Political Connections and Competition on Public Procurement Markets

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Abstract

We study the effects of political connections on the public procurement market. Our main findings suggest that political connections – measured both by political affiliation of firm representatives and implicit connections based on frequency of contracts between a procurer and a supplier – increase the final price of procurement contracts allocated to connected firms given the estimated prices. Our evidence also suggests that public procurement authorities restrict competition in order to help connected firms and that the projects awarded to connected firms tend to be of lower quality as measured by the probability of repairs. To quantify the total distortion, we estimate a structural model of the public procurement market where connected firms are being favored by the procurers. Our lower bound estimate suggests that tenders allocated to favored firms are overpriced by 3.8% which would sum up to the total welfare loss of 0.5 billion CZK.

JEL classifications: D44, D72, H57.

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1 Introduction

Public procurement contracts allocated by public-sector institutions account for 15 to 20% of GDP in OECD countries [OECD, 2015]. Anecdotal evidence on the existence and various impacts of political connections as well as a growing body of literature studying suggest that there is a relation between various measures of political connections and public procurement market outcomes [Stratmann, 1995, Goldman et al., 2013, Brogaard et al., 2016, Schoenherr, 2017]. The size of the market and the extent of potential implications of distortions induced by bidders' political connections make the understanding of the effects of such connections on the public procurement market's outcomes and the welfare implications of such distortions essential. Anecdotal evidence suggests that connections between procurers and suppliers might be a first order problem for the Czech market [Golis, 2015]. Even though the majority of contracts is allocated through an open procedure – basically lowest price auctions, procurers still have discretionary power how to exactly set up the conditions for competition and potentially favor their connected firm. Public bodies need to specify several details before the bidding starts, such as about the technical details of a particular project or requirements a firm needs to fulfill to be eligible to compete. These are the tools a public body should use to increase project quality or exclude not qualified bidders. However, procurers might also misuse the discretionary power in order to help their favored company win a contract[1]. In this paper, we study the distortionary effects of political connections on the public procurement market outcomes and evaluate their welfare loss implications using public procurement data from the Czech Republic.

The first closely related stream of literature estimates structural models of auctions in the procurement market. Marion [2007], Krasnokutskaya [2011] and Athey et al. [2013] study preferential treatment of SMEs in procurement auctions. Due to a government policy, smaller bidders receive a bidding subsidy creating additional heterogeneity among bidders. Aforementioned studies analyze the impact of such a policy on the final price, efficiency and bidding behavior of participants. In our analysis, the crucial heterogeneity among bidders does not come from a government policy, but exists as a result of a personal connection between a procurer and a supplier which might emerge in a market with relatively weak legal institutions.

A common question in the design of the procurement market is whether organizations should receive more or less discretion during the procurement procedure. Roberts and Sweeting [2013] show that a cost minimizing buyer might often prefer negotiation to an open auction which could justify increased discretion for public procurers. However, such an analysis is insufficient in the setting where the buyer might be subject to severe agency problems [Holmstrom and Milgrom, 1991]. For this reason, it is important to understand behavior and incentives of procurers and whether they are inclined to rent-seeking. So far there is limited literature studying incentives of such institutions in more detail. Ladner et al. [2009] empirically distinguish between losses coming from corruption and inefficiencies. Further, in a recent study, Kang and Miller [2015] show that restricting competition might even be a rational behavior of a procurer trying to minimize costs of bid solicitation and evaluation. On the other hand, Johnson et al. [1998], Kwon [2014] link larger discretionary power with the possibility of inducing in corruptive practices. Coviello and Mariniello [2014], Coviello et al. [2017] find that discretion is associated with a higher share procurement contracts allocated to smaller firms within the region and that the same firms are more likely to receive contracts repeat-

[1] See e.g. Spagnolo [2012], Coviello and Mariniello [2014], Coviello et al. [2017], Palguta and Pertold [2017].

edly. Palguta and Pertold [2017] find that tenders where politicians have larger discretionary power are associated with higher prices if allocated to anonymously owned companies. Our paper contributes to this literature by showing that procurers might misuse the granted discretion by favoring specific companies and by showing that this favoritism has negative welfare consequences.

The second stream of literature including, for instance, Goldman et al. [2013], Baltrunaite [2016], Brogaard et al. [2016], Schoenherr [2017] are papers that provide evidence on the link between political connections of firms and an easier access to public projects in developed countries. This literature is focused mostly on how political connections affect performance of firms, especially how they affect the volume of public contracts. Our approach differs as our main object of study is the market of procurement contracts itself, we focus on how the connections affect the competition for procurement contracts and most importantly costs of the public projects.

Schoenherr [2017] documents that contracts supplied by connected firms more often exhibit delays or other signs of bad performance and they are often renegotiated due to cost increases. Brogaard et al. [2016] show that politically connected firms might win in competitions where less bidders are participating. Using a Czech data set, Titl and Geys [2019] show that corporate donors receive contracts of higher value and document the heterogeneity in the donation-procurement relation for different allocation procedures. Importantly, these papers have so far presented mostly reduced form evidence that didn't allow for a welfare analysis. We build on this evidence and provide a comprehensive model of how connections affect the public procurement contracts.

Similarly to, for instance in Goldman et al. [2013], Schoenherr [2017], we define political connections based on personal connections between firms and procurers. More specifically, we consider a firm politically connected if there is/was a politician in the board or the supervisory board of the company or its mother or daughter company. However, we also add another implicit measure of connection based on frequency of business between a specific supplier and procurer. A firm is then said to be connected if we observe that it is a key supplier[2] for a particular public institution. Such an approach allows us to study links between institutions and companies which would be otherwise impossible to detect using approaches that are common in the literature.

Thirdly, there are few papers showing how insights from industrial organization can be used to study how market outcomes depend on underlying institutions and phenomena such as preferential treatment or corruption. Cai et al. [2013] show how the bidding behavior in the market for land in China confirms the presence of corruption. Magnolfi and Roncoroni [2015] find that political connections might play a crucial role for entry in the Italian supermarket market.

Our findings show that firms identified as implicitly connected to public contracting authorities win contracts with an approximately 10% to 18% higher price. They also win contracts with restricted entry. Specifically, our analysis suggests that there are between 0.3 and 0.6 less bidders in tenders won by connected firms. Given the average of five bidders per tender, the effects appear to be economically significant. A similar effect in price is found for firms that have an explicit political connection to the procurers. We don't find a negative effect on entry

[2]We define a key supplier based on a share of contracts supplied to a particular public institution procurer on all contracts supplied by the firm, i.e. $\frac{\#ofcontractsfirmisuppliedtoinsitutionj}{\#ofallcontractsprocuredbyinstitutionj}$.

in this case. Moreover and importantly, we construct a structural model of the procurement market and we evaluate the welfare loss caused by favoritism in public procurement. By simulating the model as if connections played no role, we estimate that 3.8% of total costs on contracts awarded to connected firms could have been saved. A lower bound estimate of the total welfare loss in our sub-sample sums up to half a billion CZK)[3].

[3]Current exchange rate is 22.01 CZK for 1 USD.

2 Market description

2.1 Public Procurement

Our analysis focuses on public procurement contracts awarded by municipalities, regions and the central government in the Czech Republic. Nationwide regulation governs the procedure of awarding public procurements for medium and big contracts. The regulation describes the allocation processes and specifies the set of possible evaluation criteria. Nevertheless, the actual implementation of these regulatory procedures is administered by the procurers and they, thus, have a substantial leeway in choosing allocations procedures, qualification and evaluation criteria. Another part of the regulation is the obligation to publish details about contracts on-line. These data are going to be the basis of our project. [4][5]

2.2 Czech Governance

In order to better understand this market, we provide a brief overview of the system of public governance in the Czech Republic. All for us relevant bodies of governance are elected indirectly when the public votes for a "parliament" (exact name depends on the level of governance) and this "parliament" then elects the government of the public body. This setup is the same for all governance levels – municipalities, regions and the central government.

The central government is, for our purposes, represented by ministries and different government offices that have their own legal autonomy and budgets that are spent also via public procurement contracts. The ministries (especially the Ministry of Finance and Industry) also often own directly state owned enterprises.

The Czech Republic has been since in 2000 administratively divided in 13 regions and the capital of Prague, which constitutes its own separate region. The regions have considerable competences in economic policies including transport, education, health care and regional development or tourism[6]. Finally, the lowest level of governance is represented in 6,253 municipalities.[7]

Our analysis will use projects of all bodies of the central government, all regions and selected big municipalities where we could identify which party was in government. During the studied period (from 2006 to 2016), there have been multiple elections on all levels of government that will help us to isolate effects of the changes in the political parties in power and thus also changes in the existing connections on the procurement market outcomes.

2.3 Connections

We study politically connected firms in the public procurement market. Thus, we define two types of political connections: *(i)* explicit political connections based on personal connections

[4]Contracts above a specific threshold (2,000,000 CZK for public service contracts, 6,000,000 CZK for public works) need to be published according to the law but also a very big number of smaller contracts are published.

[5]The registry is available on-line at https://www.vestnikverejnychzakazek.cz/.

[6]See Hooghe et al. [2016] for a detailed description.

[7]A municipality is a public corporation which has been granted its status by Act no. 128/2000 Coll. It has its own property and legal autonomy.

of board members of firms and *(ii)* implicit connections based on revealed preferences of procurers and firms.

2.3.1 Explicit Political Connections

In order to find firms with personal political connections, we collected data set of all candidates to the Parliament of the Czech Republic, the Senate, Regional and Local Councils in period from 2013 to 2017.

We matched these candidates with the dataset of members of boards and supervisory boards of all Czech firms based on their names, city of residence residence, age and some additional information such as academic titles and occupation. This approach has its limitations. It is possible that in big cities, there are two people of the same name (especially for the most common Czech names) and age. In order to avoid the mis-identification of firms that are actually not connected, we use information about frequency of names in the Czech Republic and calculate probabilities of occurrence of two people of the same name and age in the city at hand and if the calculated probability is lower than 50%, we drop such connection from our data set (i.e. we use only those connections which we can be relatively sure about).

On top of that, we consider firms that are owned or own a firm that is politically connected as defined above also politically connected (we do not restrict the length of the chain of firms, i.e. a firm that is owned by a firm which has politically connected mother company is still consider connected). In total, we identified 3,578 politically connected firms among contractors to the Czech institutions and their subsidiaries, which constitutes about 1.38 % of all contractors.

Note that this approach differs from usual definitions of connection as our connection does not mean that the firm is actually connected to a politician in power as most of the candidates will not get elected but it rather serves as a proxy showing that there might be personal ties between a specific firm and a political party.

2.3.2 Implicit Political Connections

Even though the literature usually focuses on explicit connections that are possible to clearly define, we find interesting to also an additional measure of connectedness. Many connections exist on a personal level and are very hard to measure using any possible data source. Such hidden connections might still be extremely important in terms of total impact. We will thus also study implicit potential connections purely based on observed procurement data where we define a connection if a supplier wins a large share of contracts of a given procurer. Specifically, we say that a firm is implicitly connected to a procurer if this firm delivers more than 20% of the total amount of procurements for a given procurer[8] in an election period[9]. To eliminate really small public bodies, we delete all procurers with less than 3 projects. Unfortunately, we were not able to define political connections for some small municipalities where we couldn't find political party in power which causes a loss of observations in some of the analysis in Section 4.

[8] Doroftei and Dimulescu [2015] define similarly state capture of public institutions.

[9] This means that there can be variation in the connection of a single firm over the studied period.

2.4 Data Description

In this paper, we study so-called open procedure tenders that allow every interested bidder to participate in the tender. In such tenders, contracting authorities announce the intention to award a procurement on the Internet and any supplier that satisfies the qualification criteria can bid. There are two different implementations, the contract is either directly awarded to the bidder with the lowest price or the procurer sets up a scoring auction where both price and quality are evaluated, this needs to be specified before the start of the auction. Our study focuses on the lowest price auctions which is overall the most common procedure and is used at 28% of tenders. Other procurement procedures where the winner is chosen through one of the methods with restricted competition and through a more discretionary procedure are not going to be studied in this paper. It is important to realize that we study potential discretionary effects of connection on the segment of the market which is the most transparent one and thus the least prone to potential favoritism.

For our analysis, we use the data about public procurements from 2006 until 2016. Unfortunately, due to the weak enforcement of the publication obligation during the first years, we cannot claim that our data span the whole universe of procurement contracts. Moreover, the quality of the published data is relatively low with lots of mistakes and inconsistencies. A common problem are for example errors in ID numbers of procurers and suppliers making it very difficult to link the same agencies across different observations. Because of these data issues we are going to use data from this public source which have been extensively cleaned and corrected by a private company. Our dataset contains 17,636 contracts awarded between 2006 and 2016 of the total value 227 billion CZK[10].

In terms of specific industries, we observe that majority of projects are construction works (42.8%), IT services (9.7%) and purchase of industrial goods (9.1%).

[10]Current exchange rate is 22.01 CZK for 1 USD.

3 Model

3.1 Setup

This section formalizes the aforementioned notion of favoritism. We assume that it is common knowledge that procurer j has a favored supplier i. This connection is considered predetermined and exogenous in our model. The favored bidder will enjoy a competitive advantage when applying for tenders of this particular procurer.

For each contract, there are two types of bidders – favored ones and non-favored ones. We are going to model the competition for contract z in two stages. In the first stage, all potential bidders (we will use the word bidder and supplier interchangeably) receive an imprecise signal $s_i(z)$ about their cost. Based on this signal and the knowledge of the number and types of potential bidders they decide whether to prepare the technical proposal of the project, which is a necessary condition for submitting a bid. Completing the proposal is costly and firms incur a cost $FC(z)$ which can be considered a fixed cost of participation.

Upon paying the participation costs and entering the bidders learn their actual costs $c_i(z)$, number and types of other entrants. The cost of firms are drawn from the distribution F.

$$c_i(z) \sim F(X_z, \Delta, s_i) \tag{1}$$

where X_z is a vector of characteristics of auction z and Δ is a set of parameters describing cumulative distribution function F. We assume an independent private value setting which is the standard in the procurement literature. Afterwards all bidders compete in a lowest price auction with a reserve (maximum) bid.

The connection is going to affect this game by increasing costs of non-connected firms. If contract z is such that there is a connection between the procurer and some supplier, then all non-connected bidders are going to suffer a cost penalty when bidding. Which means that costs for completing such a project are now $(1 + \delta)c_i(z)$ instead of the original cost drawn $c_i(z)$. This penalty reflects the tendency of the supplier to tailor the project requirements to the exact needs of the connected suppliers. Again, we assume the structure of the game is common knowledge among participants. We will denote by $\mathcal{F}$ all contracts such that there is a connection between the procurer of the contract and some supplier and we denote by $\mathcal{F}_j$ all suppliers that are connected to the procurer j.

Summing up the setup of the game there is the following timing of actions:

- t = 0: Connections between procurers and suppliers are established.
- t = 1: Tender for contract z starts, suppliers observe signal $s_i(z)$ and decide whether to pay $FC(z)$ and enter the tender.
- t = 2: Suppliers submit bids according to either realized costs $c_i(z)$ or costs including the penalty if $z \in \mathcal{F}$ and $i \notin \mathcal{F}_j$.

3.2 Equilibrium

3.2.1 Bidding Stage

We start analyzing the equilibrium from the second (bidding) stage. First, we impose a maximum possible (reserve) bid R. This is important for restricting the possible equilibria. We want to avoid the case when equilibrium bid diverges to infinity. It reflects the anecdotal evidence where some procurers cancel a tender ex post if the final price is too high. This approach is consistent with the literature (for example Krasnokutskaya and Seim [2011] add an implicit bid by the government as de facto maximum bid) and also our data where in 90% of procurements the winning bid doesn't exceed 112% of the estimated price.

Firstly, if there is no favored firm among potential bidders then this is a simple lowest price auction where we can get the standard closed form solution for the bidding function $\beta(c)$ in the symmetric Bayes Nash equilibrium [Hubbard and Paarsch, 2009][11].

$$\beta(c) = c + \frac{\int_c^R [1 - F(t)]^{n-1} dt}{[1 - F(c)]^{n-1}}$$

Secondly, presence of a favored bidder complicates the situation as it introduces asymmetry among bidders. The connected bidders' costs come from a distribution that stochastically dominates the non-connected bidders' cost distribution. This is very similar to the problem of bidding subsidies (see Hubbard and Paarsch [2009]). Equilibrium bidding functions are implicitly determined by the first order conditions. Let's denote n_F the number of favored suppliers that entered and similarly n_N the number of non-favored ones. Analogously the subscripts N and F denote bidding functions $\beta(c)$ for favored and non-favored bidders. $f(c)$ is the density of the costs c. Assuming bidders use type-symmetric monotonic bidding functions we get the following first order conditions of the connected and non-connected suppliers respectively:

$$(b - \beta_F^{-1}(b))[\frac{(n_F - 1) f(\beta_F^{-1}(b)) \beta_F^{-1\prime}(b)}{1 - F(\beta_F^{-1}(b))} + \frac{(n_N) f(\beta_N^{-1}(b)) \beta_N^{-1\prime}(b)}{1 - F(\beta_N^{-1}(b))}] = 1$$

$$(b - (1+\delta)\beta_N^{-1}(b))[\frac{(n_F) f(\beta_F^{-1}(b)) \beta_F^{-1\prime}(b)}{1 - F(\beta_F^{-1}(b))} + \frac{(n_N - 1) f(\beta_N^{-1}(b)) \beta_N^{-1\prime}(b)}{1 - F(\beta_N^{-1}(b))}] = 1$$

Unfortunately, these first order condition don't lead to a closed form expression for bidding functions β_N and β_F. Numerical solutions are necessary [Bajari, 2001, Gavish et al., 2008]. Under standard regularity conditions the bidding functions are going to be unique. For the discussion about uniqueness and existence of the equilibrium in the second stage see Maskin and Riley [2003] and [Reny and Zamir, 2004] and for discussion of boundary conditions necessary to solve the system of differential equations see Hubbard and Paarsch [2009].

[11] Similar conditions hold for both cases when a favored firm is or isn't among the potential bidders. In the first case, costs of firms would just be $(1+\delta)c_i$, and in the second, just c_i. Cost distribution would have to be adjusted accordingly. However, the key condition here is only that the bidders are symmetric.

3.3 Entry Stage

In the first stage bidders decide whether to enter or not based on their initial signal. We assume that $F(X_z, \Delta, s_i)$ is monotonic w.r.t. s_i, i.e. a lower signal suggests lower costs.[12]

We will analyze the type-specific Bayes Nash equilibrium. In this setting, the optimal decision is going to be a type specific threshold s_i above which the firm enters and below which it does not. This is going to be implicitly determined by the zero profit condition [Roberts and Sweeting, 2013]:

$$\int_0^R [\int_{\beta(c)}^R (\beta(c) - c)t(x|S')dx]f(c|S')dc - FC = 0$$

For clarity we drop the dependence of the variables on the attributes of the particular auction z, $t(x|S')$ is the density of the lowest bid of other firms that entered the competition (after accounting for possible bidding penalties). S' is the vector of entry thresholds for all types. The type specific thresholds are continuous and increasing in thresholds of other typer implying that a Bayes Nash equilibrium in the entry game exists.

Roberts and Sweeting [2013] argue that we generally cannot obtain uniqueness of the equilibrium but they show numerically that the equilibrium tends to be unique in a second price auction if there are sufficient asymmetries among bidders.

Generally, we thus cannot argue that our model has a unique equilibrium. Without a specific result supporting the uniqueness of our model, we can only argue that simulations of the counter factual described later offered a unique outcome.

[12] Where by monotonicity we mean that $F(X_z, \Delta, s_i)$ stochastically dominates $F(X_z, \Delta, s_i')$ whenever $s_i > s_i'$.

4 Reduced Form Analysis

In this section, we report the reduced form estimates of the effects of two types of political connections – the explicit political connections and the implicit ones – on the market outcomes.

4.1 Specification

For most of our analysis we use a basic specification:

$$outcome_{ij} = controls_{ij} + FE_{i,j,ij} + \beta * connection_{ij} + \epsilon_{ij}$$

where i stands for a bidder and j for a procurer.

4.1.1 Outcomes

Our main outcome variables are the winning price and the number of bidders. When studying the final price of the procurement, we normalize it with respect to the estimated price indirectly by including the estimated price in the regression[13]. However, this number is sometimes not available as it is not legally required to be published, which leads to a loss of some observations. We denote these two main outcomes as log_p (the winning bid price) and $bids\_count$ (the number of bidders). The summary statistics about the outcome variables are provided in two first rows of Table 1.

Table 1: Summary statistics – public contracts and political connections (2006–2017)

	mean	sd	count
bid_final_price	1.33e+07	6.74e+07	17088
bids_count	5.547017	4.704177	17281
connection_implicit	.0619755	.2411179	17636
lot_estimated_price	1.77e+07	1.19e+08	15046
avg_reneg	.0025017	.0448386	17636
prep_time	33.01573	57.03793	12841
dec_time	93.51005	98.78277	12840
connection_explicit	.0037073	.0607777	10250
N	17636		

Notes: Values of the final price (log_p) and estimated price ($log\_estimated\_price$) are in CZK. $bids\_count$ is the number of bidders per contract. $connection\_implicit$ shows the total share of contracts that is awarded to connected firms. $connection\_explicit$ is a dummy variable equal to 1 for firms with personal connection to the procurer and 0 otherwise. Average renegotiation measures (avg_reneg) the probability that a given contract is renegotiated. Preparation and decision time are measured in days. The the number of observations is different compared to the other variables as these variables are often not reported.

To get some more insight about the nature of the competition, we construct variables about the time dimension of the procurement procedure. Public institutions are often criticized for giving

[13] This is a price expected by the procurer before the tender is launched.

potential competitors only little time to submit a project. Our data confirms this as the average time between announcement of the procurement and deadline for submission of bids (of which part is a technical proposal) is only 33 days. Thus, we include the variable $prep\_time$ as it might be an interesting measure of how a procurer can directly restrict competition for a contract. Similarly, we are going to use the number of days between bid submission and announcement (dec_time) of the winner as a proxy for intensity of search. We hypothesize that if a procurer is not seriously evaluating all submitted bids (as it might have a pre-selected winner) that the decision might be issued faster. The summary statistics control about these alternative measures of connections are provided in Table 1.

Finally, we include a proxy for quality of the contracting. In the US, contract renegotiation due to cost increases (decreases) are relatively common in the procurement market. In the Czech Republic, the final cost of the contract needs to be equal to the winning bid and if there is a serious reason for additional cost increase due to unexpected circumstances it is handled in the following way. The procurer starts a new tender using the "negotiation without publication procedure" framework and awards this contract directly to the original supplier. The cost increases due to this are capped at 20%. This, however, creates problems for our analysis as we do not observe direct cost increases for each contract in our data. Nonetheless, given that we observe all contract between the specific supplier and procurer we construct a variable that shows the probability that a given contract is indirectly renegotiated in the way described above. We denote the variable $avg\_renegotiation$.

4.1.2 Controls

All our specification include the same set of controls – the logarithm of the estimated price and industry fixed effects (defined as the two digit level of CPV codes, which contains 70 different industries). Next we include year and month fixed effects and also a dummy capturing whether the contract is awarded to a local firm (from the same zip code), which should capture the geographical advantage of specific supplier for some contracts.

4.1.3 Fixed Effects

Due to the richness of our data we observe both the procurer and supplier in competitions where there is a connected firm competing as well as in the ones without a connected firm competing. This is the foundation of the variation we are going to use for our estimation. Including the firm FE allows us mitigate some concerns about heterogeneity of firms, especially the concern that connected firms might be just more productive suppliers. Procurer FE allow us to similarly mitigate concerns about procurer heterogeneities.

In the most saturated specification we exploit the panel nature of our data. Due to a change in electoral outcomes firms might gain or loose a connection to such an institution. This creates time variation in connections between procurers and suppliers. So in the last specification we can include procurer/firm fixed effects that isolate this variation. However, a potential concern might be that if connections are established outside of the party relationship directly with the bureaucrats of the procuring agency we might loose important information.

4.2 Results of the Reduced Form Estimation

In the following tables, we provide results in two panels – one for implicit (Panel I) and one for explicit connections (Panel II). Consistent with the notion that the procurer purposefully restricts competition for public procurement by making it harder to compete for all bidders except of the connected one, we see that if a connected firm wins a project it tends to be for a higher price given the estimated price of the project. For implicit connections, it is 11.9% in the basic specification and generally between 9.9% and 15.6% (see Panel I in Table 2). For explicit political connections, the results are less statistically robust but very similar in magnitude which ranges from 9% to 18%. Importantly, the estimated effect is significant when including firm/procurer FE. Overall, the results thus provide strong evidence that firms that become personally connected to a particular procurer win projects of a significantly higher price (given the estimated value of the projects).

Table 2: Effect of connections on the final price

	(1)	(2)	(3)	(4)
	log_p	log_p	log_p	log_p
	Panel I (implicit connections)			
Connection	0.119***	0.101***	0.156***	0.0999**
	(0.0124)	(0.0161)	(0.0220)	(0.0480)
Firm FE	No	Yes	No	No
Procurer FE	No	No	Yes	No
Firm/procurer FE	No	No	No	Yes
N	14741	14741	14741	14741
	Panel II (political connections)			
Connection	0.184**	0.0916	0.179	0.121**
	(0.0792)	(0.1128)	(0.1506)	(0.0495)
Firm FE	No	Yes	No	No
Procurer FE	No	No	Yes	No
Firm/procurer FE	No	No	No	Yes
N	8599	8599	8599	8599

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: The outcome variable is the logarithm of the winning bid. The logarithm of the estimated price, industry fixed effects, year and month fixed effects and also a dummy capturing whether the contract is awarded to a local firm are included throughout all specifications.

Similarly, for implicit connections, we observe restricted entry into these competitions: between 0.3 and 0.57 less bidders (in contracts in which connected firms participate) depending on the specification. Given an average of five bidders per tender, this seems like an economically large effect (see Panel I in Table 3). These estimates lack significance when procurer or firm/procurer fixed effects are included as the standard errors are much bigger in these cases, this might suggest that the difference in the number of bidders is determined by the procurer and the connected bidders often bid for contracts run by contracting authorities which run tenders with lower competition. This might also suggest that the connection is not so much

dependent on the party in power, it is connection to, e.g., officers rather than particular party. For explicit connections, we do not observe any significant decline in the number of bidders.

Table 3: Effect of connections on the number of bidders

	(1) bids_count	(2) bids_count	(3) bids_count	(4) bids_count
	Panel I (implicit connections)			
Connection	-0.472***	-0.573***	-0.422	-0.304
	(0.1194)	(0.1551)	(0.3905)	(0.4381)
Firm FE	No	Yes	No	No
Procurer FE	No	No	Yes	No
Firm/procurer FE	No	No	No	Yes
N	14843	14843	14843	14843
	Panel II (political connections)			
Connection	0.114	-0.267	0.0602	1.114***
	(0.5229)	(0.4986)	(0.6332)	(0.3318)
Firm FE	No	Yes	No	No
Procurer FE	No	No	Yes	No
Firm/procurer FE	No	No	No	Yes
N	8638	8638	8638	8638

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: The outcome variable is the number of participating bidders. The logarithm of the estimated price, industry fixed effects, year and month fixed effects and also a dummy capturing whether the contract is awarded to a local firm are included throughout all specifications.

Regarding the alternative measures, our estimates show that implicitly connected firms win tenders which take on average 2.7 days less to prepare and their offers are evaluated more than 10 days faster. This is again consistent with the hypothesis the procurer is trying to restrict competition in favor of the connected firm. We find no difference for probability of renegotiation. Even though renegotiation for higher cost might seem as an easy way to extract additional rent from the procurer, it seems not to be the case. The reason why we do not see a difference may be that NGOs and public in general was criticizing the lack of transparency during such procedures shedding more light on potential illegal behavior using this channel and lowering thus its profitability.

For explicit personal connections, we do not observe any significant effect of personal connections on the preparation time. However, in line with the results for implicit connections, the bids submitted by personally connected firms are on average evaluated 13 days faster.

Table 4: Effect of connections on alternative measures

	(1) prep_time	(2) dec_time	(3) avg_reneg
	Panel I (implicit connections)		
Connection	-2.744***	-10.73***	0.000797
	(0.9067)	(2.0874)	(0.0013)
Firm FE	No	No	No
Procurer FE	No	No	No
Firm/procurer FE	No	No	No
N	11173	11173	15037
	Panel II (political connections)		
Connection	2.203	-13.12**	-0.00153*
	(2.5518)	(5.2305)	(0.0009)
Firm FE	No	No	No
Procurer FE	No	No	No
Firm/procurer FE	No	No	No
N	7162	7162	8753

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: Preparation and decision time are measured in days. The the number of observations is different compared to Table 1 as these variables are often not reported. The logarithm of the estimated price, industry fixed effects, year and month fixed effects and also a dummy capturing whether the contract is awarded to a local firm are included throughout all specifications.

Overall, our reduced form estimates present suggestive evidence that either form of connections might negatively affect the competition for public contracts. Implicit connections offer more robust results which is in our opinion caused most importantly because of a much higher number of implicit connections in our dataset. We only found 0.3% of contracts allocated to explicitly connected firms which might cause problems especially when including various fixed effects. Also note that number of observations used in regressions differ between the implicit and explicit case because for some municipalities we were not able to identify the political party in power and thus we couldn't define the political connection for contracts of these municipalities.

4.2.1 Heterogeneity in the procurement market

In the previous analysis, we have considered public procurement that were heterogeneous. The sample of studied contracts included mostly construction works, IT services and purchases of different kind of goods. In the following analysis, we focus on more homogeneous market – public procurement of goods – where we include all goods procured on municipal, regional and national level. For goods, the estimated price should just be a function of the market price. This is an interesting setting since we can control for the estimated prices in our analysis. It would be ideal to study a completely homogeneous market with the exact same product but given that our data only include expensive goods of the value above 2 million CZK, we have a

limited number of observations for each homogeneous goods. Thus, we include all goods that should be equivalent to the products on the commercial market and there would be only little need for specific adjustments of the goods for a given procurer which is the main difference compared to the services where the needs of each procurer can be very different. The contracts that were chosen include for example cars, agricultural machines or raw materials.

The main motivation for studying the homogeneous market is that tailoring competition for a specific supplier might be a rational, albeit illegal, behavior of a contracting authority. Imagine a very complicated project. The lowest price auctions are often criticized for not necessarily delivering the best quality project. If a connection could serve as a guarantee of quality then we might see similar quantitative effects as in the previous section, but such behavior would be actually welfare improving. In the case of homogeneous goods this argument doesn't seem valid as they are identical to the products sold directly on the commercial market.

Restricting the market on this level, we expect lower effects of connection as for goods the procurer might have a only limited discretionary power how to favor specific firms. Nevertheless, we still see significant effects in all but the last specification when studying both price and number of bidders (see Tables 2, 3). Specifically, we estimate that if a connected firm wins contract for good, it tends to be for a 7% to 16% higher price and between 0.18 and 0.38 less bidders in the contracts in which connected firms participate.

Table 5: Effect of connections on the final price for contracts for goods

	(1)	(2)	(3)	(4)
	log_p	log_p	log_p	log_p
connection_implicit	0.0782***	0.0797***	0.158***	-0.00349
	(0.0187)	(0.0232)	(0.0371)	(0.0652)
Firm FE	No	Yes	No	No
Procurer FE	No	No	Yes	No
Firm/procurer FE	No	No	No	Yes
N	3770	3770	3770	3770

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: The outcome variable is the logarithm of the winning bid. The logarithm of the estimated price, industry fixed effects, year and month fixed effects and also a dummy capturing whether the contract is awarded to a local firm are included throughout all specifications.

Table 6: Effect of connections on the number of bidders for contracts for goods

	(1) bids_count	(2) bids_count	(3) bids_count	(4) bids_count
connection_implicit	-0.231**	-0.275**	-0.382**	-0.178
	(0.0940)	(0.1096)	(0.1865)	(0.3060)
Year FE	No	Yes	No	No
Firm FE	No	No	Yes	No
Procurer FE	No	No	No	Yes
Firm/procurer FE	3739	3739	3739	3739

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: The outcome variable is the number of participating bidders. The logarithm of the estimated price, industry fixed effects, year and month fixed effects and also a dummy capturing whether the contract is awarded to a local firm are included throughout all specifications.

We studied only the implicit connections as there was only a small number of firms delivering goods that could have been linked as explicitly politically connected.

4.2.2 Quality

Next we present some more evidence that a connection between a procurer and a supplier is not formed because it guarantees quality of the project, which is then reflected in the higher final price.

In order the tackle this issue, we isolated the construction of roads because we can construct a proxy for quality of the projects. In such a market, a natural way to asses quality is the amount of repairs which follow a project. Unfortunately, we are not able to exactly match each road construction with the subsequent number of repairs. However, we can construct a proxy by looking at the total number of construction and total number of repairs for a given procurer. Our proxy of quality is then going to be the expected number of repairs ($prob\_repair$) and expected price of these repairs for a given road conditionally on needing a repair (log_est_cost).

Table 7: Effect of connections on quality measures

	(1) prop_repair	(2) log_est_cost
	Panel I (implicit connections)	
Connection	0.00275	0.752***
	(0.0192)	(0.2387)
Firm FE	No	No
Procurer FE	No	No
Firm/procurer FE	No	No
N	1075	479
	Panel II (political connections)	
Connection	0.0896*	0.0358
	(0.0469)	(0.2903)
Firm FE	No	No
Procurer FE	No	No
Firm/procurer FE	No	No
N	634	400

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: The logarithm of the estimated price, year and month fixed effects are included as controls.

The results of these estimations are presented in Table 7. We observe that implicit connections do not affect the probability of a repair, however, personal connections do increase the probability of a repair by approximately 9%.

Conditional on road needing repairs, we see that the expected costs are significantly higher if the original project was done by an implicitly connected firm. These results seem to be inconsistent with the hypothesis that connections can be welfare improving by improving quality of the projects.

4.2.3 Firm Attributes

Merging our dataset with a detailed database of Czech firms, we lastly look at whether connected and non-connected firms systematically differ in firm characteristics. We find that companies with both types of connections tend to be slightly bigger and older. Also more often these companies are of a more reliable firm structure.[14] These findings are similar to standard findings in corporate finance showing that political connections are correlated with better firm-level outcomes.

In the further analysis, we intend to account for this heterogeneity among firms.

[14] In the Czech Republic there are two main legal types of companies. The first is the so called limited-liability company, where the firm only guarantees to pay for liabilities up to 200 000 CZK in case of bankruptcy. The second type are standard stock companies that are regulated in a relatively similar way as in the US.

Table 8: Firms characteristics of connected and non-connected firms

	(1) overall_con	(2) overall_con	(3) overall_con	(4) overall_con	(5) overall_con
			Panel I (implicit connections)		
reliable_firm_structure	0.0398**				
	(0.0168)				
political_con		0.118***			
		(0.0167)			
log_capital			0.0362***		
			(0.0048)		
employees_count_class				0.000655***	
				(0.0001)	
age					0.00165*
					(0.0009)
N	3072	3719	1866	3569	3569
			Panel II (political connections)		
reliable_firm_structure	0.0461***				
	(0.0120)				
political_con		0.0804**			
		(0.0397)			
employees_count_class			0.000423***		
			(0.0001)		
age				0.00167***	
				(0.0006)	
N	2034	2466	2375	2375	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table just presents simple bivariate relationships where we regress the connection characteristic on the specific firm level outcome.

5 Structural Model Estimation

5.1 Description

We will proceed by estimating the model described in Section 3. Because of absence of bidding level data we need to make restrictive assumptions. We assume perfectly selective entry, meaning the situation where firms' signals equal their costs.

This situation seems to be closer to reality as the alternative would be a model with no selection which, however, has very restrictive implications and would mean that favored firms would always enter a tender. For example [Roberts and Sweeting, 2013] reject such a model.

The key part of our estimation is recovering the distribution of underlying costs of completing the project. In the spirit of Guerre et al. [2000], we will use the distribution of winning bids and the first order conditions for optimal bidding to recover the distribution of costs. Let's denote G_F and G_N the CDFs of bids for favored and non-favored bidders respectively. Similarly, g_F and g_N are densities. The following equations would allow us to estimate both the distribution of costs and preferential parameter δ.

$$b_F - c = [\frac{(n_F - 1)g_f(\hat{b}_F)}{1 - G_F\hat{(}b_f)} + \frac{(n_N)g_N(\hat{b}_F)}{1 - G_N\hat{(}b_F)}]^{-1}$$
$$b_N - (1 + \delta)c = [\frac{(n_F)g_f(\hat{b}_N)}{1 - G_F\hat{(}b_N)} + \frac{(n_N - 1)g_N(\hat{b}_N)}{1 - G_N\hat{(}b_N)}]^{-1}$$

Estimating the model using these conditions is straightforward using all submitted bids. In our case, we need to make some more simplifying assumption as we only observe winning bids and total number of bidders. We observe n the total number of participants, however, we cannot exactly say how many firms are favored in each auction. We assume that if a non-connected firm won, then there was no connected competitor and in cases where a connected firm won there was exactly one connected firm. This might give us a conservative estimate of the cost penalty as we assume away situations where final price of an auction rises because of favored firm participating but not winning the auction. Moreover, we assume that both favored and non-favored firm are ex ante the same, meaning their costs come from the same distribution. We need to make this assumption to identify δ. We impute the distribution G by studying only the lowest order statistic which is observed in data. Given that we don't know how exactly different number of participants relates to the exact shape of distributions of bids (and thus their lowest order statistic we observe) we perform the analysis for each number of actual entrant and then weight the results by the respective empirical frequencies.

Next, we estimate the fixed costs of participating. This parameter will be identified from the relationship between the potential number of bidders and actual participants. We match the moment:

$$\mathbb{E}(n|\bar{n}) = n_{data}$$

We impute the potential number of bidders $\bar{n}$ as the maximum number of participants that entered a tender in a given industry for a given procurer. We also isolate markets with connected firms depending on whether a connected firm ever won a contract in this market. Then the zero profit condition together with the matched numbers of participants will identify the fixed costs. We estimate the fixed costs as a share of the estimated price. For each number of potential entrants, we estimate the fixed costs that rationalize the realized entry. We then again collapse the distribution to a single parameter using empirical frequencies as weights.

5.2 Results

We estimate the model with both definitions of a favored firm. The estimates are of the same order of magnitude but the implicit connections have a more serious implication for the welfare loss.

We report all results with respect to the estimated price (in percentage points). We approximated the cost distribution with a log-normal distribution with parameters μ and σ. Using the implicit and explicit connections give us both very similar estimated of the underlying cost distribution. In the first case the log-normal distribution of costs corresponds to a distribution with a mean of 69.5% relative to the estimated price. This observation shows that estimated costs are more often an upper bound of actual costs. This seems consistent with the evidence that procurers rather report an upper bound of the estimated costs as the resources need to be allocated from the budget and a low estimate might lead to a budget deficit which procurers try to avoid. Fixed costs of preparing the project correspond to 1.52% (1.48% using the explicit connections) of the estimated price.

Finally δ – the bidding penalty for non-favored firms – is estimated to be 4.6% of the estimated price in the implicit case and 7.1% in the explicit case. We argue that this is a lower bound of the real effect for several reasons. Firstly, our assumptions described earlier are likely to lead to a downward bias. Secondly, the estimated price itself might be endogenous in cases when procurers inflate the estimates price to mask the inefficiency from allocating a contract for a higher price to the favored firm. In our setting it is unlikely that procurers manipulate the estimate the other way. There are potential incentives to report a lower estimate to avoid stricter regulation as contracts below a specific threshold don't need to be procured according to the national regulation and don't need to be published on-line. However, our dataset wouldn't include these contract as they would be below the threshold for publication.

Table 9: Structural estimates: implicit connections

Parameter	Estimate	SE
δ	4.69	.06
FC	1.52	
μ	4.16	.0046
σ	.46	.0033

Table 10: Structural estimates: political connections

Parameter	Estimate	SE
δ	7.15	.0014
FC	1.48	
μ	4.13	.0086
σ	.54	.0061

5.3 Welfare analysis

Our ultimate goal it to evaluate the total cost of inefficiencies that are caused by the existence of favoritism on the market for public procurements. Having estimated the parameters in the previous section, we can perform a simple welfare calculation. We calculate the cost increase in projects that are awarded to favored firms. We thus again ignore the potential spillovers that might occur if a favored firm competes and doesn't win. Technically, we simulate the model where we replace the actual value of δ with 0.

In our market 7% of contracts are awarded to implicitly connected firms and 0.4% to explicitly connected firms. An average cost of these contracts is 13.3 million CZK. By eliminating the inefficiencies caused by the implicit connections, 3.8% of total costs of contracts allocated to connected firms could have been saved. This sums up to the total amount of 493.4 million CZK of possible savings. Similarly using political connections, the welfare costs are 5.5% of total costs for 0.4% contracts summing up to 31.1 million CZK.

This suggests that consequences of favoritism in the procurement market constitute a serious inefficiency and policies helping to tackle this problem could help achieve significant savings. However, we need to realize that this is only a lower bound of the total inefficiencies as our estimated are likely downward biased, and perhaps even more importantly, we only study the most transparent open auctions. The possibilities of inefficiencies are even magnified in less transparent allocation methods (for evidence in the Czech setting, see e.g. Titl and Geys [2019]).

5.4 Unobserved Heterogeneity

When estimating our model, we had to make several simplifying assumptions. Probably the most serious one being that we can control for unobserved heterogeneity of different projects using only the described set of control variables and then recover the underlying cost distribution. Unobserved heterogeneity can bias the results of the estimation in our non-linear model even if it doesn't interact with the most important variable of interest, the proxy for connection. A possible way how to tackle this issue is to use bidding level data and control for heterogeneity using methods developed in [Krasnokutskaya, 2011]. This will be done in a future version of this paper depending on obtaining reliable bidding level data.

6 Conclusion

In this paper, we study political connections and their impacts on the public procurement market. A natural challenge to this and similar studies is the difficulty of measuring any sort of connection between public institutions and private firms which makes it complicated to present a convincing estimate of the magnitude of inefficiencies caused by these institutional factors. We propose two types of political connections – the explicit connections that are measured based on presence of political candidates in boards of companies and the implicit ones that are measured based on frequency of contracts between a procurer and a supplier – and show that favoritism to connected firms can have negative impacts on the public procurement market outcomes. We examine how such connections affect the competition for public procurement tenders and evaluate the welfare loss of this distortion.

We find evidence that contracts supplied by politically connected firms tend to be procured for a higher price and with less competing bidders. Moreover, connected firms tend to perform worse in terms of quality than the non-favored competitors. A conservative estimate suggests that tenders allocated to favored firms are overpriced by 3.8% summing up to a total loss of almost half a billion CZK. We contribute to the previous literature by developing a model which allows us to perform a counter factual analysis and estimate the welfare loss induced by the political connections.

As it doesn't seem likely that any dataset will allow researchers to quantify the total welfare loss induced by political connections (not only a conservative lower bound using specific types of connection as it is done in this paper), we think that an interesting future venue of research is development of a connection model which works only with implications of favoritism for the procurement market. Studies such as Cai et al. [2013] or Kawai and Nakabayashi [2014] study implications of corruption and collusion for markets without explicitly observing it. We think that similar models capturing favoritism would be a significant contribution for the literature as it still remains unknown what are the total costs of such distortions.

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