

Procurement, Competition and Market Power*

Sampreet Goraya[†]

Jurica Zrnc[‡]

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Abstract

We provide evidence of market power in public procurement. Firms with ex-ante similar markups witness a 10% increase after winning a public procurement contract relative to firms which sell only to the private sector. Parallel with this increase in markups, profits increase as well, while labor share declines. Limited competition in public procurement is a potential driver behind these findings, given that 35% of contracts are awarded in a single bid procurement procedure. We show that single bid procurement consistently incurs higher prices than expected by the procuring body relative to a multi-bid setting, even for standardized products. Similarly, single bid procedures are also associated with an increase in firm-level markups.

Keywords: Procurement, Markups, Concentration, Competition, Labor Share.

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[†]Department of Economics, Stockholm School of Economics. Email: sampreet.goraya@hhs.se

[‡]Croatian National Bank and University of Vienna. Email: jurica.zrnc@univie.ac.at

1 Introduction

Every year around 250,000 government authorities indulge into public procurement that represents 14% of the Eurozone's GDP.¹ Despite its large size, there is a growing evidence that only handful of firms take part in the procurement process which raises the concerns about low competition and high market power of firms in this sector.² Thriving competition among firms helps the government agencies to carry out their mission by procuring best-quality of goods and services at the lowest price possible.³ In the absence of competition, firms gain market power and command high prices. Market power in the procurement sector has implications for the public budget but it may also spill over to the private sector which may lead to a decline in the labor demand, business dynamics and innovation.

Despite the importance of procurement sector in the overall economy, there is a lack of systematic evidence on the degree of competition in the procurement process, spanning all the sectors of the economy and over time.⁴ In this article, our main goal is to document market power in the procurement sector for the Croatian economy. First, we analyze markups, the ability of sellers to price their goods above marginal cost. This measure is of particular importance because it is informative about the underlying production technology and efficiency relative to other measures of market power such as Herfindahl-Hirschman Index. Based on firm-level data, we find that firms that are active in the procurement sector charge 10% percent higher markups than firms that only sell goods in the private sector. This markup premium for procurement firms increases with the share of sales coming for procurement sector (procurement intensity). Furthermore, we find strong positive association between markups, our proxies for prices in public procurement and the number of bids for a contract. We show that single bid procurement procedures consistently incur higher prices than expected by the procuring body relative to a multi bid setting, even for standardized products.

In principle, markups for procurement firms may be high because overhead costs or fixed costs of producing for government are high. These costs may stem from bureaucratic/administrative costs of bidding in the procurement process. In that case, the firm charges prices well above marginal costs to cover these excess costs. Therefore, markups alone can not be associated directly with market power. We thus also analyze measures of profitability (earning before taxes as share of total sales) that take into account not only the marginal cost but total costs for firms. We find that procurement firms tend to have much higher profits

¹See, for instance, [European Commission \(2017a\)](#).

²[Kang and Miller \(2017\)](#), for instance, document that 44 percent of the procurement budget was paid to contracts that attracted a single bid during fiscal year 2015 in United States. In EU co-funded projects, [European Commission \(2019\)](#) also documents a large share of single bidder contracts in European countries.

³Competitive bidding can be a powerful tool to reduce procurement prices, [Bulow and Klemperer \(1996\)](#).

⁴There is a rich, both theoretical and empirical literature in Industrial organization that documents level of competition in some specific cases.

relative to non-procurement firms.

In general, measuring market power is hard. It is even harder in our setting as firms produce in two different sectors: private and procurement, where they face different demand functions. Moreover, both production decision and amount of quantity sold in procurement sector is driven by non-market forces such as political connections and government policies which are hard to observe in a usual firm-level dataset. Therefore, in order to rigorously study markups for procurement firms, we need a detailed, large-scale micro dataset on firms, their procurement history, and their political affiliations.

To this end, we construct a new dataset for the Croatian economy, spanning the entire period of 2013-2019, wherein we merge: (i) firm-level balance sheet data; (ii) administrative data on procurement contracts above 25,000 euros; (iii) court registry data on firms and manager of firms; (iv) registry of politicians that contain information of ownership and employment histories of local and central government officials. The nature of this data allows us to exploit rich heterogeneity in the type of procurement contract across different sectors of the economy to understand the degree of competition and its implications for the markups.

We use the above mentioned dataset to measure markups at the firm-level. To do so, we follow recent advancements in the literature on markup estimation by [De Loecker and Warzynski \(2012\)](#) and [De Loecker et al. \(2020\)](#), and rely on individual firm output and input data. Together with the assumption of cost minimization at firm-level, a measure of the markup is obtained for each firm at a given point in time as the wedge between a variable input's expenditure share in revenue, i.e., directly observed in the data, and that output elasticity of variable input. The latter is obtained by estimating the associated production function. The advantage of this approach is that the production approach does not require to model demand for many heterogeneous markets, such as private and procurement, over a period of time.

The procurement process is a complicated endeavour where rules and regulation poses many challenges for the economists to infer demand functions. Furthermore, each auction has different properties that ties ones' hands and limit the analyses to a specific set of auctions or a certain procurement agency. This is the reason that we adopt the methodology as in [De Loecker and Warzynski \(2012\)](#) because it helps to ignore the microcosm of the underlying allocation mechanism and measure market power for broad range of procurement activity in the economy. Needless to say that this convenience comes at a cost of assumptions that help us identify the markups using financial statements data. Furthermore, we only estimate one markup for each firm in a given year rather than separate markups for private and procurement markets. However, even with these limitations, this methodology helps us to understand the conditions under which these firms sell goods and services to government.

We use our empirical model to estimate markups for Croatian firms jointly with the production technology, and test whether procurement firms, on average, have different

markups relative to firms that only produce in the private sector.⁵ We document a significant and positive markup premium for procurement firms in all the major sectors of the economy. For instance, the markup premium stands at 4% in manufacturing, 24% in construction sector and 6% in wholesale and retail sector.⁶ We also find that large proportion of firms only have a minority of their sales coming from procurement sector whereas there are few firms that have a majority of sales coming from procurement activities. The mean yearly procurement intensity, defined as the share of procurement sales over total sales is 32% and markup premium increases sharply with procurement intensity.

We explore to what extent high markups in the procurement sector are associated with low competition. To do so, we exploit another dimension of our data that provides the number of bids for individual procurement auctions. Firms that enter into procurement with contracts for which there was only one bid (single bidder) charge even higher markups relative to multi-bid contracts. Furthermore, we corroborate our findings of positive procurement markup premium with the data on the differential between the estimated price by the government and the actually attained price in auctions. The estimate and actual contract value differential is 6% higher for the single-bid relative to multi-bid setting, even after controlling for firm-year-8 digit product-county fixed effects. The price differential is similar also when we restrict the sample to standardized products such as printing paper following [Bandiera et al. \(2009\)](#).

We then analyze firm profitability. The objective is to analyze whether markups have not increased exclusively due to a rise in overhead/administrative costs that are associated with procurement process. To address this issue, we calculate the profit rate, which is total sales minus all cost (including overhead and the expenditure on capital) as a share of sales. We find that firms in procurement sector do have higher profits relative to firms that only operate in the private sector in all sectors of the economy. For instance, procurement firms in manufacturing sector have 3 percentage points higher profits, whereas in construction sector they have 6 percentage points higher profits relative to non-procurement firms. These magnitudes are large as the average profit rate is close to 1.5 percent (of sales). We also find in a staggered difference in differences framework that after winning procurement contracts firm profits increase.

We analyse firm-level labor share that has gained a lot of attention in the recent times.⁷ In particular, we analyze how the rise in markups is associated with the labor share after firms enter procurement sector. We find a negative relation between procurement activity and labor share in all the sectors. We also find this result when comparing the dynamics of labor share after winning the procurement contract. This is in line with the theoretical

⁵We follow a two-stage estimation procedure following [Akerberg et al. \(2015\)](#).

⁶Together these three sector, constitutes around 85% of the sales and procurement values within in our sample.

⁷See, for instance, [Autor, Dorn, Katz, Patterson, and Van Reenen \(2020\)](#) and [Kehrig and Vincent \(2021\)](#).

literature, for instance, [Atkeson and Burstein \(2008\)](#), where high markups firms also have labor share. In conjunction, this also highlights the concerns for monopsony power and subsequent wage suppression in the labor markets.

Finally, we estimate dynamic effects of public procurement. We use the staggered difference in differences design to show how the evolution of our variables interest changed prior and after winning the procurement contracts. This design also allows us to discuss the plausibility of a causal interpretation of our estimates. We find very similar results as in the cross-sectional analysis. Before winning the public procurement contract, markups of treated and not treated firms were statistically similar, while at the year of winning the procurement contract markups increase by 10%. In the following years there is no effect of procurement on markups, suggesting that price increases are driving our results and not shocks to productivity, as these are persistent (see e.g. [Foster et al., 2008](#)). We find that firms increase profits, employment and decrease labor share after winning a public procurement tender. We also check the robustness of our results to heterogeneous treatment effects by using the estimator from [De Chaisemartin and d'Haultfoeuille \(2020a\)](#).

This paper is related to the literature that documents the effects of procurement on firm dynamics, for instance, [Colonnelli and Prem \(2017\)](#) highlights the negative impact of corruption in procurement on local entrepreneurial activity, [di Giovanni, García-Santana, Jeenas, Moral-Benito, and Pijoan-Mas \(2022\)](#) focus on the high collateralizability of cash-flows emerging from procurement sectors, and [Ferraz, Finan, and Szerman \(2015\)](#) and [Gugler, Weichselbaumer, and Zulehner \(2020\)](#) documents the growth effects of winning a procurement contract. Relative to all these papers, we focus on how procurement activity affects markups at the firm-level.

There are a few papers that have directly studied empirically the relation between competition and rents in the procurement sector. For instance, [Kang and Miller \(2017\)](#) looks into ICT industry and highlight the role of costs in determining the number of bidders in government auctions, whereas [Kroft, Luo, Mogstad, and Setzler \(2020\)](#) focus on construction sector in the US and estimates labor both labor and product market power together. [Carril and Duggan \(2020\)](#) studies the effects of large mergers on competition in US defense sector. [Gugler, Weichselbaumer, and Zulehner \(2015\)](#) documents the effects of crisis on competition in procurement in Austrian construction sector. Relative to all these papers, we estimated the market power for all the firms active in procurement sector and link that to other firm-level outcomes such as firm-level labor share.

This paper is also linked to a comprehensive literature in Industrial Organization on market structure in procurement sector. [Laffont and Tirole \(1987\)](#), [Laffont and Tirole \(1990\)](#), [Laffont and Tirole \(1993\)](#), [Goldberg \(1977\)](#), and [Bajari and Tadelis \(2001\)](#) propose a theoretical framework of procurement contracts that emphasizes the choice of contract terms as a means for influencing the ex post performance of the underlying project. Subsequently, there are empirical papers studying the interplay between competitive mechanisms and contract

outcomes (Spulber 1990, Bajari, McMillan, and Tadelis 2009, Warren 2014, and Decarolis 2014).

The organization of the paper is as follows. In the next section, we describe the construction of our main dataset and provide descriptive statistics. Section 3 documents the institutional setting, highlighting the main features of procurement in Croatia. In Section 4, we present structural framework to estimate markups and in Section 5 we discuss main results. In Section 6, we conclude.

2 Data and Measurement

We tap on data from multiple administrative sources to build a comprehensive dataset on firms, procurement contracts, workers and politicians in Croatia for the period of 2013-2019. The core of this data construction is the firm level financial statements that are collected by the Financial agency (FINA). We combine it with the administrative dataset, collected by the Ministry of Economy and Sustainable Development, on public procurement contracts allocated to firms. Furthermore, we merge this dataset with court registry data on firm owners and managers and then link it with registry of politicians to construct our proxy for political networks. In this section, we give details about the multiple administrative sources used to build our dataset and further, provide additional definitions relevant to the analysis.

Firm level financial statements are collected by the Financial agency (FINA). All non-financial companies in Croatia are obliged to provide their financial reports to FINA, only sole proprietors are excluded. This data is used for statistical purposes by the Croatian Bureau of Statistics and Croatian National Bank. We exclude predominantly non-market sectors and sectors dominated by the government such as agriculture, public utilities, education, health and defense. We also remove the financial sector. After dropping these sectors, our dataset contains firm level data for more than 400 sectors in industry and services according to NACE Rev. 2. four digit classification. Similarly, we drop all firms with zero capital, labor and sales. After data cleaning, our sample captures captures 64% of the GVA in the economy. We have access to the data from 2002 to 2019.

Public procurement data is also an administrative dataset, collected by the Ministry of Economy and Sustainable Development. It contains all public procurement that was published in the Official Gazette from 2008 until 2019. In our analysis, we use the data starting from 2013 because it includes information on the unique firm identifier and the published data corresponds very closely to official statistics on total public procurement. After 2013 the threshold for required publishing of the tender in the Official Gazette is 200,000 Kuna (approx. 25,000 EUR) for goods and services, and 500,000 Kuna (approx. 70,000 EUR) for construction. Although very small contracts are not published and hence not in our data, we capture the majority of public procurement. For example in 2019, public procurement that

was above the thresholds and published in the Official Gazette is 43 billion Kuna, while the below threshold and unpublished procurement was 11 billion Kuna (see Table A.1). Overall procurement is around 13% of GDP. After cleaning the financial statements dataset and merging it with procurement data, we capture around half of total procurement $\approx 6\%$ of GDP. The data contains rich set of information about the final value of contracted procurement, estimated value of the tender by the procuring body, identity of the procuring body, location, number of bidders, type of contract, type of procedure, Common Procurement Vocabulary (CPV) code for the goods and services procured. In this data, we do not have information on the duration of the procurement contracts. We use a separate web-scraped dataset acquired from GONG, a leading civil society organization in Croatia, and has information on the timeline for the delivery of goods and services for procurement in 2010 and 2011. The dataset shows that a large majority of goods and services are due in one year, but it also has many missing observations. Ferraz et al. (2015) also find that most of public procurement is due within a year.

The court registry is a dataset acquired from GONG. It contains all managers and owners of firms in Croatia from 2005 onwards. The registry of politicians also comes from GONG, and is web-scraped from web-pages of high ranking public officials that need to disclose their work and ownership histories. This includes parliament members, ministers, deputy ministers, mayors and deputy mayors. The dataset contains their ownership and employment histories. We use these datasets to build political connections indicators. First, we flag all firms that are owned or managed by former or current politicians. Second, we identify former managers of all procurement bodies (e.g. public utilities and regulatory agencies) and flag all firms that are owned or managed by them. Using these indicators we flag on average 3,721 unique firms as politically connected, out of 15,551 total unique firms in our sample (see Table A.2).

In our analysis we define a procurement firm as a firm that has at least one procurement contract in a given year. At the individual procurement contract level a firm is a single bidder if it was the only bidder. At the firm-year level a firm is a single bidder if it has at least one single bidder contract in a given year. Approximately 60% of total procurement contracts are awarded in procedures with only one bidder. This translates to $\approx 9,000$ firm-year single bidder observations out of $\approx 16,000$ firm-year procurement observations (see Table A.3).

In Table 2, we present the descriptive of our merged dataset. In Panel A, we report the sectoral allocation of output and procurement contracts in the economy. Manufacturing, Construction and Wholesale & Retail sector constitutes almost 85% of the total sales and procurement value in our sample. All of the three sectors contain substantial number of procurement contracts that attracted only one bidder. For instance, 40% of the firms in the manufacturing sector have at least one single bidder contract, that points towards the low degree of competition in the procurement sector.

Table 1: Data Sources

Data Name	Data Source	Sample	Years	Variables & Content
1) Firm-level Data		Universe of firms	2002-2019	Balance Sheet Information and Income statement.
2) Procurement Data	Ministry of Economy	Administrative data on published public procurement contracts value \geq 25k EUR in goods and 65k EUR for construction	2008-2019	Estimated value of the contract, Final amount paid for the contract (after completion), Winner of the contract and number of bids received.
3) Court registry				Court registry that has info on all managers and owners of firms and government entities.
4) Registry of Politicians				Ownership and employment histories of local and central government officials.
5) Procurement Bidders	Web-Scrapped	Food and Construction	2016-2019	Tenders

In Panel B of Table 2, we provide descriptive statistics on the firms. In our dataset, around 16% firms are involved in the procurement sector. The procurement firms are substantially larger than that of non-procurement firms. Furthermore, they also have revenue labor productivity, lower average revenue product of capital and higher profit rate.

Next, we document how firms characteristics varies over procurement intensity (procurement sales over total sales). First, we find that as firms size is non-monotonic in procurement intensity. For instance, firms with procurement intensity less than 0.1 is are much larger than that the firms that have majority of sales coming from procurement sector (procurement dependent firms). These procurement dependent firms gets much larger procurement contracts on average and they also make much higher profits relative to other procurement firms. All these findings hint towards a higher markups in the procurement sector, where procurement dependent firms charge even higher markups.

3 Institutional framework

All public procurement above the thresholds mentioned in Section 2 is subject to the Public Procurement Law, which is harmonized with European Union Public Procurement directives. According to the Law, public procurement needs to be done through the Electronic

Public Procurement Notice (Elektronicki Oglasnik Javne Nabave). The majority of public procurement (85%) is done through an open procedure in which anybody can submit a bid, while in the rest the buyer invites selected sellers to submit a bid. Firms submit sealed bids until a known deadline. The winner is determined as the most economically advantageous bid, taking into account the price and other factors such as quality. Before the change in the Law in 2017, there was a bigger focus on prices, while after the Law changed the procuring bodies are instructed to take other factors such as quality and reliability in consideration. The procuring authority can assign how much weight it gives to each factor. In most cases, the lowest price is still a dominant decision factor. The government can sign various types of contracts with suppliers. Most of contracts are standard individual purchase contracts where the government pays for the delivery of previously specified goods or services. However, soliciting bids and selecting best offers for recurring needs of the public authority might entail large administrative costs. Framework agreements allow more flexibility for the procuring authority. They can be signed with multiple suppliers to a duration of up to 4 years and allow the procurer to choose among the pre-specified set of suppliers. While this procedure allows the procuring body to reduce administrative costs it decreases competition due to long term relationships between the procurer and a set of suppliers. Around 40% of procurement is done under framework agreements.

Although Croatia is fully compliant with the EU directives on public procurement, corruption is still a major concern. According to the Eurobarometer Survey of Business Attitudes in 2019, 77% respondents think that corruption is widespread in public procurement, which is well above the EU average (European Commission, 2020). The main concerns that discouraged participation in public procurement according to respondents were "The criteria seemed to be tailor-made for certain participants", "The deal seemed to be done before the call to tender" and "The procedure seemed too bureaucratic or burdensome". Corruption, however, is not the only concern about the procurement process. The European Commission expressed concerns about the limited administrative capacity of contracting authorities in Croatia (European Commission, 2017b). A report on single bidding in the EU (European Commission, 2019) suggests that these political and administrative issues result in a high share of single bidder contracts. The report finds that Croatia has the highest share of single bid contracts in analyzed countries, but it also uses a non-representative sample of public procurement.

4 A Structural Framework to Estimate Markups

In this section, we present the structural framework to estimate the firm-level markups. It relies on the production approach as used in De Loecker and Warzynski (2012) and De Loecker, Eeckhout, and Unger (2020). In particular, we rely on optimal input demand conditions ob-

Table 2: Summary Statistics on the Matched Firm-level Data: 2013-2019

PANEL A: Output and procurement allocation across sectors						
Sector	Sales Share	Procurement Share	Single Bidder share of Procurement	Single Bidder Firms	Procurement Firms	Single Bidder Share (N)
Manufacturing	0.26	0.14	0.40	1688	2976	0.57
Construction	0.08	0.39	0.26	1665	3371	0.49
Wholesale & Retail	0.46	0.29	0.37	2903	4825	0.60
Transportation & Storage	0.04	0.02	0.54	322	544	0.59
Accommodation and Food	0.04	0.00	0.60	154	201	0.77
Information & Communication	0.04	0.06	0.58	957	1184	0.81
Real Estate	0.01	0.00	0.48	18	32	0.56
Professional, S & T	0.05	0.07	0.41	1571	3006	0.52
Administrative & Support	0.02	0.02	0.29	304	658	0.46

PANEL B: Firms characteristics and procurement intensity									
$\frac{\text{Procurement Sale}}{\text{Sale}}$	$\frac{\text{Procurement Total Proc.}}{\text{Total Proc.}}$	Labor	Obs.	$\frac{\text{Sale}}{\text{Employees}}$	$\frac{\text{Sale}}{\text{Capital}}$	$\frac{\text{Profits}}{\text{Sale}}$	$\frac{\text{Wagebill}}{\text{Sale}}$	$\frac{\text{Loans}}{\text{Capital}}$	Mean Proc.(10 ³)
0	0.00	9	361572	5984	140	0.01	0.28	0.02	0
< 10%	0.09	88	6902	13329	80	0.06	0.18	0.02	1766
[10%, 20%)	0.09	42	2663	8994	63	0.08	0.21	0.02	4819
[20%, 30%)	0.10	36	1737	8957	59	0.07	0.22	0.02	8048
[30%, 50%)	0.16	37	2133	9066	119	0.08	0.21	0.02	10521
[50%, 100%)	0.23	32	2106	8705	114	0.07	0.22	0.02	15035
≥ 100%	0.32	31	1234	7385	107	0.06	0.24	0.02	35802

Note. Panel A presents the descriptive statistics at the sector-level. The variable Sales share is defined as the sector sales over total sales, Procurement share is sector procurement value over total procurement value, Single Bidder share of procurement is the value of single bidder contracts over total procurement, Single bidder firm is number of firm-year observation of firms with atleast one single bidder contract, Procurement firm is number of firm-year observation of firms active in procurement. Panel B presents firm-level statistics.

tained from cost minimization and the ability to identify the output elasticity of a variable input free of adjustment costs. This approach does not require us to make any assumption on the demand side or the market structure. Therefore, it is helpful in estimating the markups of firms that are active in procurement sector without taking a particular stand on the underlying contract allocation mechanism. However, we need to estimate a production function at the firm-level using financial statements. We rely on the control function approach as developed by [Olley and Pakes \(1992\)](#), [Levinsohn and Petrin \(2003\)](#), and [Akerberg, Caves, and Frazer \(2015\)](#). This requires a two-stage estimation procedure that is explained in the next section.

4.1 Deriving an Expression for Markups

In order to derive markups, we need to define the cost minimization problem of the firms. In particular, we assume that the production function is defined as:

$$Y_{ft} = \min[\gamma_m M_{ft}, F(L_{ft}, K_{ft}) \exp(\omega_{ft})] \exp(\varepsilon_{ft}). \quad (1)$$

where Y_{ft} is output of firm f at time t , M_{ft} is material input, K_{ft} is capital stock, L_{ft} is labor input, ω_{ft} is productivity, and ε_{ft} is measurement error in output.

Assumption I: The production technology is sector-specific.

We assume that all the firms use the same technology within a sector, however, they can have different productivity ω_{ft} and that makes Y_{ft} to differ across firms. This implies that input shares are same for all firms within a sector.

Assumption II: Materials are a perfect complement to the combination of labor and capital.

This is a structural value added specification, the dependent variable is gross output. Here, labor and capital may be substitutable, but material are perfect complement to the combination of labor and capital. This is specification of the production function is not subject to the critique of [Gandhi, Navarro, and Rivers \(2020\)](#).

Assumption III: $F(\cdot)$ is continuous and twice differentiable in labor and materials (variable input).

This assumption implies that the firms can adjust their output quantity by changing a particular variable input. Moreover, this implies that firms cost minimization involves two first-order conditions with respect to variable inputs of production.

Assumption IV: ω_{ft} is Hicks neutral.

The productivity ω_{ft} affects both labor and capital in the same way such that capital-labor ratio would equalize across firms in the absence of capital adjustment costs (capital is a free input).

Assumption V: State Variables $S_{ft} = \{K_{ft}, \omega_{ft}, Proc_{ft}, G_{ft}\}$.

The state variables of the firms include the stock of capital K_{ft} (determined in period $t - 1$), productivity ω_{ft} , firm active in procurement status $Proc_{ft}$ (decision to produce in procurement sector at time t is taken in period $t - 1$), and the exogenous factors such as location.⁸

Assumption VIa: Firms minimize short-run costs taking input prices as given.

Firms face a vector of input prices and it does not depend on the quantity of input, ruling out any sort of monopsony power. We consider the firms' cost minimization problem conditioning on the state variables. From previous assumptions, firms minimize costs with respect to variable inputs (labor and material).

The associated Lagrangian function for any firm f at time t is

⁸ $Proc_{ft}$ is a dummy variable that takes the value one if the firm is active.

$$\begin{aligned}
\mathcal{L}_{ft}(L_{ft}, M_{ft}, K_{ft}, \lambda_{1,ft}, \lambda_{2,ft}) &= \mathcal{F} + rK_{ft} + wL_{ft} + p^m M_{ft} \\
&\quad - \lambda_{1,ft}(F(L_{ft}, K_{ft})\exp(\omega_{ft} + \varepsilon_{ft}) - Y_{ft}) \\
&\quad - \lambda_{2,ft}(\gamma_m M_{ft}\exp(\varepsilon_{ft}) - Y_{ft}).
\end{aligned} \tag{2}$$

The firm's first-order condition for variable inputs would pin down $\lambda_{1,ft}$ and $\lambda_{2,ft}$ and thus, the marginal cost of increasing output by one unit. In particular, the marginal cost is defined as:

$$MC_{ft} = \lambda_{1,ft} + \lambda_{2,ft} = \frac{wL_{ft}}{\beta_\ell Y_{ft}} + \frac{p^m M_{ft}}{Y_{ft}},$$

where, β_ℓ is the output elasticity of labor, wL_{ft} is the wage bill and $p^m M_{ft}$ is the cost of materials.

Assumption VIb: Prices are flexible. They are set annually.

Finally, we assume that the prices are flexible and set annually that helps us to pin down the markups at the firm-level. This means that we can write expression for markups as;

$$\mu_{ft} := \frac{P_{ft}}{MC_{ft}} = \beta_\ell \frac{P_{ft} Y_{ft}}{wL_{ft} + \beta_\ell p^m M_{ft}}.$$

This expression only requires us to estimate the output elasticity of labor and all others items required are directly observed in the data (namely sales, material cost and wagebill). In order to estimate the output elasticity of labor, we assume $F(L_{ft}, K_{ft})$ is Cobb-Douglas.⁹ This implies that the structural value added in logs is;

$$y_{ft} = \beta_0 + \beta_k k_{ft} + \beta_l \ell_{ft} + \omega_{ft} + \varepsilon_{ft}. \tag{3}$$

Here, the left-hand side is given directly in the data, and in the right-hand side the parameter vector β must be estimated. Estimating Equation 3 directly by OLS could potentially suffer from simultaneity bias (as unobserved productivity shocks in ω_{ft} are correlated with input choices), serial correlation bias (if the observed productivity ω_{ft} has correlated effects), and selection bias (if, over time, sample selection occurs among exiting low-productivity firms). To deal with these issues, we proceed using the control function approach as in [Olley and Pakes \(1992\)](#) that entails two-stage estimation procedure.

Assumption VIII: $m_{ft} = m_t(k_{ft}, \omega_{ft}, \mathbf{proc}_{ft}, \mathbf{ms}_{ft}, \mathbf{z}_{ft})$.

The vector \mathbf{z}_{ft} includes wages, procurement agency dummies, etc. In this context, \mathbf{z}_{ft} may also include political network proxies, and dummy for privatized firms. In particular,

⁹One can allow for translog production function and this does not change results substantially.

we will include proxy for political connections as it can change material demand via directly influencing input prices or indirectly by increasing the probability of winning a procurement contract. For instance, in appendix, we show in Table A.2 that politically connected firms do on average have larger procurement contracts relative to relative unconnected firms. Further, we also show in Table A.4 that connected firms are more likely to be involved in procurement sector (overall 4% of firms in our sample are involved with public procurement, however, when it comes to politically connected firm, this number increases to 13%).¹⁰

Assumption IX: Material demand increasing in ω_{ft} .

$$\omega_{ft} = h_t^{-1}(k_{ft}, m_{ft}, \mathbf{proc}_{ft}, \mathbf{ms}_{ft}, \mathbf{z}_{ft}), \quad (4)$$

where h_t is a non-parametric function (e.g. a polynomial) of variable inputs, capital, labour, possibly other fixed inputs, and time dummies.

Now, we focus on the selection bias due to non-random entry and exit of firm. If the current state variables indicate continuing in operation is not worthwhile, the firm closes down the plant. If this is not the case the firm chooses an optimal investment level (constrained to be non-negative). The solution to this control problem generates an exit rule and an investment demand function. If we define the indicator function χ_{ft} to be equal to zero if the firm exits, then the exit rule and the investment demand equation are written, respectively, as

$$\chi_{ft} = \begin{cases} 1 & \omega_{ft} \geq \bar{\omega}_{ft}(\mathbf{s}_{ft}) \\ 0 & \text{otherwise} \end{cases}$$

Consider next the problem self-selection into production that may bias the production function estimation. Assuming, temporarily, that there are no variable factors, the conditional expectation of y , (conditional on current inputs, survival, and information available at $t - 1$), includes the term $E[\omega_{ft-1}, S_{ft}, \chi_{t-1} = 1]$.

Recall that $\chi_{t-1} = 1$ if and only if $\omega_{ft-1} > \bar{\omega}_{ft-1}$. For instance, if the profit function is increasing in k_{ft} , the value function must be increasing and $\bar{\omega}_{ft}$ decreasing in k_{ft} . Firms with larger capital stocks can expect larger future returns for any given level of current productivity, and hence will continue in operation at lower ω_{ft} realizations. Furthermore, access to procurement sector may delay the exit of unproductive firms as they remain afloat with profits from public sector contracts. Hence, the self-selection generated by exit behavior implies that $E[\omega_{ft-1}, S_{ft}, \chi_{t-1} = 1]$ will be decreasing in k_{ft} , leading to negative bias in the capital coefficients.

¹⁰These findings are in line with large literature that find positive link between political connection and procurement activity at firm-level, such as Cingano and Pinotti (2013), Gerardino, Litschig, and Pomeranz (2017), Decarolis, Fisman, Pinotti, and Vannutelli (2020a), Brogaard, Denes, and Duchin (2021), Baltrunaite, Giorgiantonio, Mocetti, and Orlando (2021), Decarolis, Giuffrida, Iossa, Mollisi, and Spagnolo (2020b), and Decarolis (2014).

The survival probabilities can be written as;

$$\begin{aligned}
Pr(\chi_{ft} = 1) &= Pr[\omega_{ft} \geq \bar{\omega}_{ft} | \bar{\omega}_{ft}(s_{ft}), \omega_{ft-1}] \\
&= \kappa_{t-1}(\bar{\omega}_{ft}(s_{ft}), \omega_{ft-1}) \\
&= P_{ft}
\end{aligned} \tag{5}$$

To control for the impact of the unobservable productivity on selection, we need a measure of ω_{ft} and a measure of the value of $\bar{\omega}_{ft}(s_{ft})$ which makes the firm just indifferent between continuing in operation and selling off. As in [Olley and Pakes \(1992\)](#), we have two different indexes of firm heterogeneity, the productivity and the productivity cutoff point. Note that, using equation 5, we can write $\bar{\omega}_{ft}(s_{ft}) = \kappa_{t-1}^{-1}(\omega_{ft}, P_{ft})$.

To estimate the parameter vector β , we follow [Akerberg, Caves, and Frazer \(2015\)](#) and form moments based on the innovation in the productivity ζ_{ft} . We consider the following law of motion for productivity,

Assumption X: ω_{ft} follows Markov process.

$$\omega_{ft} = g(\omega_{ft-1}, P_{ft}) + \zeta_{ft}. \tag{6}$$

To form moment based on the innovation in the productivity shock in Equation 6, we need to express productivity in forms of data and parameters. In particular, we follow a two-stage procedure to estimate the production function. In the first-stage, we run the following regression,

$$y_{ft} = \phi_t(k_{ft}, \ell_{ft}, m_{ft}, proc_{ft}, z_{ft}, G_{ft}) + \varepsilon_{ft},$$

where we estimate $\hat{\phi}_t$. Next, we obtain the estimates for productivity $\omega_{ft}(\beta) = \hat{\phi}_t - \beta_k k_{ft} - \beta_\ell \ell_{ft}$. By regressing $\omega_{ft}(\beta)$ on a function of $\omega_{ft-1}(\beta)$ and P_{ft} (nonparametrically), we recover the innovation to productivity given β , $\zeta(\beta) = \omega_{ft}(\beta) - g(\omega_{ft-1}(\beta), P_{ft})$.¹¹

In the second-stage, to obtain our estimated parameters $\hat{\beta}$, we use the following moment conditions,

$$E \left[\begin{array}{c} \zeta_{ft}(\beta) \\ \left(\begin{array}{c} k_{ft} \\ \ell_{ft-1} \\ m_{ft-1} \\ \phi_{ft-1} \end{array} \right) \end{array} \right] = 0 \tag{7}$$

and we use standard GMM technique to obtain the estimate of the production function and rely on the bootstrapping for the standard errors.

¹¹In principle, one may also include other state variables that may affect productivity in period t .

5 Markups and Procurement

We rely on our empirical framework to analyze how markups, size, labor share and profits differ between procurement firms and firms without procurement contracts. Moreover, we are interested in how the procurement intensity (share of procurement in total sales) is correlated with our main outcome variables.

There is rich literature in IO on public procurement auctions studying how different auction designs change firm-level and government surplus. A recent paper by [Kang and Miller \(2017\)](#) shows that more competition in the procurement can increase government surplus (reducing profits for firms). Other papers that are more directly linked to the firm dynamics such as [Ferraz, Finan, and Szerman \(2015\)](#) document an increase in firm size when it gets an procurement contract and [di Giovanni, García-Santana, Jeenas, Moral-Benito, and Pijoan-Mas \(2022\)](#) argue that the procurement revenues are more collateralizable and therefore, relaxes borrowing constraints for firms. However, there is no systematic evidence on the the impact of procurement on the firm-level markups.

Firm-level markups can be driven by physical productivity in a model of oligopolistic competition such [Atkeson and Burstein \(2008\)](#). More productive firms are larger in size and also charge a higher markup, supply-side sources of markup of heterogeneity. Meanwhile, the demand-side factors (profitability) are also important for firm growth and size ([Foster, Haltiwanger, and Syverson 2008](#)) and thus, they can also explain markup heterogeneity in the cross-section.

Access to procurement sector acts as a demand shifter for firms and therefore, it may increase firm size and thus, can increase their markup as well. From the supply-side, the firms in the procurement sector may have higher physical productivity. On the one hand, entry into the procurement process is costly as firms may face bureaucratic costs (see e.g. [Krasnokutskaya and Seim, 2011](#)), which would imply a entry of productive firms in the sector. On the other hand, firms' connections with bureaucrats and politicians may allow unproductive firms to enter, which would imply a lower productivity of procurement firms.¹² Finally, procurement agencies may demand higher quality goods that allows firms to charge higher markups.¹³ Given the fact, there are multitude of counter-balancing forces involved, it is not ex-ante clear how markups change as firms enter procurement sector. In this regard, we see this paper as providing a holistic evidence on procurement affects firm characteristics such as, size, markups, profits and labor share.

Taking stock of the above, we therefore expect higher markups for procurement firms. As we discussed before, markups differences are related to both cost and price side factors, our

¹²[Colonnelli and Prem \(2017\)](#) shows that corruption allows less productive firms to enter and produce into procurement.

¹³The intuition is line with the literature on firm-level exporting, quality and markups. If exporters produce higher-quality goods, while relying on higher-quality inputs, all things equal, they can charge higher markups. See [Kugler and Verhoogen \(2012\)](#) and [Hallak and Sivadasan \(2013\)](#).

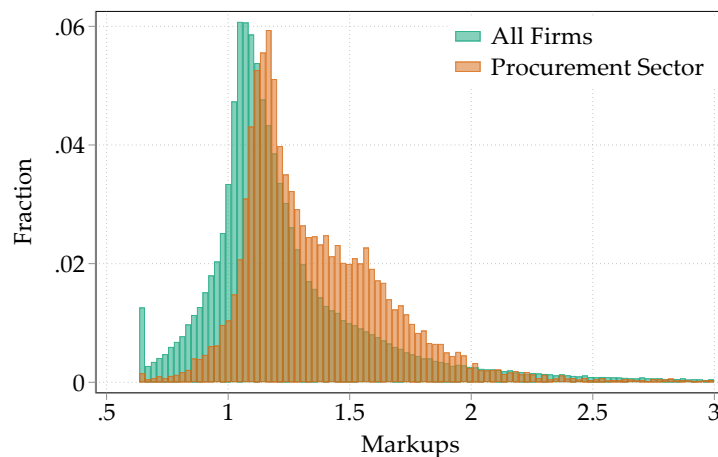
methodology, will be able to disentangle these two forces if the assumptions stated in Section 4 are valid. Using the methodology presented in the previous section, we can measure markups and revenue productivity at the firm-level. We use revenue productivity $tfpr$ as a crude measure of the physical productivity tfp and disentangle demand and supply side forces. Needless to say that $tfpr$ is an imperfect measure and contain unobserved price heterogeneity. In the future, we will combine product price data to provide more precise evidence on the different role of supply and demand side forces.

5.1 Results

In this section, we use our empirical model to estimate markups for Croatian firms, and test whether procurement firms, on average, have different markups relative to firms that only produce in the private sector.

We plot the distribution of the estimated markups in Figure 1. Similar to the findings in the literature, we document a fat tailed distribution of markups, where a lot of mass is concentrated around one and some firms have high markups above 2. Further, we find that the markup distribution of procurement firms is systematically skewed towards right, suggesting a higher markups for them relative to others.

Figure 1: Markups



Note. The distribution of estimated markups between 2013-2019. The x-axis is markups and y-axis is the fraction of firms for a certain bin of the histogram. We winsorize the variable at 1% and 99% to remove outliers. Green represents the distribution for all firms in the economy whereas red represents the firms active in the procurement sector. The mean and median for non-procurement firms are 1.27 and 1.14 respectively, and in case of procurement firms they stand at 1.39 and 1.29 respectively.

5.1.1 Markup Premium

More specifically, we run the following regression for each 2 digit industry separately,

$$\ln \mu_{ft} = \delta_0 + \delta_1 Procurement_{ft} + b'_{ft}\sigma + v_{ft}, \quad (8)$$

where $Procurement_{ft}$ is a dummy that indicates if a firms f is active in the procurement sector in a given year t and δ_1 measures the percentage markup premium for procurement firms. We control for labor and capital use in order to capture the differences in size and factor intensity, as we as full year-industry (four digit level) interaction to take out industry specific trends in markups. Needless to say that, we are not interpreting δ_1 as the causal impact of procurement on markups. We collect all the controls in a vector b_{ft} with σ the corresponding coefficients.

The results are presented in Table 3. We find that firms that are active in procurement have 6% higher markup relative to those firms that are not active in procurement in the Manufacturing sector. Similarly, markup premium for procurement firms is 25% in the Construction sector and 4% in the Retail & Wholesale sector. These sectors constitute almost 85% of the revenues and procurement value in the economy. Apart from them, we also find that markup premium for procurement firm is 14% in Professional Services & Technical Services sector. In the rest of the sectors, we do not find any statistically significant difference in the markups across procurement and non-procurement firms, but these also capture the least of procurement contracts.

Table 3: Markups and Procurement I: Cross-Sectional Analysis

	(1) Manufacturing	(2) Construction	(3) Wholesale & Retail	(4) Transportation & Storage	(5) Accomm. & Food	(6) Information & Comm.	(7) Financial & Insurance	(8) Professional, S & T Services	(9) Admin. & Support
Procurement	0.06*** (0.01)	0.25*** (0.02)	0.04*** (0.01)	0.01 (0.02)	0.03 (0.04)	-0.03 (0.03)	0.06 (0.08)	0.14*** (0.01)	-0.03 (0.02)
Sector#year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note. This table presents the estimated coefficients from regression specification Equation 8 in Panel A. We always use lagged capital and labor as controls. Manufacturing, Construction and Wholesale & Retail capture 85% of the sales and procurement activity in the economy. Furthermore, Professional, Scientific & Technical services sector capture another 7% of the procurement contracts in value. The regression standard errors in parentheses below the coefficient values are clustered at 4 digit NACE rev.2 sector level \times year, where significance level is defined as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5.1.2 Procurement at the Intensive Margin

So far, we have documented the procurement markup premium at the extensive margin, however, there is a lot of heterogeneity among the procurement firms themselves. As documented in Section 2, there is rich heterogeneity in the size of procurement contract that a firm gets relative to their overall size. A large proportion of firms only have a minority of their sales coming from procurement sector whereas there are few firms that have a majority of sales coming from procurement activities. The mean yearly procurement intensity, defined as the share of procurement sales over total sales, is 32%.¹⁴ We exploit this heterogeneity to

¹⁴This measure potentially suffer from the bias that is generated due to the fact that some procurement contract are multi-year and we do not observe this directly.

estimate the procurement markup premium at the intensive margin. To see this, we run the following regression

$$\ln \mu_{ft} = \delta_0 + \delta_1 \left(\frac{\text{Procurement}}{\text{Sale}} \right)_{ft} + b'_{ft} \sigma + v_{ft}, \quad (9)$$

where, δ_1 will measure the markup premium at the intensive margin. The results are presented in Table 4. At the extensive margin, procurement firms charge a 9% markup premium in the cross-section. Meanwhile, at the intensive margin, we find that higher procurement intensity also implies higher markup premium in the cross-section. The estimates δ_1 is 0.13 and it is statistically significant. An average firm has a procurement intensity of 32% that leads to a markup premium of 4%. However, it may be the case that the firms that are active in the procurement sector are inherently different from the non-procurement firms so that the markup heterogeneity is a result of some unobserved heterogeneity. Furthermore, our approach assumes implicitly that inputs are used in proportion to final sales (this assumption is made in [Foster, Haltiwanger, and Syverson 2008](#)).

Table 4: Markups and Procurement II: Intensive Margin

	(1)	(2)	(3)	(4)
	μ_{ft}	μ_{ft}	μ_{ft}	μ_{ft}
<i>Procurement</i> _{ft}	0.09*** (0.01)		0.11*** (0.01)	
$\left(\frac{\text{Procurement}}{\text{Sale}} \right)_{ft}$		0.13*** (0.02)		0.09*** (0.01)
Observations	309,948	309,948	293,115	293,115
R-squared	0.59	0.58	0.85	0.85
Sector#year FE	✓	✓	✓	✓
Firm FE	-	-	✓	✓

Note. This table presents the estimated coefficients from regression specification [Equation 9](#). Dependent variable is log markups. *Procurement*_{ft} is dummy variable. Clustered standard errors at sector×years are in brackets below the coefficient values. The average procurement over sales value is 32%. The regression standard errors in parentheses clustered at 4 digit NACE rev.2 sector level × year, where significance level is defined as *** p<0.01, ** p<0.05, * p<0.1.

5.2 Procurement, Profits and Labor share

In this section, we provide further evidence on firm-level effects of procurement activities. Previously, we have documented that the procurement firms do charge a substantial markup premium. In a simple framework of imperfect competition, markups may be associated with higher profits rate (total profits over sales) and lower labor share.

For instance, [Atkeson and Burstein \(2008\)](#) show that larger firms (with higher market share) face lower demand elasticity and therefore, can charge a higher price-cost markups. However, higher markups does not necessarily imply that firms have more market power

and therefore higher economic profits. In fact, increasing markups in procurement sector can come from a variety of reasons that are not associated with a decline in competition, such as ex-ante high entry costs, fixed bureaucratic costs, bribery costs, product customization costs, among others. In order to cover these costs, firms may charge higher markups in the procurement sector. However, if firms do make excess profits in the procurement sector then that would be stronger evidence in the support of the market power hypothesis.

In what follows, we measure firm's profit with EBT (earnings before taxes). Our measure of profitability is EBT over sales.¹⁵ Further, we run the same specification as in 8, however, in this case the dependent variable is profit rate. The results are presented in Panel A of Table 5. We find that firms in procurement sector do have higher profits relative to firms that only operate in the private sector in all sectors of the economy. For instance, procurement firms in manufacturing sector have 3 percentage points higher profits, whereas in construction sector they have 6 percentage points higher profits relative to non-procurement firms. These magnitudes are large as the average profit rate is close to 1.5 percent (of sales). These results highlight the fact the high markups in the procurement sector reflect lack of competition and not only high administrative costs.

Next, we move towards analysing labor share of procurement firms. In a simple framework of imperfect competition, labor share is inversely proportional to markups and profits. In order to build intuition for this result, let us suppose production function with only one factor, labor. If firms are making more profits then the share of production that goes to labors declines.¹⁶

We define labor share at firm-level as the ratio of wagebill and sales. Further, we run the same specification as in 8, however, in this case the dependent variable is labor share. The results are presented in Panel B of Table 5. We find that firms in procurement sector do have lower labor share relative to firms that only operate in the private sector in all sectors of the economy. For instance, procurement firms in manufacturing sector have 8 percentage points higher profits, whereas in construction sector they have 13 percentage points lower labor share relative to non-procurement firms. These results highlight that procurement affects firms in multiple ways apart from the standard size/growth effects that has been discussed in the literature.

5.3 Dynamics Effects of Procurement

We proceed to explore the dynamic effects of public procurement on firms. This will allow us to test whether firms that win procurement contracts are systematically different before

¹⁵We also compute accounting profits as $Sales - rK - WL - p^m M - Overhead\ Costs$, and results are similar.

¹⁶Recent work by [Autor, Dorn, Katz, Patterson, and Van Reenen \(2020\)](#) summarize these results. A firm will have a lower labor share if its markup is higher. Moreover, larger firms that have lower demand elasticity would have higher price-cost markups and lower labor share. The reason is because markups are generally falling in the absolute value of the elasticity of demand, and according to Marshall's "Second Law of Demand," consumers will be more price-inelastic at higher levels of consumption and lower levels of price.

Table 5: Profits and Procurement I: Cross-Sectional Analysis

	(1) Manufacturing	(2) Construction	(3) Wholesale & Retail	(4) Transportation & Storage	(5) Accommodation & Food	(6) Information & Comm.	(7) Financial & Insurance	(8) Real Estate	(9) Admin. & Support
PANEL B. Profit Share									
Procurement	0.03*** (0.00)	0.06*** (0.00)	0.05*** (0.00)	0.06*** (0.01)	0.07*** (0.02)	0.03*** (0.01)	0.03** (0.01)	0.06*** (0.00)	0.04*** (0.01)
Observations	50,936	37,512	88,341	16,517	25,993	15,876	5,541	53,468	12,645
R-squared	0.05	0.02	0.02	0.03	0.02	0.05	0.02	0.04	0.03
PANEL B. Labor Share									
Procurement	-0.08*** (0.00)	-0.13*** (0.01)	-0.10*** (0.00)	-0.05*** (0.01)	-0.03*** (0.01)	-0.04*** (0.00)	-0.08*** (0.02)	-0.07*** (0.00)	0.01 (0.02)
Observations	51,390	38,086	89,133	16,636	26,234	16,018	5,807	54,039	12,774
R-squared	0.11	0.03	0.06	0.08	0.01	0.06	0.04	0.04	0.16
Sector#year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note. This table presents the estimated coefficients from regression specification 8 in Panel A and ?? in Panel B. We always use capital and lagged labor as controls. Clustered standard errors at sector \times years are in brackets below the coefficient values. Manufacturing, Construction and Wholesale & Retail capture 85% of the sales and procurement activity in the economy. Furthermore, Professional, Scientific & Technical services sector capture another 7% of the procurement contracts in value. The regression standard errors in parentheses below the coefficient values are clustered at 4 digit NACE rev.2 sector level, where significance level is defined as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

procurement and how long do the procurement effects persist. Armed with these estimates, we will discuss the plausibility of a causal interpretation of our results. We use the staggered difference-in-difference design. In particular, our regression model is;

$$y_{it} = \alpha + \sum_{l \in \Lambda} \beta_{t+l} \text{Procurement}_{it+l} + \gamma X_{it-1} + \phi_i + \delta_{st} + \epsilon_{it}, \quad (10)$$

where ϕ_i is the individual fixed effect, and δ_{st} are year and sector FE. $\Lambda = \{-2, 0, 1, 2\}$ are coefficients of interest that estimate the evolution of the outcome relative to the year prior to getting the contract. X_{it-1} is the vector of pre-treatment controls. The identification assumption is that that conditional on controlling for time invariant heterogeneity and time variant characteristics in the vector X_{it-1} there are no unobservables driving both procurement and our outcomes of interest. Firm TFP is one such unobservable, given that a positive TFP shock can both drive procurement and markups. We will discuss the plausibility of TFP shocks explaining our results.

Additionally, a recent literature on staggered difference in differences shows that estimating Equation 10 with OLS in the presence of heterogeneous treatment effects for different treatment cohorts may lead to biased estimates.¹⁷ For instance, the bias appears when units treated later have lower treatment effects than units treated earlier. While it is not obvious why this would happen in the context of procurement, for robustness we use the estimator from [De Chaisemartin and d'Haultfoeuille \(2020b\)](#) which provides unbiased esti-

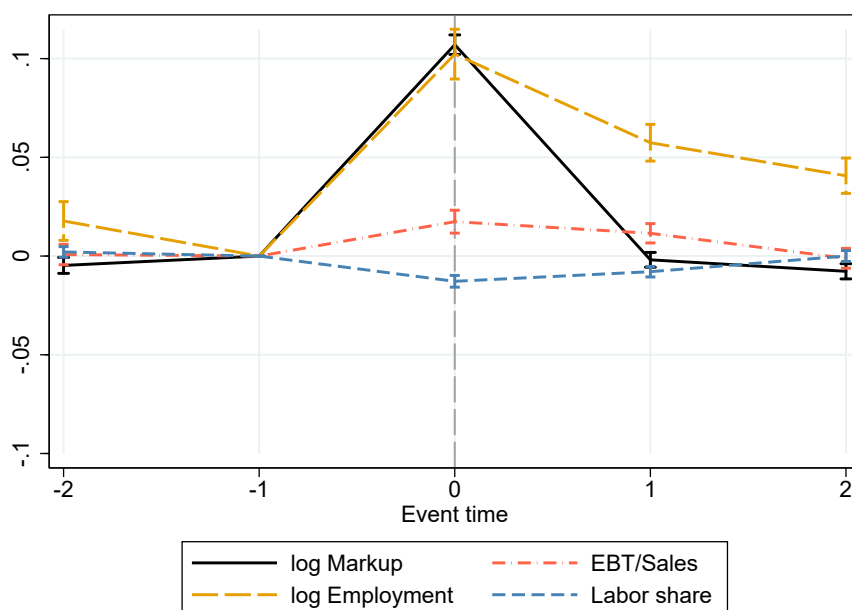
¹⁷See [Goodman-Bacon 2018](#); [Abraham and Sun 2018](#); [Callaway and Sant Anna 2020](#); [De Chaisemartin and d'Haultfoeuille 2020b](#).

mates in this setting. In particular, they propose comparing units that switch from untreated to treated from $t - 1$ to t with never treated units at both dates and comparing units that switch from treated to untreated from $t - 1$ to t with units treated at both dates. This approach allows units entering and exiting from treatment, which is crucial in our case given that procurement is not necessarily an absorbing state. [De Chaisemartin and d’Haultfoeuille \(2020a\)](#) extend this framework to identify dynamic treatment effects across multiple periods. Intuitively, they rely on comparing switchers l periods after the switch to units whose treatment status remained constant.

We find that, at the year of getting their procurement contract, firms experience a sharp increase (10 percentage points) in their markups. The effect completely dissipates after one year, which is consistent with firms charging higher prices for public procurement contracts. Another potential explanation for this effect is a transitory productivity shock without persistence that reduced the marginal cost only in the year when the firm won public procurement and later it reverted to the mean. This is inconsistent with a large body of research that finds productivity shocks to be very persistent ([Foster, Haltiwanger, and Syverson 2008](#); [İmrohoroğlu and Tüzel 2014](#); [Pozzi and Schivardi 2016](#)). Similarly to our cross-sectional evidence, we find that firms increase employment, profit share and decrease labor share. These effects are more persistent, especially the effect on employment, which is in accordance with stickiness of employment contracts and other research on employment effects of procurement ([Ferraz, Finan, and Szerman 2015](#); [Gugler, Weichselbaumer, and Zulehner 2020](#)). We do not see any pre-trends in markups, labor share and profit share. A pre-trend in employment is visible, but it is very small relative to the effect at the time of getting the public procurement. The reason behind this pre-trend might be differences in size growth rates between procurement and non-procurement firms, which we proceed to explore below.

In [Figure A.1](#) we present results using the [De Chaisemartin and d’Haultfoeuille \(2020b\)](#) estimator, which doesn’t suffer from the heterogeneous treatment effect bias. We get very similar instantaneous effects on markups, profit share and labor share relative to the OLS approach. The dynamic effects differ, because of the way [De Chaisemartin and d’Haultfoeuille \(2020a\)](#) estimator constructs treatment and control groups. Their approach doesn’t take into account that firms which got procurement at time t did get procurement again at $t + l$, so in [Figure A.1](#) the effects of procurement are more persistent on all variables. This happens because winning a procurement contract at time t increases the probability of winning contracts in the future. In the OLS approach outlined in [Equation 10](#) future procurement is included as a variable in the equation, so the persistence in procurement contracts doesn’t affect OLS results. The [De Chaisemartin and d’Haultfoeuille \(2020a\)](#) estimator doesn’t show any pre-trends for markups, labor share and profit share. It shows, however, significant pre-trends in employment, indicating that firms that get a new procurement contract might be growing faster than other firms. To further alleviate concerns about possible differing trends across treated and non-treated firms, we also run a specification with firm specific

Figure 2: Dynamic effects of procurement - OLS



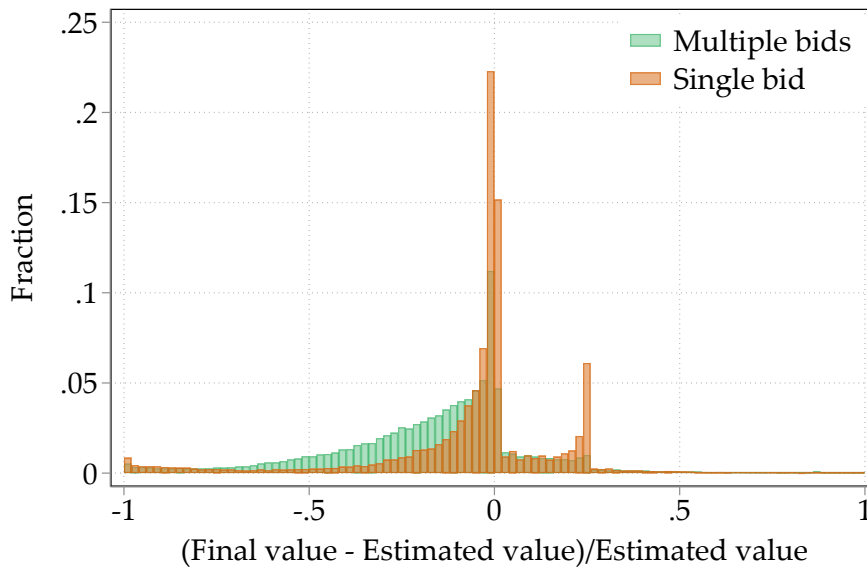
Note: This graph presents the results from an event study in Equation 10. The base period is -1 to which all other time periods are normalized and the treatment period is 0 (when procurement contract is allocated). EBT is earnings before taxes. Labor share is labor cost over sales.

time trends, thus controlling for possibly differing growth rates across firms. In Figure A.2, we show that unit time trends shrink the pre-trends in employment towards zero, while the coefficients on markups, profit share and labor share stay almost the same. This robustness check suggests that we are estimating the true effect of procurement on these variables. The estimated effect of procurement on employment is 3.6%. This is similar to estimates from close auctions in Ferraz, Finan, and Szerman (2015); Gugler, Weichselbaumer, and Zulehner (2020), which arrive at estimates ranging between 3%-5% after one year. Ferraz, Finan, and Szerman (2015), and Gugler, Weichselbaumer, and Zulehner (2020) also find the effects of procurement on employment to be persistent.

5.4 Markups, Competition and Number of Bids

Until now, we have documented both static and dynamic effects of entry into the procurement sector on various firm-level characteristics. In this section, we provide corroborating evidence on the underlying mechanism that is driving high markups in public procurement. In what follows, we use the information on the number of bids in each procurement procedure. We will use the data on estimated costs of procurement projects, which are provided by the contracting authority. The contracting authority is mandated by law to estimate the cost of goods and services it wants to procure. Following European Commission (2019) and Fazekas and Kocsis (2020) we use the percent difference between actual cost of the public

procurement and the estimated cost as a proxy for prices. We explore how the difference between actual and estimated cost systematically varies with the number of bids. We use the number of bids as a proxy for competition in a given procurement auction. In Figure ?? we show the distribution of this cost differential across procurement contracts. There is a much larger mass around zero for single bid auctions, while for multiple bid auctions there is more mass below zero. This is consistent with competitive bidding driving prices down and reducing firm markups.



Note. The Figure plots the distribution of contract value difference (Final value - Estimated values) for public procurement projects. Green bars show the contracts with multiple bids and red bars show contracts with single bid.

Since we have very granular data, we can analyze how this price differential varies across single bid and multiple bid procurement procedures for the same firm, selling the same 8-digit CPV good or service, within the same county (approx. 150,000 people). In other words we can control for firm-year-product-county fixed effects. We find that the firm which wins a procurement contract within the same county for the same product wins contracts with consistently higher price differentials in single bid relative to multiple bid auctions (Table 6). This suggests that lower competition in public procurement increases the prices that firms charge. Given that Croatia is a small country there might be a single firm that supplies the good for the whole country and thus drives our results. In column 2 of Table 6 we check that our estimates hold if we exclude firms that sell to more than three municipalities (Croatia has 21 municipalities). Furthermore, the variation in prices might come from the fact that we do not observe the quality of the goods and services. We also perform the same exercise, but restrict the sample to standardized goods such as printing paper as in [Bandiera, Prat, and Valletti \(2009\)](#). We find very similar estimates, but the number of procurement contracts shrinks drastically, so standard errors increase correspondingly. This suggest that differences in quality are not driving our results.

Next we relate firm level markups to the number of bidders in the procurement auction. Given that we only have estimates of markups at the firm level we separate the firm FE from the Year-Product-County FE. This allows us to follow the change in firm level markups related to single bid auctions for the same product in the same county and year. We find that an average single bid auction for the same good is associated with higher firm level markups by 0.3%. The estimates increase if we consider firms that sell only in a few municipalities. The estimate is similar in size if we focus only on standardized products, but the amount of observations shrinks considerably (there are only 111 unique firms in column 6).

Table 6: Procurement price differentials, competition and markups

	(1)	(2)	(3)	(4)	(5)	(6)
	Final value-Estimated value Estimated value			log Markup		
Single bidder	0.0637*** (0.00501)	0.0792*** (0.00643)	0.0542* (0.0277)	0.00284** (0.00117)	0.00675*** (0.00172)	0.00582 (0.00999)
Observations	61,637	25,949	658	72,346	31,919	798
R-squared	0.618	0.695	0.586	0.934	0.945	0.868
Firm \times Year \times Product \times County FE	✓	✓	✓			
Selling to max 3 counties		✓			✓	
Standardized products			✓			✓
Year \times Product \times County & Firm FE				✓	✓	✓

In columns (1)-(3) we present the estimates for δ_1 from regression: $Diff_{fit} = \delta_0 + \delta_1 Single Bidder_{fit} + \phi_{fpc} + v_{fit}$, where $Diff_{fit} = \frac{Final\ value_{fit} - Estimated\ value_{fit}}{Estimated\ value_{fit}}$. f, m, c, i, p, t are the firm, municipality, county, contract, product and time indices, respectively. ϕ_{fpc} is the firm-year-product-county fixed effect. In columns (4)-(6) we present estimates for δ_1 from regression: $\log Markup_{ft} = \delta_0 + \delta_1 Single Bidder_{fit} + \phi_{pct} + \tau_f + v_{ft}$. The number of observations is smaller in columns (1)-(3) because there are missing values on estimated value of procurement project. The regression standard errors in parentheses clustered at firm level, where significance level is defined as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Next, we move to evidence at the firm-level by aggregating contract level data to firm-level. We define a firm as a single bidder if it has at least one single bidder contract in a given year. We find that single bidder firms are larger (see Table A.3) on average in relative to other procurement firms both in terms of sales and employment. Furthermore, the average single bidder contract value is smaller relative to multi-bidder contract. Although the contract value is smaller, the estimated markups are even higher for single bidders relative to other procurement firms (Table A.5). This is in line with the hypothesis that low competition is driving high markups in this sector. Finally, we perform an event study as in `refeq:diff` to disentangle impact of winning a single bidder contract relative to multiple bid contracts and find that all effects on markups, profits, labor share and employment are more pronounced for these firms (Table A.3). For example, single bidder firms have 3% higher markups after winning a single bid contract than firms winning a procurement contract in a multi-bid environment.

6 Conclusion

In this paper, we find evidence that firms command higher market power in public procurement relative to the private market and this may be driven by low competition. Employing the recent advancement in the estimation techniques of firm-level markups, we show that firms in the procurement sector charge much higher markups relative to firm that only sell in the private sector. We provide suggestive evidence that these markups difference emerges due to high pricing rather than lower marginal cost of firms producing in the procurement sector. As further test of this finding, we show that procurement sector firms also earn high profits, suggesting that the high markups are not an artifact of bureaucratic or administrative costs of doing business with government. Furthermore, we show that the markup premium of producing in government sector increase with the share of sales coming from that sector. Finally, we exploit the data on number of bids for a select group of contracts and document that number of bids are negatively correlated with markup premium and positively correlated with the associated cost of the project. All these evidence taken together highlights that the low competition in the public procurement may rationalize high markups of firms that produce for the public sector.

Given the suggestive evidence documented in this paper, a natural next step is to understand the causes of the low competition in the government sector and highlighting the macroeconomic implications of these distortions. In the future, we want to combine these empirical facts together with a theoretical framework to quantify the impact of various forces that are responsible for low competition in the procurement sector.

Appendices

A Figures and tables

A.1 Tables

Table A.1: Procurement dataset aggregates

Year	Total published procurement	Total procurement in our dataset	Unpublished procurement
2013	33	25	6
2014	33	31	9
2015	31	26	9
2016	35	35	10
2017	31	31	9
2018	37	37	10
2019	43	43	11

Note: Procurement figures in our dataset are drawn from Ministry of economy and sustainable development. The overall procurement activity in the economy is taken from Official Gazette. Numbers are billions of Kuna. 1 EUR \approx 7.4 Kuna.

Table A.2: Political connections, procurement and firm descriptives

	All Firms	Connected	Procurement	Connected and Procurement
Revenue (Mean)	8,498,811	53,481,001	58,515,672	221,306,285
Capital (Mean)	3,439,618	27,547,091	15,586,897	68,129,141
Employees (Mean)	11	58	59	217
Procurement dummy	0.04	0.13		
Procurement value (Mean)	341,625	2,780,636	7,789,598	22,107,196
Wage bill (Mean)	1,071,563	6,556,182	6,478,207	24,583,862
Wages (Mean)	75,747	98,868	109,299	125,175
Loans (Mean)	1,624,731	14,144,206	7,733,551	31,133,466
% of total procurement value				40%
Observations	384,111	15,551	13,993	1,956
Unique firms	94,702	3,721	5,177	587

Note: All Numbers are in Kuna. 1 EUR \approx 7.4 Kuna. The political connection are defined as in Section 2. First column presents statistics for all firms, second is for firms with political connections, third column is for firms active in public procurement, fourth column is for firms that have political connections and are active in public procurement. Capital is mean stock of fixed assets at firm-level. Wages are average wage paid by firm to all of its employees. Loans are outstanding value of borrowing in a given year. Procurement dummy captures the percentage of firms active in procurement sector. Unique firms represents the number of firms in each category. The time period is 2013-2019.

Table A.3: Descriptive Statistics: Firm Level

	All Firms	Procurement	Single - Bidders
Revenue (000s)	8442	58033	74817
Capital (000s)	3374	15280	20401
Employees	11.20	57.71	70.25
Procurement Contract Value (000s)		8178	11883
Single-Bidder Contract Value (000s)			4990
Wagebill (000s)	1070	6410	8204
Observations	384,111	16,797	9,582
Unique firms	94,702	5,775	3,810

Note: All Numbers are in Kuna. 1 EUR \approx 7.4 Kuna. The single bidder contracts are defined as contracts that received only one bid and firms those have atleast one single-bidder contract in a given year would be classified as single-bidder firms in our data. First column presents statistics for all firms, second is for firms with procurement contracts, third column is for firms that are classified as single-bidders. Procurement Contract Value is the average value of contract awarded and Single-Bidder Contract Value is the average value of single-bidder contract awarded in the sample period. Capital is mean stock of fixed assets at firm-level. Unique firms represents the number of firms in each category. The time period is 2013-2019.

Table A.4: Political Connection and Entry into Procurement

	(1)	(2)	(3)	(4)	(5)	(6)
	Procurement dummy _{it}			Single bidder _{it}		
Politically connected _{ft}	0.12*** (0.02)	0.11*** (0.02)	0.11*** (0.02)	0.12*** (0.03)	0.09** (0.03)	0.09*** (0.03)
4 digit sector and year FE		✓	✓		✓	✓
Municipality and year FE			✓			✓
Observations	319,063	318,948	318,866	13,997	13,549	12,893
R-squared	0.00	0.06	0.07	0.00	0.16	0.23

Note: Formally, the first three columns show the coefficient α_0 from the estimation of the following regression model:

$$Procurement_{ft} = \alpha_0 + \alpha_0 Politically\ connected_{ft} + b'_{ft}\sigma + v_{1,ft},$$

and the column 4,5 and 6 show the coefficient δ_0 from the estimation of the following regression model:

$$Single\ bidder_{ft} = \delta_0 + \delta_1 Politically\ connected_{ft} + c'_{ft}\sigma + v_{2,ft},$$

The regression standard errors in parentheses clustered at 4 digit NACE rev.2 sector level \times year. *** p<0.01, ** p<0.05, * p<0.1. Regressions in columns (4)-(6) are done for the subsample of firms that have public procurement.

Table A.5: Markups and Procurement I: Cross-Sectional Analysis

	(1) Manufacturing	(2) Construction	(3) Wholesale & Retail	(4) Transportation & Storage	(5) Accommodation & Food	(6) Information & Comm.	(7) Financial & Insurance	(8) Professional, S & T Services	(9) Admin. & Support
Procurement	0.06*** (0.01)	0.25*** (0.02)	0.04*** (0.01)	0.01 (0.02)	0.03 (0.04)	-0.03 (0.03)	0.06 (0.08)	0.14*** (0.01)	-0.03 (0.02)
Single bidder	0.02*** (0.01)	0.03*** (0.01)	0.02*** (0.01)	-0.01 (0.03)	-0.01 (0.03)	-0.01 (0.02)	0.11 (0.09)	0.00 (0.01)	0.04* (0.02)
Observations	58,139	43,092	102,582	18,704	28,840	17,842	6,514	60,845	14,229
R-squared	0.23	0.21	0.09	0.35	0.18	0.20	0.17	0.46	0.55
Sector#year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓

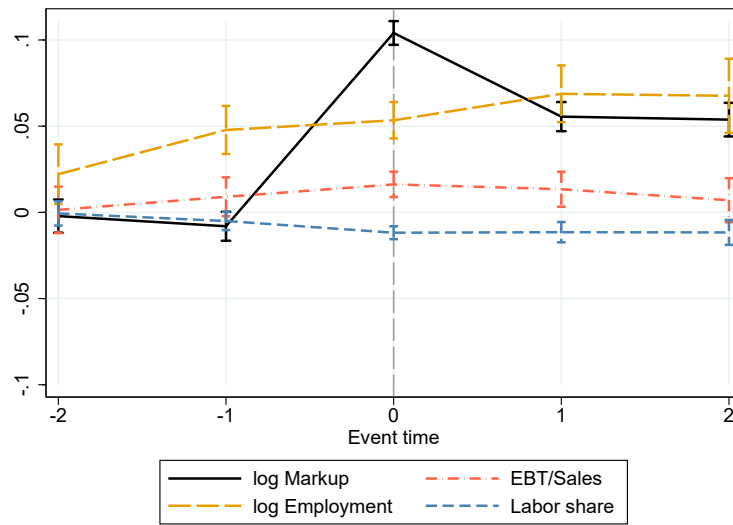
Note. This table presents the estimated coefficients δ_1 and δ_2 from regression specification:

$$\ln \mu_{ft} = \delta_0 + \delta_1 \text{Procurement}_{ft} + \delta_2 \text{Single bidder}_{ft} + b'_{ft} \sigma + v_{ft},$$

We always use capital and lagged labor as controls. Clustered standard errors at sector \times years are in brackets below the coefficient values. Manufacturing, Construction and Wholesale & Retail capture 85% of the sales and procurement activity in the economy. Furthermore, Professional, Scientific & Technical services sector capture another 7% of the procurement contracts in value. The regression standard errors in parentheses clustered at 4 digit NACE rev.2 sector level \times year where significance level is defined as *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

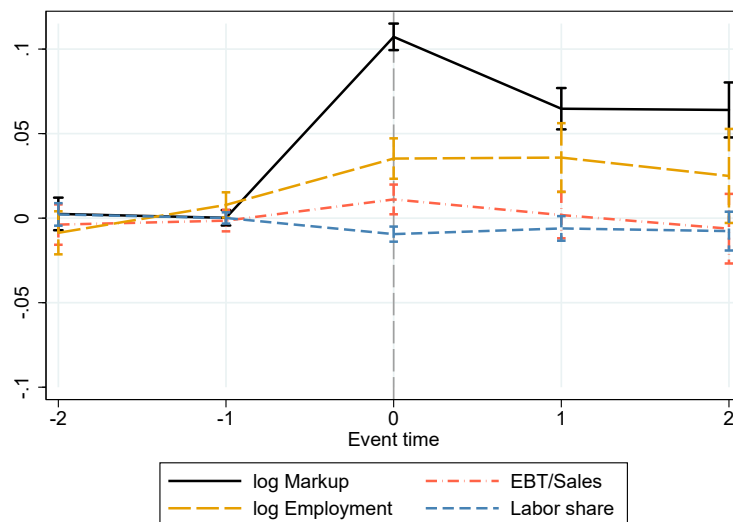
A.2 Figures

Figure A.1: De Chaisemartin and d’Haultfoeuille (2020b) Staggered Difference-in-Differences



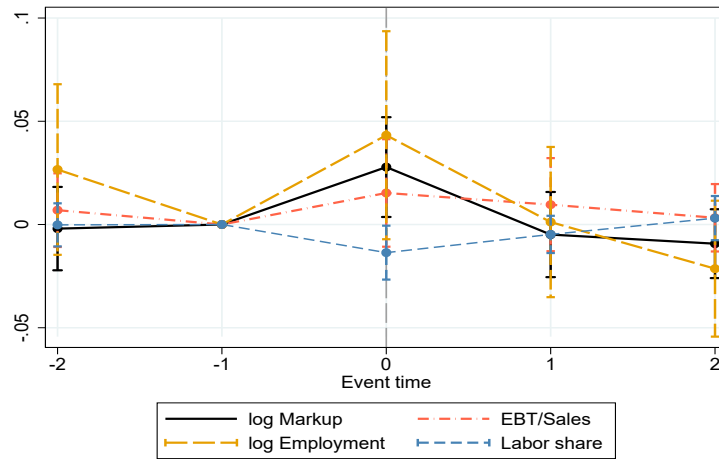
Note: This figure shows graphically the estimates using De Chaisemartin and d’Haultfoeuille (2020b) staggered difference-in-differences approach. EBT is earnings before taxes. Labor share is labor cost over sales. We control for lagged log capital, log sales and the share of exports in sales. In De Chaisemartin and d’Haultfoeuille (2020b) there is no base period, e.g. at event time -1 the comparison is between switchers at time 0 and the never treated.

Figure A.2: De Chaisemartin and d’Haultfoeuille (2020b) Staggered Difference-in-Differences with unit specific time trends



Note: This figure shows graphically the estimates using De Chaisemartin and d’Haultfoeuille (2020b) staggered difference-in-differences approach with unit specific time trends. EBT is earnings before taxes. Labor share is wagebill over sales. We control for lagged log capital, log sales and the share of exports in sales. In De Chaisemartin and d’Haultfoeuille (2020b) there is no base period, e.g. at event time -1 the comparison is between switchers at time 0 and the never treated.

Figure A.3: Dynamic Effects Procurement on Single Bidder Firms- OLS



Note: This graph presents the results from event study in 10. The dependent variable in this case is single bidder dummy and all effects are relative to procurement firms. The base period is -1 to which all other times periods are normalized and the treatment period is 0 (when procurement contract is allocated). EBT is earnings before taxes. Labor share is labor cost over sales

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