Loc. conn. (in power)	Any	Any (second order)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sum	141	166	179	202	195	373	675
Mean	0.13	0.16	0.17	0.19	0.19	0.35	0.64
Std. dev.	0.34	0.37	0.38	0.39	0.39	0.48	0.48
Obs.	1071	1071	1071	1071	1071	1071	1071

Notes: The first 5 columns show statistics for any connection to politicians using a dummy of 1 for a full name match or a last name match. (6) & (7) give an overview of all political connections anytime, and to politicians in power in 2013– (overlap is accounted for). A more detailed explanation of the variables: Table A2.

Table A18: Auction criteria characteristics

Sample	Variable	Sum	Mean	Std. dev.	10th	50th	90th	Obs.	Raw obs.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
LP & MEAT	Winning bid	2062.55	0.72	6.47	0.06	0.18	0.88	2859	3257
	Bid of runner-up	2362.39	0.83	7.67	0.07	0.21	1.01	2859	3257
	Est. value	2310.79	0.81	5.96	0.08	0.22	1.07	2859	3257
	No. of bids	10232	4	2.01	2	3	7	10232	11873
LP	Winning bid	1276.89	0.73	4.8	0.06	0.18	0.95	1758	1983
	Bid of runner-up	1368.14	0.78	4.94	0.07	0.2	1.01	1758	1983
	Est. value	1163.28	0.83	5.02	0.08	0.21	1.07	1758	1983
	No. of bids	6739	4.16	2.14	2	4	7	6739	7743
MEAT	Winning bid	785.66	0.71	8.48	0.05	0.18	0.79	1101	1274
	Bid of runner-up	994.25	0.9	10.68	0.07	0.24	1.01	1101	1274
	Est. value	856.69	0.78	7.21	0.08	0.24	1	1101	1274
	No. of bids	3493	3.74	1.76	2	3	6	3493	4130

Notes: The table shows auction data characteristics across auctions awarded via LP & MEAT, separately & when grouped together, after the further exclusion. The last two columns show the observations, the last column shows the observations before the exclusion of the bids for which we do not have the necessary financial & employment data for the analysis, the Obs. column shows the observations after the exclusion. All monetary values are in mil. Euro. VAT is not included.

Table A19: MEAT criteria distribution

Price crit.	No.	Share	Cost crit.	No.	Share	Quality crit.	No.	Share	Other crit.	No.	Share
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
90	619	0.61	more than 30	7	0.01	more than 30	30	0.03	more than 10	3	0.00
80 to 89	285	0.28	11 to 30	90	0.09	11 to 30	281	0.28	10	2	0.00
70 to 79	71	0.07	10	91	0.09	10	551	0.54	5	1	0.00
less than 70	46	0.05	0 to 9	833	0.82	0 to 9	159	0.16	0	1015	0.99

Notes: The table shows MEAT criteria distribution of auctions for which we have the criteria data. The observed dataset contains 3493 bids across 1101 auctions which were awarded via the MEAT criteria. Of those 1101 auctions, we have the criteria data for 1021 of them, for which the distribution is shown above.

Table A20: The impact of PPC on Firms' Employment: LP and MEAT samples

	Entire sample		LP sample		MEAT sample	
	All	Within 10%	All	Within 10%	All	Within 10%
	(1)	(2)	(3)	(4)	(5)	(6)
-5	0.131	0.183	0.134	0.262	0.126	−0.220
	(0.649)	(0.551)	(0.474)	(0.557)	(1.406)	(1.282)
-4	0.206	0.390	0.189	0.425	0.231	0.208
	(0.649)	(0.551)	(0.474)	(0.557)	(1.406)	(1.282)
-3	0.165	0.384	0.087	0.390	0.283	0.348
	(0.649)	(0.551)	(0.474)	(0.557)	(1.406)	(1.282)
-2	0.325	0.678	0.472	0.754	0.101	0.283
	(0.649)	(0.551)	(0.474)	(0.557)	(1.406)	(1.282)
-1	0.382	0.797	0.648	0.902	−0.022	0.245
	(0.649)	(0.551)	(0.474)	(0.557)	(1.406)	(1.282)
0	0.635	1.110**	0.907*	1.247**	0.219	0.394
	(0.649)	(0.551)	(0.474)	(0.557)	(1.406)	(1.282)
1	0.934	1.495***	1.251***	1.509***	0.450	1.402
	(0.649)	(0.551)	(0.474)	(0.557)	(1.406)	(1.282)
2	1.170*	1.602***	1.391***	1.517***	0.831	2.014
	(0.649)	(0.551)	(0.474)	(0.557)	(1.406)	(1.282)
3	1.716***	2.008***	1.626***	1.884***	1.841	2.608**
	(0.649)	(0.551)	(0.474)	(0.557)	(1.406)	(1.282)
4	1.820***	2.236***	1.606***	2.028***	2.132	3.264**
	(0.649)	(0.551)	(0.474)	(0.557)	(1.406)	(1.282)
5	1.794***	2.450***	1.618***	2.219***	2.046	3.593***
	(0.649)	(0.551)	(0.474)	(0.557)	(1.406)	(1.282)
Won (dummy)	−0.336	−0.272	−0.469	−0.681*	−0.231	−0.677
	(0.463)	(0.395)	(0.339)	(0.399)	(1.015)	(0.967)
Log. of employees	−19.073***	−20.258***	−44.876***	−44.117***	−16.392***	−16.873***
	(0.470)	(0.451)	(0.580)	(0.727)	(0.999)	(0.766)
Mean employees	119.4382	124.2338	122.5497	126.6245	114.3798	110.2171
N	62.544	31.872	38.724	27.228	23.820	4.644
R^2	0.294	0.394	0.458	0.476	0.305	0.497
Adjusted R^2	0.283	0.381	0.448	0.464	0.287	0.469
Residual Std. Error	16.555 (df = 61638)	10.037 (df = 31207)	9.521 (df = 38028)	9.378 (df = 26639)	22.149 (df = 23205)	8.914 (df = 4396)

Notes: The dependent variable is employment growth at firm-auction level in each fortnight period (from -6 to 6). The model is estimated with the equation (1). The independent variables are the fortnight periods, the 'Won (dummy)' for auction winner, 'Log. of employees' is the natural log of the firms' number of employees -6 fortnights before the auction and firm specific fixed effects are included. The estimates are calculated using the package ('lfe', Gaure, 2013) and show the LATE, difference in employment growth rates between winners and runner-ups in close auction sample. The point estimates and standard errors are transformed to absolute employment increase based on the coefficients and the mean number of employees (given in 'Mean employees') at the beginning of the -6th fortnight.

***, **, * Significant at the 1, 5, 10 percent level.

Table A21: Effect of winning a close auction on future auction victories

	Within 30 days		Within 90 days		Within 180 days		Within 270 days		Within 360 days	
	Multiple bid	Single bid	Multiple bid	Single bid	Multiple bid	Single bid	Multiple bid	Single bid	Multiple bid	Single bid
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Close winner (within 10%)	−0.023	0.006	−0.179***	0.005	−0.278***	0.029	−0.401***	0.014	−0.421***	0.016
	(0.037)	(0.016)	(0.063)	(0.030)	(0.085)	(0.038)	(0.102)	(0.045)	(0.119)	(0.051)
N	2.674	2.674	2.674	2.674	2.674	2.674	2.674	2.674	2.674	2.674
R^2	0.312	0.306	0.506	0.423	0.656	0.615	0.726	0.678	0.757	0.722
Adjusted R^2	0.095	0.087	0.350	0.240	0.548	0.493	0.639	0.576	0.681	0.634
Residual Std. Error (df = 2032)	0.817	0.365	1.419	0.669	1.898	0.839	2.280	1.011	2.668	1.150

Notes: The dependent variable is the number of awarded PPC in a given period following a close auction victory. It is split by single- and multiple-bidder auctions & by 5 time-periods. Its independent variable is a dummy (which is equal to 1 if the bidder is a victor only in a close auction, and 0 if the bidder is a runner-up in a close auction). The control variable is unique firm ids (OIB).

***, **, * Significant at the 1, 5, 10 percent level.

Table A22: Effect of winning a close auction on future PPC awarded (natural log) value

	Within 30 days		Within 90 days		Within 180 days		Within 270 days		Within 360 days	
	Multiple bid	Single bid	Multiple bid	Single bid	Multiple bid	Single bid	Multiple bid	Single bid	Multiple bid	Single bid
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Close winner (within 10%)	−0.437	0.116	−0.803***	0.056	−0.644***	0.295	−0.942***	0.219	−0.961***	0.011
	(0.286)	(0.179)	(0.282)	(0.238)	(0.247)	(0.240)	(0.218)	(0.241)	(0.199)	(0.235)
N	2.674	2.674	2.674	2.674	2.674	2.674	2.674	2.674	2.674	2.674
R^2	0.304	0.296	0.485	0.420	0.594	0.562	0.659	0.601	0.688	0.647
Adjusted R^2	0.085	0.074	0.322	0.237	0.466	0.424	0.552	0.476	0.589	0.535
Residual Std. Error (df = 2032)	6.397	3.991	6.302	5.328	5.530	5.362	4.872	5.393	4.446	5.264

Notes: The dependent variable is the natural log value of awarded PPC in a given period following a close auction victory. It is split by single- and multiple-bidder auctions & by 5 time-periods. Its independent variable is a dummy (which is equal to 1 if the bidder is a victor only in a close auction, and 0 if the bidder is a runner-up in a close auction). The control variable is unique firm ids (OIB).

***, **, * Significant at the 1, 5, 10 percent level.

Table A23: Contamination of evaluation period and seasonality

	Main (within 10%)	In-season	Off-season	One auction victors	+ window	+ month
	(1)	(2)	(3)	(4)	(5)	(6)
-5	0.183	0.241	0.075	−0.466	0.183	0.183
	(0.551)	(0.629)	(0.915)	(0.853)	(0.487)	(0.549)
-4	0.390	0.613	−0.005	−0.428	0.390	0.390
	(0.551)	(0.629)	(0.915)	(0.853)	(0.487)	(0.549)
-3	0.384	0.528	−0.024	−0.383	0.384	0.384
	(0.551)	(0.629)	(0.915)	(0.853)	(0.487)	(0.549)
-2	0.678	0.647	0.157	−0.048	0.678	0.678
	(0.551)	(0.629)	(0.915)	(0.853)	(0.487)	(0.549)
-1	0.797	0.655	0.240	0.067	0.797	0.797
	(0.551)	(0.629)	(0.915)	(0.853)	(0.487)	(0.549)
0	1.110**	1.047*	0.420	0.558	1.110**	1.110**
	(0.551)	(0.629)	(0.915)	(0.853)	(0.487)	(0.549)
1	1.495***	1.362**	0.710	1.147	1.495***	1.495***
	(0.551)	(0.629)	(0.915)	(0.853)	(0.487)	(0.549)
2	1.602***	1.302**	1.100	1.486*	1.602***	1.602***
	(0.551)	(0.629)	(0.915)	(0.853)	(0.487)	(0.549)
3	2.008***	1.477**	1.837**	1.825**	2.008***	2.008***
	(0.551)	(0.629)	(0.915)	(0.853)	(0.487)	(0.549)
4	2.236***	1.645***	1.906**	1.986**	2.236***	2.236***
	(0.551)	(0.629)	(0.915)	(0.853)	(0.487)	(0.549)
5	2.450***	1.610**	1.884**	2.860***	2.450***	2.450***
	(0.551)	(0.629)	(0.915)	(0.853)	(0.487)	(0.549)
Won (dummy)	−0.272	−0.296	−0.221	−1.608**	−0.353	−0.273
	(0.395)	(0.453)	(0.656)	(0.653)	(0.375)	(0.394)
Log. of employees	−20.258***	−16.182***	−18.422***	−7.574***	−17.242***	−20.225***
	(0.451)	(0.484)	(0.697)	(0.492)	(0.507)	(0.451)
Mean employees	124.2338	123.1657	117.4026	85.7815	124.2338	124.2338
N	31.872	22.092	40.452	7.524	31.872	31.872
R^2	0.394	0.456	0.295	0.495	0.545	0.398
Adjusted R^2	0.381	0.443	0.281	0.463	0.516	0.385
Residual Std. Error	10.037 (df = 31207)	9.547 (df = 21548)	18.776 (df = 39671)	7.555 (df = 7082)	8.869 (df = 30008)	10.002 (df = 31196)

Notes: Columns (2) and (3) split the sample in 2 parts, column (2) contains each auction awarded from April to (including) October. Column (4) examines the effect on the victors whose only winning bid during the next 3 months is from the observed auction. Final two columns include the value a bidder won during the next 3 months (in column (5)), and month in which the auction was awarded (column (6)) as additional control variables.
The dependent variable is employment growth at firm-auction level in each fortnight period (from -6 to 6). The model is estimated with the equation (1). The independent variables are the fortnight periods, the 'Won (dummy)' for auction winner, 'Log. of employees' is the natural log of the firms' number of employees -6 fortnights before the auction and firm specific fixed effects are included. The estimates are calculated using the package ('lfe', Gaure, 2013) and show the LATE, difference in employment growth rates between winners and runner-ups in close auction sample. The point estimates and standard errors are transformed to absolute employment increase based on the coefficients and the mean number of employees (given in 'Mean employees') at the beginning of the -6th fortnight.
***, **, * Significant at the 1, 5, 10 percent level.

Figure A3: Histograms for winner distribution by timing (in minutes)

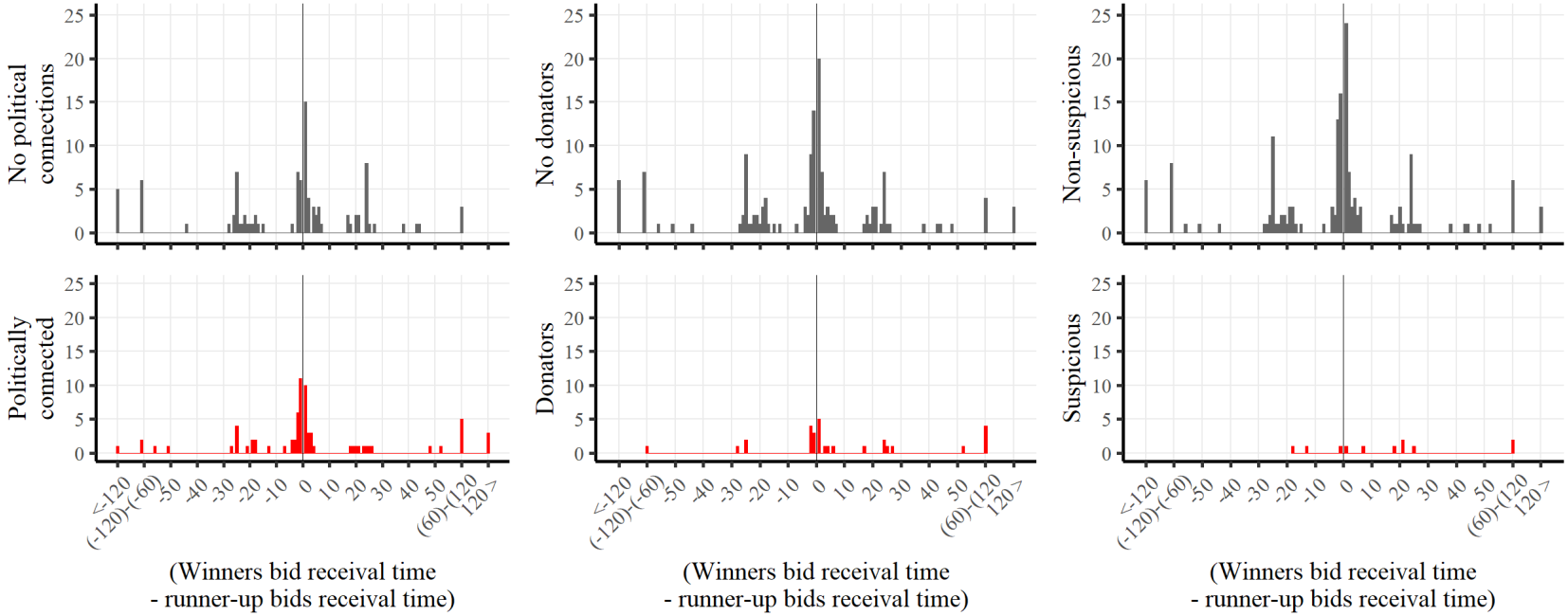


Figure A4: Histograms for timing by political connection distribution by auctions size (in minutes)

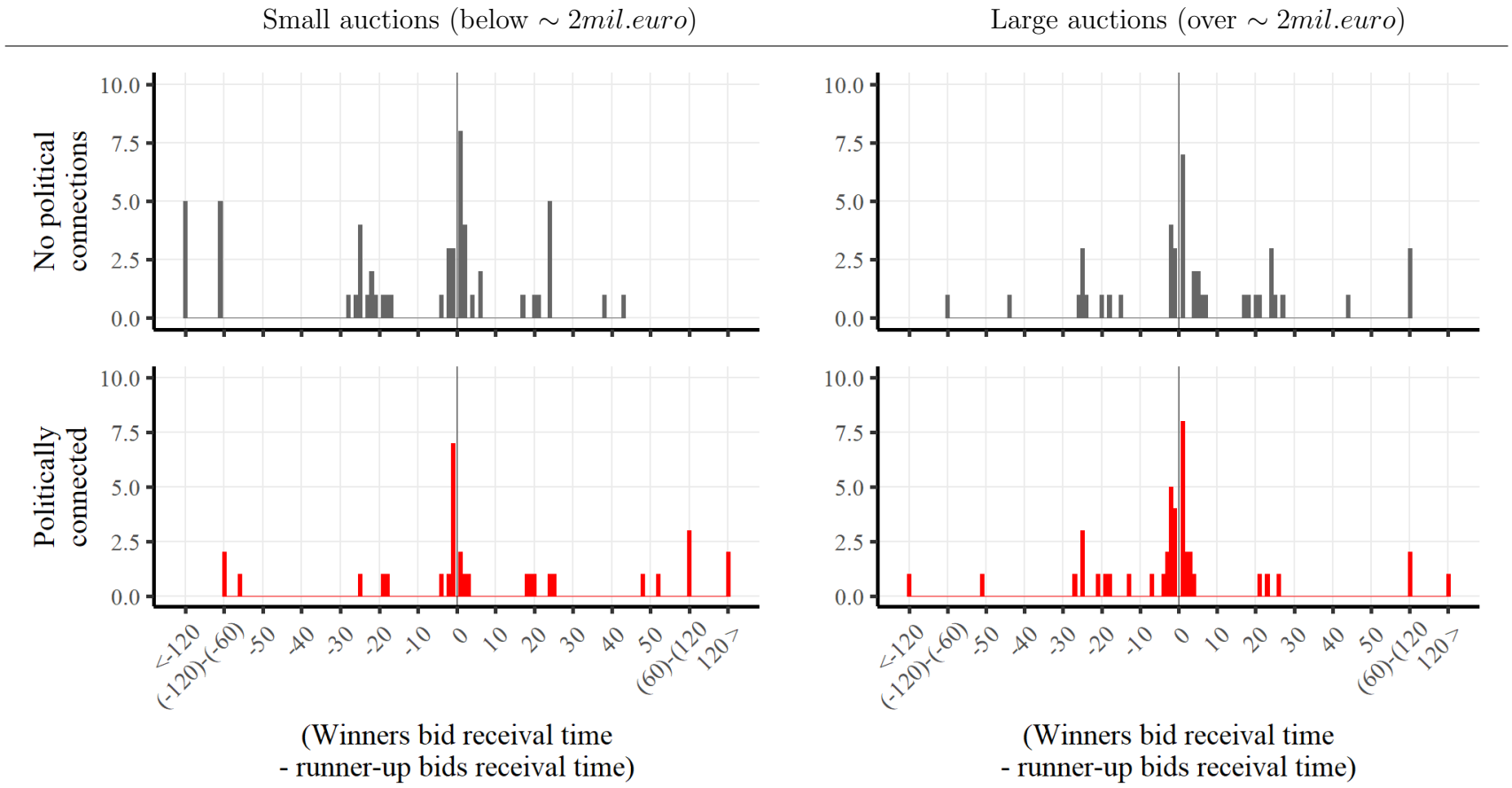


Table A24: Bidder distribution in 171 auctions examined in timing

		Pol. conn. count	Pol. conn. share	Donators count	Donators share	Sus. firms count	Sus. firms share
Winners	Dummy = 0	96	0.56	142	0.83	160	0.94
	Dummy = 1	75	0.44	29	0.17	11	0.06
	No dummy	171	1	171	1	171	1
Runner-ups	Dummy = 0	18	0.11	153	0.89	171	1.00
	Dummy = 1	153	0.89	18	0.11	0	0.00
	No dummy	171	1	171	1	171	1
Both	Dummy = 0	114	0.33	295	0.86	331	0.97
	Dummy = 1	228	0.67	47	0.14	11	0.03
	No dummy	342	1	342	1	342	1

Notes: The dummy is auction specific, and equal to 1 if the winning bid was received before the runner-ups, 0 otherwise.

Table A25: Bid timing

		Time difference (in minutes)		
	Dummy	Total	Dummy = 0	Dummy = 1
Min.	0.00	−287.57	0.02	−287.57
1st Qu.	0.00	−17.71	0.84	−24.00
Median	0.00	0.02	5.67	−17.94
3rd Qu.	1.00	5.67	24.00	−1.17
Max.	1.00	432.00	432.00	0.00
Mean	0.50	−2.59	27.47	−33.00

Notes: The table shows the bid timing data on a sample of close bids for which the exact receival time of each bid was available. We examine 268 auctions in 2018, of which the bid timing data was available for 171 (63.81%). The dummy is auction specific, and equal to 1 if the winning bid was received before the runner-ups, 0 otherwise. The time difference represents the time difference between the receival time of the winning bid & the receival time of the runner-up bid (which is negative if the winning bid was received first).

Table A26: Long-term effects on employment

	Main (within 10%)	Within 8%	Within 6%	Within 4%	4% to 0.5%
	(1)	(2)	(3)	(4)	(5)
-5	0.181	0.297	0.141	0.260	0.321
-4	0.397	0.495	0.387	0.547	0.654
-3	0.409	0.417	0.319	0.527	0.502
-2	0.709	0.728	0.556	0.840	0.620
-1	0.829	0.764	0.541	0.901	0.735
0	1.139	1.044	0.763	1.085	1.004
1	1.525*	1.452*	1.093	1.192	1.131
2	1.624*	1.502*	1.206	1.209	1.151
3	2.023**	1.866**	1.639*	1.620	1.526
4	2.241**	1.962**	1.801*	1.936*	1.884*
5	2.450***	2.175**	1.939**	2.063**	2.163**
6	2.384***	2.186**	1.909**	2.093**	2.148*
7	2.229**	2.020**	1.805*	2.164**	2.162**
8	1.952**	1.751**	1.614*	2.048**	1.923*
9	1.930**	1.635*	1.598*	1.877*	1.698
10	2.037**	1.487*	1.408	1.662	1.403
11	2.143**	1.482*	1.393	1.672	1.165
12	1.786**	1.111	1.004	1.409	0.747
13	1.828**	1.087	1.033	1.378	0.699
14	1.924**	1.041	0.911	1.410	0.827
15	1.998**	1.168	1.085	1.489	0.743
16	1.813**	0.906	0.820	1.248	0.430
17	1.592*	0.602	0.438	0.706	−0.168
18	1.694*	0.536	0.567	1.027	0.290
19	1.509*	0.361	0.646	1.079	0.382
20	1.119	−0.109	0.386	0.781	0.175
Won (dummy)	−0.171	−0.076	−0.004	−0.311	0.175
	(0.632)	(0.622)	(0.661)	(0.734)	(0.787)
Log. of employees	−36.671***	−59.994***	−60.187***	−56.725***	−59.739***
	(0.485)	(0.661)	(0.702)	(0.808)	(0.897)
Mean employees	124.3356	121.0558	122.6488	123.6177	122.2624
N	71.766	62.100	49.113	36.207	29.943
R^2	0.447	0.483	0.507	0.536	0.569
Adjusted R^2	0.441	0.477	0.501	0.529	0.562
Residual Std. Error	16.198 (df = 71071)	14.810 (df = 61453)	13.974 (df = 48525)	13.298 (df = 35699)	12.955 (df = 29481)

Notes: The dependent variable is employment growth at firm-auction level in each fortnight period (from -6 to 20). The model is estimated with the equation (2). The independent variables are the fortnight periods, the 'Won (dummy)' for auction winner, 'Log. of employees' is the natural log of the firms' number of employees -6 fortnights before the auction and firm specific fixed effects are included. The estimates are calculated using the package ('lfe', Gaure, 2013) and show the LATE, difference in employment growth rates between winners and runner-ups in close auction sample. The point estimates and standard errors are transformed to absolute employment increase based on the coefficients and the mean number of employees (given in 'Mean employees') at the beginning of the -6th fortnight.

***, **, * Significant at the 1, 5, 10 percent level.

Table A27: Effects of winning a PPC on market and public revenue: close auction sample

	Period t - 1		Period t		Period t + 1	
	Public revenue	Market revenue	Public revenue	Market revenue	Public revenue	Market revenue
	(1)	(2)	(3)	(4)	(5)	(6)
PPC win	−0.087	0.021	0.543***	−0.057***	−0.277**	0.006
	(0.091)	(0.015)	(0.074)	(0.012)	(0.115)	(0.009)
N	3.118	2.659	3.118	2.778	3.118	1.507
R^2	0.919	0.973	0.917	0.980	0.878	0.996
Adjusted R^2	0.888	0.961	0.884	0.972	0.830	0.993
Residual Std. Error	2.091 (df = 2239)	0.311 (df = 1855)	1.703 (df = 2239)	0.267 (df = 1966)	2.650 (df = 2239)	0.136 (df = 904)

Notes: OLS models on the subsample of close auction within 10% win margin. Both dependent variables, the public revenue and the market revenue are in natural logs. Main independent variable is a dummy indicating whether a firm is winner or runner-up in an auction. Period t-1 is the accounting year before the year of auction result, t is year of auction result, and t+1 year after. Unit of observation is firm-auction. All models include firm fixed effects and a control variable for firm size (number of employees).

***, **, * Significant at the 1, 5, 10 percent level.

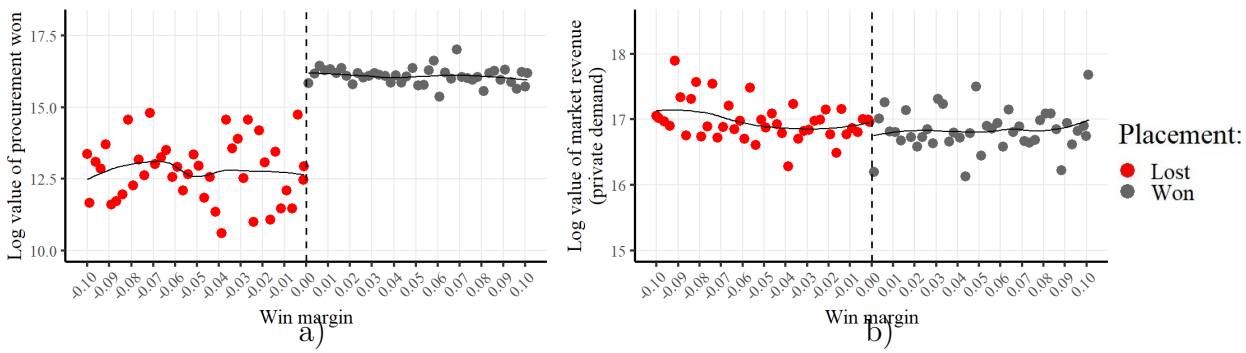
Table A28: Effects of winning a PPC on growth in market and public revenue: close auction sample

	Period (t) - period (t - 1)		Period (t + 1) - period (t - 1)	
	Public revenue	Market revenue	Public revenue	Market revenue
	(1)	(2)	(3)	(4)
PPC win	0.630***	−0.071***	−0.190	−0.014
	(0.129)	(0.023)	(0.163)	(0.014)
N	3.118	2.468	3.118	1.427
R^2	0.808	0.789	0.763	0.967
Adjusted R^2	0.732	0.695	0.670	0.945
Residual Std. Error	2.968 (df = 2239)	0.456 (df = 1709)	3.751 (df = 2239)	0.189 (df = 851)

Notes: OLS models on the subsample of close auction within 10% win margin. Both dependent variables, the public revenue and the market revenue are calculated as the difference in natural logs between periods t and t-1 and t+1 and t-1. Period t-1 is the accounting year before the year of auction result, t is year of auction result, and t+1 year after. Unit of observation is firm-auction. Main independent variable is a dummy indicating whether a firm is winner or runner-up in an auction. All models include firm fixed effects and a control variable for firm size (number of employees).

***, **, * Significant at the 1, 5, 10 percent level.

Figure A5: PPC value won vs. market value acquired



Notes: the X-axis represents the "win margin" of a bid, it is essentially the criteria we use for defining "closeness" in an auction (see method), only we multiply it by -1 if the bid is a losing one. The Y-axis represents the natural log of the total procurement value won by a firm, graph a), and on graph b) the natural log of the firms revenue in the examined year. Points represent bins which are formed according to the win margin (sizes of 0.0025).

Table A29: The Impact of PPC on Firms' Employment by PPC size

	Main	Below 100,000 €	100,000 to 500,000 €	500,000 to 1,500,000 €	Above 1,500,000 €
	(1)	(2)	(3)	(4)	(5)
-5	0.183	0.333	0.191	0.172	−0.328
	(0.551)	(1.043)	(0.640)	(1.168)	(2.720)
-4	0.390	0.194	0.684	−0.304	−0.350
	(0.551)	(1.043)	(0.640)	(1.168)	(2.720)
-3	0.384	0.259	0.582	−0.061	0.212
	(0.551)	(1.043)	(0.640)	(1.168)	(2.720)
-2	0.678	0.929	0.703	0.415	0.704
	(0.551)	(1.043)	(0.640)	(1.168)	(2.720)
-1	0.797	1.017	0.715	0.760	1.589
	(0.551)	(1.043)	(0.640)	(1.168)	(2.720)
0	1.110**	0.896	0.991	1.449	2.376
	(0.551)	(1.043)	(0.640)	(1.168)	(2.720)
1	1.495***	1.003	1.364**	1.997*	3.218
	(0.551)	(1.043)	(0.640)	(1.168)	(2.720)
2	1.602***	0.664	1.493**	2.366**	3.876
	(0.551)	(1.043)	(0.640)	(1.168)	(2.720)
3	2.008***	0.854	1.988***	2.481**	4.336
	(0.551)	(1.043)	(0.640)	(1.168)	(2.720)
4	2.236***	0.473	2.323***	2.801**	4.804*
	(0.551)	(1.043)	(0.640)	(1.168)	(2.720)
5	2.450***	0.360	2.433***	2.791**	7.355***
	(0.551)	(1.043)	(0.640)	(1.168)	(2.720)
Won (dummy)	−0.272	0.616	−0.372	0.018	−2.606
	(0.395)	(0.785)	(0.462)	(0.852)	(2.007)
Log. of employees	−20.258***	−37.265***	−13.381***	−39.694***	−50.210***
	(0.451)	(1.625)	(0.455)	(1.603)	(3.319)
Mean employees	124.2338	93.2281	107.1458	147.6345	208.8068
N	31.872	4.104	18.276	6.600	3.540
R^2	0.394	0.568	0.423	0.505	0.465
Adjusted R^2	0.381	0.541	0.406	0.484	0.439
Residual Std. Error	10.037 (df = 31207)	6.817 (df = 3866)	8.825 (df = 17763)	9.686 (df = 6330)	16.518 (df = 3377)

Notes: Column (1) shows the estimates for the main sample of auctions within 10%. Columns 2-5 show results for PPC auctions depending on the estimated PPC value and pre-defined dosages.
The dependent variable is employment growth at firm-auction level in each fortnight period (from -6 to 20). The model is estimated with the equation (2). The independent variables are the fortnight periods, the 'Won (dummy)' for auction winner, 'Log. of employees' is the natural log of the firms' number of employees -6 fortnights before the auction and firm specific fixed effects are included. The estimates are calculated using the package ('lfe', Gaure, 2013) and show the LATE, difference in employment growth rates between winners and runner-ups in close auction sample. The point estimates and standard errors are transformed to absolute employment increase based on the coefficients and the mean number of employees (given in 'Mean employees') at the beginning of the -6th fortnight.
***, **, * Significant at the 1, 5, 10 percent level.

Table A30: Various effects on employment

		Outsourcing share (split by median)		External labour over total labour costs (split by median)	
	Main	(below 31.3%)	(above 31.3%)	(below 38.3%)	(above 38.3%)
	(1)	(2)	(3)	(4)	(5)
-5	0.183	0.093	0.208	0.122	0.157
	(0.551)	(0.558)	(0.872)	(0.564)	(0.837)
-4	0.390	0.278	0.259	0.278	0.238
	(0.551)	(0.558)	(0.872)	(0.564)	(0.837)
-3	0.384	0.294	0.073	0.270	0.076
	(0.551)	(0.558)	(0.872)	(0.564)	(0.837)
-2	0.678	0.551	0.320	0.426	0.477
	(0.551)	(0.558)	(0.872)	(0.564)	(0.837)
-1	0.797	0.752	0.205	0.608	0.365
	(0.551)	(0.558)	(0.872)	(0.564)	(0.837)
0	1.110**	1.175**	0.013	1.014*	0.131
	(0.551)	(0.558)	(0.872)	(0.564)	(0.837)
1	1.495***	1.537***	0.036	1.341**	0.167
	(0.551)	(0.558)	(0.872)	(0.564)	(0.837)
2	1.602***	1.562***	0.183	1.630***	−0.135
	(0.551)	(0.558)	(0.872)	(0.564)	(0.837)
3	2.008***	1.919***	0.682	2.058***	0.220
	(0.551)	(0.558)	(0.872)	(0.564)	(0.837)
4	2.236***	2.193***	0.796	2.168***	0.569
	(0.551)	(0.558)	(0.872)	(0.564)	(0.837)
5	2.450***	2.470***	0.603	2.066***	0.973
	(0.551)	(0.558)	(0.872)	(0.564)	(0.837)
Won (dummy)	−0.272	−0.655	0.571	−0.591	0.302
	(0.395)	(0.403)	(0.622)	(0.409)	(0.597)
Log. of employees	−20.258***	−33.198***	−40.340***	−38.964***	−30.700***
	(0.451)	(0.784)	(0.921)	(0.664)	(0.986)
Mean employees	124.2338	100.0533	137.7475	92.9547	145.9471
N	31.872	15.768	14.640	15.888	14.508
R^2	0.394	0.508	0.395	0.518	0.349
Adjusted R^2	0.381	0.493	0.384	0.503	0.339
Residual Std. Error	10.037 (df = 31207)	7.149 (df = 15313)	10.763 (df = 14368)	7.259 (df = 15420)	10.289 (df = 14275)

Notes: The dependent variable is employment growth at firm-auction level in each fortnight period (from -6 to 20). The model is estimated with the equation (2). The independent variables are the fortnight periods, the 'Won (dummy)' for auction winner, 'Log. of employees' is the natural log of the firms' number of employees -6 fortnights before the auction and firm specific fixed effects are included. The estimates are calculated using the package ('lfe', Gaure, 2013) and show the LATE, difference in employment growth rates between winners and runner-ups in close auction sample. The point estimates and standard errors are transformed to absolute employment increase based on the coefficients and the mean number of employees (given in 'Mean employees') at the beginning of the -6th fortnight

***, **, * Significant at the 1, 5, 10 percent level.

Table A31: Heterogeneous effects - firms' costs for agency workers as share of total labour costs

	Within 10% (main)	1st bin (0%)	2nd bin (1% - 28%)	3rd bin (29% - 47%)	4th bin (48% - 65%)	5th bin (66% +)
	(1)	(2)	(3)	(4)	(5)	(6)
-5	0.183	0.382	0.301	−0.145	−0.495	0.659
	(0.551)	(1.313)	(1.093)	(0.932)	(1.079)	(1.231)
-4	0.390	0.438	0.693	0.116	−0.768	0.915
	(0.551)	(1.313)	(1.093)	(0.932)	(1.079)	(1.231)
-3	0.384	0.063	1.102	−0.034	−0.513	0.397
	(0.551)	(1.313)	(1.093)	(0.932)	(1.079)	(1.231)
-2	0.678	0.957	1.153	−0.186	−0.009	0.362
	(0.551)	(1.313)	(1.093)	(0.932)	(1.079)	(1.231)
-1	0.797	1.805	1.044	−0.260	0.084	−0.067
	(0.551)	(1.313)	(1.093)	(0.932)	(1.079)	(1.231)
0	1.110**	2.367*	1.654	−0.075	−0.390	−0.101
	(0.551)	(1.313)	(1.093)	(0.932)	(1.079)	(1.231)
1	1.495***	2.623**	2.256**	0.035	−0.303	0.008
	(0.551)	(1.313)	(1.093)	(0.932)	(1.079)	(1.231)
2	1.602***	3.051**	2.843***	−0.622	−0.191	−0.162
	(0.551)	(1.313)	(1.093)	(0.932)	(1.079)	(1.231)
3	2.008***	3.819***	3.640***	−0.981	0.571	−0.019
	(0.551)	(1.313)	(1.093)	(0.932)	(1.079)	(1.231)
4	2.236***	4.127***	3.621***	−1.101	0.807	0.740
	(0.551)	(1.313)	(1.093)	(0.932)	(1.079)	(1.231)
5	2.450***	3.856***	3.142***	−0.322	0.768	1.346
	(0.551)	(1.313)	(1.093)	(0.932)	(1.079)	(1.231)
Won (dummy)	−0.272	−1.227	−1.218	−0.077	0.040	0.391
	(0.395)	(0.955)	(0.796)	(0.668)	(0.772)	(0.879)
Log. of employees	−20.258***	−49.823***	−61.618***	−39.603***	−36.372***	−20.223***
	(0.451)	(1.306)	(2.430)	(1.481)	(1.406)	(1.464)
Mean employees	124.2338	45.0804	127.7355	142.9283	113.1478	174.929
N	31.872	6.720	6.396	5.856	5.844	5.580
R^2	0.394	0.486	0.594	0.427	0.404	0.359
Adjusted R^2	0.381	0.468	0.579	0.412	0.390	0.345
Residual Std. Error	10.037 (df = 31207)	10.987 (df = 6490)	8.921 (df = 6165)	7.277 (df = 5709)	8.415 (df = 5708)	9.382 (df = 5461)

Notes: We split the data into 5 similarly sized samples according to the bidders share of costs for agency workers in the total labour costs.
The dependent variable is employment growth at firm-auction level in each fortnight period (from -6 to 20). The model is estimated with the equation (2). The independent variables are the fortnight periods, the 'Won (dummy)' for auction winner, 'Log. of employees' is the natural log of the firms' number of employees -6 fortnights before the auction and firm specific fixed effects are included. The estimates are calculated using the package ('lfe', Gaure, 2013) and show the LATE, difference in employment growth rates between winners and runner-ups in close auction sample. The point estimates and standard errors are transformed to absolute employment increase based on the coefficients and the mean number of employees (given in 'Mean employees') at the beginning of the -6th fortnight.

***, **, * Significant at the 1, 5, 10 percent level.

Table A32: Characteristics of winners' new employees: education level, sources of previous employment and mean age

Education level	Previous employment	No. of new employees	Mean employee age
Higher Educated	Different firm	240	38.56
	No previous employment	538	32.89
	Same firm	488	35.80
	Total	1266	35.08
Lower Educated	Different firm	1332	38.49
	No previous employment	3976	34.62
	Same firm	4711	38.65
	Total	10019	37.03
Any education level	Different firm	1572	38.50
	No previous employment	4514	34.41
	Same firm	5199	38.38
	Total	11285	36.81

Table A33: The sector where the winners' unique new employees were previously employed: subsample of employees coming from different firm

Sector of previous employment	No. of new employees
F - Construction	1145
C - Manufacturing	146
G - Wholesale and retail trade; repair of motor vehicles and motorcycles	110
M - Professional, scientific and technical activities	55
N - Administrative and support service activities	40
H - Transportation and storage	27
E - Water supply, sewerage, waste management and remediation activities	14
B - Mining and quarrying	10
L - Real estate activities	10
I - Accommodation and food service activities	4
D - Electricity, gas, steam and air conditioning supply	3
J - Information and communication	3
A - Agriculture, forestry and fishing	2
R - Arts, entertainment and recreation	2
S - Other service activities	1
Total	1572

Table A34: Professions of the winners new employees

NKD code	Number of new employees
(7122) Masons	996
(7124) Carpenters & joiners	799
(9911) Workers without occupations	774
(9312) Civil engineering workers	638
(8332) Operators of construction-, and similar machinery	634
(8324) Drivers of heavy goods vehicles and towing vehicles	602
(3112) Architectural, civil and geodetic engineers and technicians	571
(7222) Toolmakers and related occupations	438
(7129) Other masonry occupations	389
(9132) Cleaners and maids	361
In top 10 professions	6202
Total	11285

Table A35: Quantification

		Auction awarded value			Quantification of a single employee		
		Median	Mean	Obs.	Employee effect	Cost (by Median)	Cost (by Mean)
Entire sample		178506.67	721422.24	2859.00	1.82	98080.59	396385.80
By bid "closeness"	10%	206294.67	804698.65	1436.00	2.45	84201.90	328448.43
	.5% to 4%	214906.13	641032.67	610.00	2.167	99172.19	295815.7
By agency expenses	2nd quantile	176805.47	782083.31	484.00	3.64	48572.93	214858.10
	1st quantile	186612.00	537966.51	511.00	4.127	45217.35	130352.90
By auction size	< 100,000€	62252.27	55558.84	201.00	0.85	72894.93	65057.19
	100,000€–500,000€	162488.93	187529.35	816.00	2.43	66785.42	77077.42
	500,000€–1,500,000€	635793.07	682022.80	290.00	2.79	227801.17	244365.03
	> 1,500,000€	1989373.97	5199027.43	158.00	7.36	270479.13	706869.81

Notes: All monetary values are given in euros. VAT is excluded.

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Public procurement and supplier job creation: Insights from auctions

Abstract
Public procurement contracts (PPCs) of goods, services and works is about one tenth of global gross domestic product. Much research has been conducted on government spending and its aggregate effects, but evidence is scarce at the micro-level. This study exploits sealed-bid PPC auctions of construction works, discontinuity in bidders' win margin and firms' daily employment variation to provide a causal estimate of winning a PPC on firms' employment. Winning a PPC has a small positive impact on a firm's short-run employment. The study investigates mechanisms and heterogeneity that can explain the initial small magnitudes. No compelling evidence is found in favour of political connections, an information leakage channel or PPC size as explanations for the small magnitude. A investigation of longer period shows the impact phases out in less than a year. The lack of a long-term impact is due to runners-up winning more PPCs and runners-up substituting towards more market revenue in the year after closely losing a PPC. Finally, the impacts are concentrated in construction firms that conduct the majority of contracted work in-house. The final estimation shows the effect is about four new employees per PPC with a public cost per job created at €45,200 [€34,200 – €66,200].

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