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Firm performance, imperfect competition, and corruption risks in procurement: evidence from Swedish municipalities

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Abstract
Previous research has shown that corruption risks may distort market incentives in high-risk contexts. However, there is a dearth of evidence on the potential impact of corruption in settings characterized by low corruption and high-quality institutions. Against that background, this paper delves deeper into the alleged consequences of corruption by examining the link between corruption risks in public procurement and the profitability of firms in the Swedish construction industry. We introduce a novel measure of corruption risk based on the share of single bidder contracts that a firm has won. Validity analysis confirms that our measure is correlated with an alternative corruption measure and local tender winners. Our results reveal that firms that win many single bidder contracts have higher profitability than other firms in the sector: 10 percentage points higher single bidding rate firms have a 0.2–0.6-percentage-point higher sales margin. The findings underscore that public procurement corruption risks distort markets and economic incentives, and that this risk is present even in low-corruption contexts such as in Sweden.

Keywords Public procurement · Corruption · Imperfect markets · Firm performance

1 Introduction

Public authorities are major buyers of construction and infrastructure services worldwide, and public procurement accounts for 10–15% of global GDP (WTO, 2020). Public purchases are highly regulated in most countries to ensure equal opportunities between potential suppliers and to avoid favoritism and opportunism. The overarching purpose of public procurement is to ensure competition based on price or quality. However, this aim is short-circuited if competition is restricted in ways that favor specific suppliers above others.

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From the taxpayer's perspective, restricted competition in public procurement leads both to an inefficient allocation of resources (Fazekas & Tóth, 2018; Heggstad & Frøystad, 2011) and to inflated costs (Bergman et al., 2020; Locatelli et al., 2017; Olken, 2007). From a market perspective, restricted competition distorts market incentives, so firms' success is determined by favoritism rather than quality and efficiency (Fazekas et al., 2017; Ravenda et al., 2020).

While noncompetitive procurement tenders could have a wide range of explanations, corruption certainly is one of them. It has been estimated that corruption drains between 20% and 25% from national procurement budgets annually, to an estimated total sum of approximately USD 2 trillion (OECD 2015, p. 22). One common way to manipulate procurements is to customize the tendering process or the advertised criteria in ways that ensure that only the desired supplier participates in the tender, resulting in a noncompetitive process (Ferwerda et al., 2017).

Despite the fact that corruption is generally associated with developing economies (Tanzi & Davoodi, 1998; Treisman, 2007), public procurement undoubtedly remains a danger zone for corruption even in Organisation for Economic Co-operation and Development (OECD) countries (Hessami, 2014). There is growing awareness of—and research on—risk factors for corruption and restricted competition in public procurement also in mature democracies (e.g., Charron et al., 2017; Graycar, 2019). For instance, previous research has found that firms with political connections benefit from noncompetitive tenders (Palansky, 2021; Goldman et al., 2013). Moreover, tenders with only one bidder are more common in settings with weak electoral accountability (Broms et al., 2019) and politicized agencies (Dahlström et al., 2021).

However, the potential market impact of imperfect competition in public procurement is often overlooked, and research on the effects of noncompetitive tenders in public procurement on individual enterprises and markets remains scarce. One exception is a study by Fazekas et al. (2017) which found that corruption risks as measured by restricted competition led to market dominance of a few favored suppliers in clientelist contexts. That said, currently there is limited knowledge on to what extent this finding is transferable to mature democracies with more robust institutions.

Against this backdrop, this paper examines the extent and the market impact of noncompetitive public procurement in a mature democracy, specifically the construction industry in Sweden. Theoretically, we expect limited competition in public procurement to increase the profitability of the winning firm, since it has no incentives to reduce its costs under such circumstances. Our main hypothesis is therefore that firms that win a higher share of government contracts without competition have higher profitability than other firms. To test this, we take a departure from the previous research that uses the share of single bidder contracts (i.e., single bidder ratio, also called "red flag contracts"), as a proxy for corruption risk from the perspective of public agencies (Broms et al., 2019; Dahlström et al., 2021). Based on this, we develop an original corruption risk indicator—the *single bidder winner ratio*—to analyze corruption risks from the firm's perspective. The single bidder winner ratio is a proxy measure of procurement tender manipulation that assesses the share of single bidder contracts that are won by a specific firm in the absence of competition. A high single bidder winner ratio shows that a firm often wins procurement contracts without competition, which thereby indicates a corruption risk.

Our results confirm the expectations, i.e., we observe higher profitability among firms that won a higher share of single bidder contracts. We further conduct a validation analysis that shows that single bidder contracts are more common in municipalities where corruption is perceived to be higher. Moreover, even after we control for the general competitiveness of each market, single bidder contracts are most commonly won by local firms, which is a smoking gun of sorts, indicating that local suppliers are favored. In contrast, we do not find any evidence that restricted competition systematically favors leading firms that are the most common winners of single bidder contracts in the Swedish construction industry. In sum, the original contribution of the paper is twofold: (1) it introduces a novel corruption risk measure adapted to measure corruption risks at the firm level, and (2) it extends previous findings on corruption risks in mature democracies (cf. Dahlström et al., 2021; Broms 2019) by focusing on how corruption risks in public procurement affect market incentives and firms' profitability. While previous research has made valuable contributions to our understanding of how political and institutional factors lead to corruption risks in mature democracies, this paper offers a complementary perspective by shifting the emphasis onto the impacts of such risks.

2 Corruption risks in the market of public procurement

A well-functioning market is based on free and fair competition, where firms' success depends on their efficiency and the quality of their goods and services. In an attempt to ensure impartial purchasing processes, where all potential suppliers have an equal opportunity to compete for contracts, public procurement is heavily regulated in most countries. Despite this, public procurement remains a potential rent-seeking channel since it is a contact area between the public and the private sector and involves a legitimate flow of money from the former sphere to the latter (Lambsdorff, 2002; Shleifer & Vishny, 1994). Since the outcome of a single tendering process is critical for the profitability, or even the survival, of individual companies, some firm owners are willing to secure an advantage by illicit measures (Brockman, 2011). Correspondingly, some public officials may be willing to favor specific firms because of personal reward (bribes through gifts or money), friend- and kinship ties, political connections, and/or ideological reasons (Palansky, 2021; Dastidar & Mukherjee, 2014; Goldman et al., 2013; Stapenhurst & Langseth, 1997). When these circumstances coincide, there are many methods for manipulating a tendering process to secure a contract for a specific supplier with low risk of detection (Ferwerda et al., 2017). If government contracts are distributed in violation of prior explicit rules and principles of an open and fair procurement tender, this is a form of corruption (Fazekas et al., 2016).

While corruption is acknowledged to have a wide range of negative effects on society, studies examining the effects of corruption in public procurement from the perspective of the firm are rare. In addition, the literature is ambiguous when it comes to how markets are affected in different contexts. As a rule, restricted competition can reasonably be hypothesized to increase profits among leading market actors, in addition to increasing costs for buyers, since the seller has no incentives to cut its costs in the absence of competition (Brockmann, 2011). In the context of public procurement, restriction and exclusion through corruption can be analyzed as a barrier to entry. For instance, Campos et al. (2010) posit that corruption generally favors incumbents, since the incumbent position can be used to create barriers to entry for potential newcomers. Similarly, in a study of the specific impacts of corruption risks in clientelist contexts, Fazekas et al. (2017) found that corruption in public procurement tends to lead to market concentration. In the studied cases, Hungary and the Czech Republic, government contracts were distributed based on political loyalties to the hands of a few favored suppliers.

However, these studies were conducted in contexts permeated by fairly low institutional quality, which in these cases allows politics to have a far-reaching and systematic influence on the private market. As highlighted by Capasso and Santoro (2018), corruption may have very different effects depending on whether it is passive or active. With active corruption, politicians and public officials have the bargaining power and may use it to extort bribes. With passive corruption, on the other hand, firms have the bargaining power and may use it to make illicit gains such as illicitly securing procurement contracts (see Bauhr, 2012, for a similar discussion).

Interestingly, almost no studies have examined how corruption in public procurement affects profit among firms in general, and in mature democracies in particular. This is a significant gap in research, as the profitability that results from corruption can provide insight into the incentives for firms to engage in corrupt behavior. This paper aims to address this lacuna by analyzing procurement markets from a novel and slightly different perspective. It does so by examining whether corruption risks in public procurement affect firms' profitability in the Swedish construction industry. While one of the purposes of procurement is to ensure efficient use of taxpayers' money, this effect is far from expected in the absence of competition. Theoretically, we expect corruption to have a direct and positive effect on the profitability of those individual firms that win a higher share of contracts without competition. Firms that win contracts without competition have no incentives to cut their costs, and can therefore add a premium price (Brookman, 2011). Consequently, our overarching hypothesis concerns the profitability of firms that win procurement contracts associated with corruption risk:

H1 Firms that have won procurement contracts that are associated with corruption risk (i.e., single bidder contracts) will have higher profitability than other firms.

3 The case of the Swedish construction industry

To test our hypothesis in a mature democracy, we use contract data for purchases that Swedish state agencies, regional authorities, and municipalities made from construction companies. Sweden is a well-suited case for the purposes at hand, given that it represents a low-corruption country where systematic corruption such as "speed money" is close to nonexistent, but where "greed corruption"—initiated to gain an illicit advantage such as a procurement contract—is comparatively common (see Bauhr, 2012). Previous research has found nontrivial variations in corruption levels in Sweden (Bergh et al., 2017; Erlingsson & Lundåsen, 2021), and just as in several other mature democracies, corruption-related crimes in Sweden are often related to public procurement (Hols Salén & Korsell, 2013; Karlsson Westergren, 2019). For instance, a Eurobarometer survey from 2006 found that 47% of Swedes believed that officials awarding tendering contracts are likely to be corrupt, which was approximately on the EU mean (European Commission 2006). The decision to focus on the construction industry is almost self-explanatory, given that it is highly policy-relevant, constitutes a large share of the public sector's expenses, and is regularly highlighted as a danger zone for corruption. Thirty percent of all alleged givers of bribes in Sweden between 2003 and 2011 were affiliated with the construction industry, and many of these cases were related to public procurement (Hols Salén & Korsell, 2013). Lastly, the occurrence of procurement in Sweden is slightly above the OECD average, with a value of public procurements that corresponds to about 17% of GDP, constituting a market with a value of SEK 706 billion[1] in 2019 (The National Agency for Public Procurement Sweden, 2019).

4 Data and methodology

Our proposed hypothesis posits that restricted competition in government contracting affects firm profitability. To test this hypothesis, we examine whether there is an association between corruption risks—in the form of red flag contracts—and firm performance. We use longitudinal procurement data, provided by Visma Opic and collected under transparency provisions of the Swedish Public Procurement Act, which include contracts of all sizes. The database covers the key characteristics of the tendering and contract award phases such as date of publication, name of the winning bidder, name of the buyers, or the product category of the purchase. Contracts from all types of government authorities (state, regional, and municipal levels) are included in the database, including local and regional governments and state agencies. We analyze contracts with Common Procurement Vocabulary (CPV) codes of 44 and 45, codes that identify the construction industry, ultimately yielding a population of 20,864 tenders.

We use firm data on profitability, age, sales, and similar measures from the allabolag.se website, a database covering all registered firms in Sweden. The firm data were combined with the procurement data by company register numbers of bidding firms. We restrict our analysis to the period 2010–2015 since Swedish procurement data are only available for the period 2009–2015, and firm performance data are available from 2010 onwards. We also restrict our analysis to incorporated firms, since performance data are not available for other types of firms. This is, however, a minor problem. Ninety-five percent of all bidding firms in construction procurement in Sweden are incorporated (The National Agency for Public Procurement Sweden, 2019). In total, our analysis is based on an unbalanced panel of 6589 incorporated firms. Descriptive statistics for all of the variables employed are presented in Appendix 1.

4.1 Dependent variable—profitability measure

Firm profitability is our dependent variable. We operationalize profitability with sales margin (return on sales), defined as earnings before interest and taxes (EBIT), divided by sales for a given year. Sales margin has previously been used as a profitability measure in several studies (Brännback et al., 2009; Delmar et al., 2013; Margaritis & Psillaki, 2010) and is often seen as the best profitability measure by venture capitalists, accountants, public investors, policymakers, and entrepreneurs (e.g., Kiviluoto, 2011, p. 111). We use sales margin as our main dependent variable since it is a direct measure of whether income is generated from normal business operations. It is thereby the most accurate measure of the impact of tender outcomes since bid-rigging is primarily expected to increase sales in the short term. In contrast, return on assets (ROA)—which is another common profitability measure—is influenced by external factors unrelated to sales such as administrative costs, overhead costs, and debt. Sales margin is also less likely to be inflated by low asset bases, which are common among small construction firms (Kiviluoto, 2011; Wennberg et al.,

[1] Approximately corresponds to €63 billion based on the exchange rate on 18 January 2023.

2011). Nonetheless, as a robustness test, we also estimate our models with ROA (EBIT/total assets) as the dependent variable.

We converted sales margin and ROA to percentage, which gives a scale from 0 to 100. We also excluded 652 observations for which information on turnover was either 0 or missing during a given year. Our dependent variable was not defined for these observations. Profitability measures such as sales margin and ROA are subject to severe outliers. To mitigate this problem, we use a winsorizing technique to truncate the extreme values to the minimum and maximum values at the 5th and 95th percentiles, respectively.

4.2 Independent variable—single bidder winner ratio

Our focal independent variable is corruption risk. In line with previous research (Broms et al., 2019; Fazekas & Koscis, 2017), we operationalize corruption risk based on single bidder contracts, defined as contracts from procurement tenders with only one bidder. It is common to use the share of single bidder contracts, also referred to as red flag contracts, in relation to the total number of contracts as a proxy for corruption risk. For instance, the share of contracts with only one bidder in a given municipality has been used as a proxy for corruption risk at the municipality level. However, to our knowledge, previous research has only operationalized the share of single bidder contracts from the perspective of the procuring authorities (municipalities, state agencies, etc.) and not at the firm level. For the purposes at hand, we needed to develop a new measure of corruption risk at the firm level which measures firms' involvement in single bidder contracts. Using a similar line of argument as in previous research, we introduce the indicator *single bidder winner ratio* (SBWR) for firms. We define SBWR, at the firm level, as the percentage of single bidder contracts won in relation to the total number of tenders the firm has participated in. Hence, a relatively high SBWR value indicates high corruption risk. SBWR is calculated using the following formula:

$$\mathrm{SBWR} = \frac{\text{Number of single bidder tenders won}}{\text{Total number of tender bids submitted}} * 100 \tag{1}$$

The rationale of SBWR is that a high single bidder ratio indicates that the contracting procedure is subject to some type of competition-restricting manipulation that is aimed to either inflate prices or ensure that a specific supplier wins a contract. While SBWR is obviously a ratio, we transform it to a percentage and a scale of 0–100. SBWR is designed to be comparable between firms of different sizes and different degrees of bidding activity. The number of single bidder wins is shown in relation to the number of bids submitted. However, as a ratio, it has the drawback of being more volatile for firms with a lower number of bids, increasing the "noisiness" of the measure. To handle this, we also include models with analytical weights to reduce the reliance on observations from firms that participated in few procurement tenders during a given year. We weight by the natural logarithm of the number of bids submitted (rather than the number of bids), since the variance is relatively stable for firms with 20 bids or more. Apart from this, we also estimate models based on a subsample of observations based on firms that submitted at least either three or five bids during a given year. This resulted in more stable measures without any significant change in the results.

As with the previously employed operationalization single bidder contract, SBWR has the advantage of being objective and directly related to a situation of potential corruption (Mungiu-Pippidi & Fazekas, 2020). Single bidder contracts have a high degree of convergent validity compared with several other corruption indicators—such as corruption perceptions, prosecuted corruption crimes, registrations in tax havens, and overpricing—in different contexts (Lisciandra et al., 2021; Ravenda et al., 2020; Wachs et al., 2020; Broms et al., 2019; Fazekas & Koscis, 2017). At the end of the results section, we conduct an additional validation analysis of single bidder contracts vis-á-vis a perception-based corruption index uniquely designed for all 290 Swedish municipalities. This validation shows a significant correlation between the frequency of single bidder contracts and perceived municipal corruption levels. The analysis also reveals that single bidder contracts are more common in procurement tenders won by local firms, i.e., that have their base in the particular municipality where the contract is won.

Although the upshot of SBWR is that it constitutes a good proxy for hidden and unexposed corruption, its potential downside is that it only indirectly measures corruption. Our interpretation of single bidder contracts as a corruption risk depends crucially on our ability to adequately identify competitive markets. The Swedish construction industry is best described as regional (evidence for this is provided in Appendix 2). Only 17% of all bids come from firms located in the same municipality as the buying authority, while 60% of all bids come from firms in the same NUTS [Nomenclature of Territorial Units for Statistics] 1 region. Moreover, 70% of all construction firms that participated as bidders in procurement auctions during the studied period are only active within their own NUTS 1 region. Hence, NUTS 1 regions serve as a reasonable approximation for geographical markets.

To ensure that our results are not driven by single bidder contracts from markets with few potential bidders, we exclude all contracts from noncompetitive CPV3-NUTS 1 submarkets with fewer than 10 unique bidders during the entire time period 2010–2015. Previous research has argued that five unique bidders are enough to reduce the risk that single bidder contracts result from a lack of competition (Charron et al., 2017). The threshold of 10 unique bidders is deliberately strict to exclude markets that are on the verge of being noncompetitive. A threshold of 10 unique bidders also reduces the risk that our results are driven by cartels. Among the cartels that were discovered by the European Commission during the period 1998–2010, most cartels included 5–6 members. Only 14% included more than 10 cartel members (Heimler, 2012).

A total of 159 contracts were excluded on the basis of our 10-unique-bidders criteria, corresponding to 0.7% of all contracts. The fact that few contracts are excluded despite our high threshold underscores that the construction industry in Sweden is a competitive industry regarding the potential number of bidders. Given this setting, we argue that the SBWR provides strong hints about deviations from a competitive process—deviations that statistically are expected to be associated with irregularities.

4.3 Overview of firms in the sample

Table 1 presents a descriptive overview of our final sample of 6589 incorporated firms bidding for at least one contract during 2010–2015. A general conclusion that can be drawn is that well-established and experienced firms tend to participate in bids in the Swedish procurement market. The median age of bidding firms is 16 years, and the median number of employees is 9. Apart from this, a look at the median number of bids (2) and the median number of wins (1) confirms that most firms rarely participate in procurement. Over the studied 6-year period, half of the companies only submitted bids on one or two contracts and a majority of all firms did not win any single bidder contract. Meanwhile, the

Table 1 Descriptive statistics for the firms within our sample

	Median	Mean	SD	Min	Max
Sales margin	3.82	4.10	9.18	−43.22	32.89
Return on assets	9.01	9.64	15.69	−49.61	54.91
SBWR	0	7.16	22.90	0	100
Age	16	19.07	16.15	0	117
Employees	11	54.68	430.71	0	19,389
Turnover (1000 SEK)	19,992	152,608.30	1,764,243	0	1.18e+08
No. bids	2	8.94	55.97	1	2288
No. wins	1	2.80	17.98	0	615
Number of firms	6589				

Descriptive statistics for firms within the sample used in this paper

distribution of bids is highly skewed: the maximum number of bids by a single company was 2288, and the maximum total number of wins by one company was 615.

4.4 Control variables

In our models, we control for other dynamic effects, besides corruption risks, that are expected to affect profitability according to theory and previous research. We include year fixed effects to control for macro trends such as the business cycle or external obstacles. In addition, we include the following firm-level control variables:

- *(ln) Turnover.* Natural logarithm of firm size in terms of turnover in thousands of Swedish krona. Turnover can be expected to be associated with market position and economy of scale (Barnett & McKendrick, 2004). We standardize this variable to prevent multicollinearity problems with other control variables.
- *(ln) Firm age*. Natural logarithm of firm age during a given year. Similar to turnover, firm age can be expected to affect firm profitability due to potentially having stronger market positions and access to resources (Delmar et al., 2013; Majumdar, 1997).
- *(ln) Number of employees.* Natural logarithm of number of employees. A change in the number of employees can be expected to increase costs in the short term and have a negative impact on profitability.
- *(ln) Total assets.* Natural logarithm of total assets. The construction industry includes both labor-intensive firms with low capital assets and national firms with competence in infrastructure projects that are more capital-intensive. We control for total assets to differentiate between these types of firms.
- *Geographical embeddedness.* The share of bids that are submitted to tenders issued by buyers within the same NUTS 1 region. We also include a squared term to account for potential nonlinearity.
- *Average number of bids in relevant market.* Relevant markets are defined as a combination of product markets and geographical markets. We identify product markets based on the most frequent CPV3 codes in each firm's tenders. For firms that submit 50% or more of their bids in their own NUTS 1 region, we calculate the average number of bids for their most common CPV3 code in their own NUTS 1 region. For firms that

submit fewer than 50% of their bids in their own NUTS 1 region, we calculate the average number of bids for their most common CPV3 code in the entire national market.
- *(ln) Herfindahl index* (measured in percentage). In line with common convention, we control for industry structure by including the Herfindahl concentration index which measures competition based on the concentration of market share (based on turnover) (Acar & Sankaran, 1999). We calculate the Herfindahl concentration index nationally for markets that are defined by product categories.
- *Structural fixed effects*. In our OLS models, we incorporate several structural controls including year fixed effects, municipality fixed effects, and product type fixed effects. Product type fixed effects are based on CPV4 codes.

4.5 Model specification

We utilized an unbalanced panel of firms in the construction industry that submitted bids between 2010 and 2015 to test our hypothesis. Both ordinary least squares (OLS) and system generalized method of moments (GMM) estimations were employed. For our OLS, we estimate the following specification:

$$\mathrm{S}_{it} = \beta_0 + \beta_1 \mathrm{SBWR}_{\mathrm{it}} + \sum_{\mathrm{j=2}}^{\mathrm{j=n}} \mathrm{B_j X_{ijt}} + \beta_p \mathrm{P}_i + \beta_m \mathrm{M}_i + \beta_t \mathrm{Y}_t + \varepsilon_{\mathrm{it}}$$

where S_{it} is the dependent variable, i is index firms, t is index years, and β_0 is the global intercept. $\mathrm{SBWR_{it}}$ is our measure of single bidder winner ratio, which operationalizes corruption risk. X_{ijt} denotes a vector of control variables and B_{j} denotes their coefficients. P_i, M_{i}, and Y_{t} are dummies for product market, municipality (where the firm is located), and year, and B_{p}, B_{m}, and B_{t} are their coefficients. $\varepsilon_{\mathrm{it}}$ is the error term. In addition, our estimations also include analytical weights proportional to the square root of the number of bids to account for heteroskedasticity.

As an additional approach, we also employed the system GMM estimator to model changes in profitability within firms over time. Our dependent variable, sales margin, which represents profitability, tends to be autocorrelated because a firm's performance at time *t+1* is often similar to its performance at time *t*. This autocorrelation can be caused by both external factors such as the business cycle and internal factors such as the duration of construction projects. A Wooldridge test for autocorrelation in panel data rejected the null hypothesis, indicating that the dependent variable is autocorrelated. To ensure that the result was not affected by autocorrelation, we estimated models with a lagged value of our dependent variable. We used the system GMM models developed by Blundell and Bond (1998) to avoid introducing the Nickell (1981) bias as a consequence of the lag. The system GMM estimator is robust against autocorrelation issues and suitable for unbalanced panels with many observational units and a small number of time periods (Roodman, 2009).[2] We used system GMM with forward orthogonal deviations to minimize data loss caused by the unbalanced panel structure of our data set (see Arellano & Bover, 1995). For our system GMM estimations, we utilize the following reduced form model:

[2] When presenting the system GMM models, we present the p values from the second-order autocorrelation test to confirm that autocorrelation has been eliminated, and the p values for the Hansen test of overidentification to confirm the validity of the instruments used.

$$S_{it} = \beta_0 + S_{it-1} + \beta_1 \mathrm{SBWR}_{\mathrm{it}} + \sum_{\mathrm{j=2}}^{\mathrm{j=n}} \mathrm{B_j X_{ijt}} + \beta_i \mathrm{Firm}_i + \beta_t \mathrm{year}_t + \varepsilon_{\mathrm{it}}$$

where S_{it} is the dependent variable, and $S_{\mathrm{it}-1}$ represents sales margin in period *t–1*; *i* is index firms, *t* is index years, and β_0 is the global intercept. $\mathrm{SBWR_{it}}$ is our measure of the single bidder winner ratio which operationalizes corruption risk. $\mathrm{X_{ijt}}$ denotes a vector of control variables and B_{j} denotes their coefficients. $\mathrm{Firm_i}$ and $\mathrm{Year_t}$ are dummies for firms and years, and B_{i} and B_{t} are their coefficients. $\varepsilon_{\mathrm{it}}$ is the error term. In addition, our system GMM estimations also include analytical weights proportional to the square root of the number of bids to account for heteroskedasticity.

5 Main results

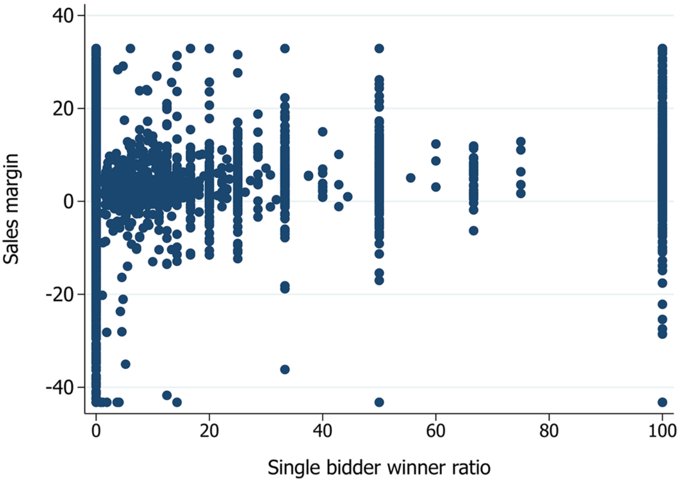
We begin the results section by providing a visual inspection of our data. Figure 1 illustrates the bivariate relationships between SBWR and sales margin at the firm level. The values of sales margin are winsorized at cut points of 5 and 95. As seen in Fig. 1a, no obvious relationship can be identified from the raw graph that includes all observations. Although the mean value of the sales margin is only 4.1, the variable is extremely volatile, with a lowest value of −46 and highest value of 34. However, as can be seen more clearly in Table 2, a majority of the observations are within the interval between −2.72 (10th percentile) and 12.67 (90th percentile).

Moreover, the data are clearly zero-inflated since many observations have a value if 0 for firms that did not win any single bidder contract during a given year. In addition, there is a concentration of observations at SBWR = 0.5 and SBWR = 1 given that these values are common among firms that only participated in a few bids. This confirms the relevance of including weights related to the number of bids submitted by each firm. As a robustness check, we will also estimate models on a subsample of the data that only includes firms with at least five bids each year. The concentration at specific values can be expected to be less pronounced for this subsample.

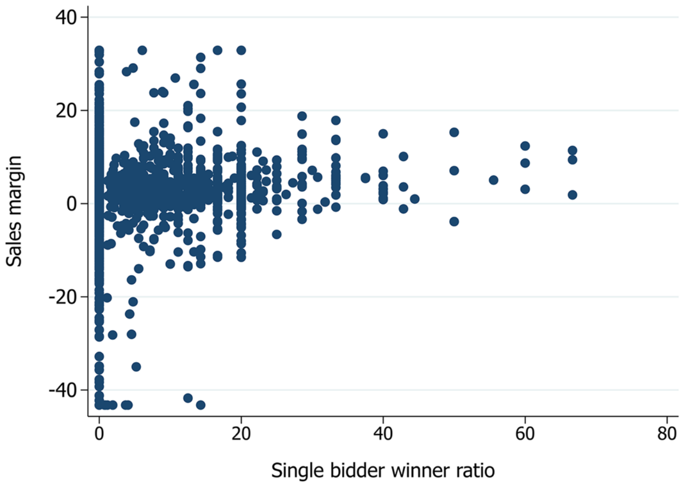
Figure 1b shows the relationship between SBWR and sales margin for firm-year observations that are based on at least five bids. Although this subset still suffers from zero inflation, there is no concentration at SBWR = 0.5 or SBWR = 1 for this subsample. In addition, for this subsample, it seems that firms with a high SBWR are more likely to have positive and stable sales margins than firms with low SBWR.

5.1 Regression models

This section reports the results from estimations that test our main hypothesis concerning the profitability of firms that win a high share of single bidder contracts. Table 3 shows regression models of sales margins among the construction firms in our sample. The models include robust clustered standard errors at the firm level to account for heteroskedasticity. Model 1 includes all observations in the sample as well as fixed effects for year, product market, and municipality (but not firm-level fixed effects). Consistent with H1, the SBWR coefficient in Model 1 in Table 3 has a positive and significant impact on sales margins. With regard to controls, turnover has a positive and significant impact on sales margins, while the number of employees has a negative impact. With regard to competition



a Scatter plot on the relationship between single bidder winner ratio and sales margin for all observations.



b. Scatter plot on the relationship between single bidder winner ratio and sales margin for firm-year observations that are based on at least 5 bids submitted.

Fig. 1 **a** Scatter plot on the relationship between single bidder winner ratio and sales margin for all observations. **b** Scatter plot on the relationship between single bidder winner ratio and sales margin for firm-year observations that are based on at least five bids submitted

measures, the Herfindahl index and average number of bids are nonsignificant. This is likely because many firms only participate in a few bids.

Given the high volatility of SBWR for firms that participate in a small number of contracts, it is relevant to examine a model that only includes observations from firms that have participated in a larger number of tenders. Models 2–4 are estimated only on samples of firms that are more frequent bidders. Model 2 estimates the same model as Model 1,

Table 2 Overview of percentiles for our dependent variable sales margin

Percentiles	
1%	−33.86
5%	−7.36
10%	−2.72
25%	0.92
50%	3.85
75%	7.82
90%	12.67
95%	16.90
99%	28.31
Mean	4.10
Standard deviation	9.18
Observations	14,538

but only including firms that participated in at least three procurement processes during a given year. This leads to a decrease in the number of observations from 14,545 to 4345, but an increase in the magnitude of the coefficient of SBWR, indicating that the relationship between SBWR and sales margins is solid. Model 3 is restricted to firms that participated in at least three bids during a given year and includes 2416 observations and 933 unique firms. SBWR is still significant in Model 3, and the coefficient increases substantially from 0.027 to 0.052, indicating that SBWR is a more relevant measure among more frequent bidders.

Finally, in Model 4 we introduce weights proportional to the natural logarithm of the number of submitted bids to account for the fact that our main dependent variable and the independent variable are more volatile for small firms or firms that are less frequent bidders. Model 4 still includes firm-year observations based on at least five submitted bids. SBWR is also significant in this model and increases slightly from 0.052 in Model 3 to 0.058 in Model 4. Hence, the results support our hypothesis about increased profitability among firms that have won a relatively large share of single bidder contracts.

Figure 2 shows predictive sales margins for different values of SBWR for firms based on Model 4. The graph shows a positive relationship between SBWR and sales margins. For instance, 1 standard deviation increase in SBWR of 23 percentage points is expected to increase sales margins by 1.4 percentage points. The effect can be considered moderate in comparison to an average sales margin of 4%, but it still holds economic significance. For instance, each standard deviation increase in SBWR for a firm with average yearly revenue of SEK 152 million would result in additional annual operating profit (EBIT) of 152*0.014 = SEK 2.1 million [€220,000].[3]

5.2 System GMM estimations

Although Models 1–4 include a wide range of fixed effects, they are still vulnerable to unobserved heterogeneity at the firm level, as well as autocorrelation. We therefore estimated system GMM models with an additional lag of the dependent variable. System

[3] Based on the exchange rate on 18 January 2023.

Table 3 OLS models estimating the relationship between single bidder winner ratio and sales margin at the firm level

	Model 1 OLS, full sample	Model 2 OLS, > 2 bids	Model 3 OLS, > 4 bids	Model 4 OLS, > 4 bids and weights
	Estimate (std. error)	Estimate (std. error)	Estimate (std. error)	Estimate (std. error)
Single bidder winner ratio	0.024***(0.003)	0.027** (0.009)	0.052** (0.018)	0.058** (0.020)
(Ln) Firm age	−0.187 (0.150)	−0.023 (0.285)	0.367 (0.412)	0.507 (0.451)
(Ln) Turnover (centered)	2.832*** (0.447)	2.403** (0.962)	3.809*** (1.430)	5.304** (1.574)
(Ln) No. of employees	−2.785*** (0.254)	−2.843*** (0.485)	−3.289*** (0.711)	−3.088*** (0.839)
(Ln) Total assets	−0.362 (0.407)	0.193 (0.981)	−0.820 (1.435)	−2.518 (1.668)
Geographical embeddedness	−0.038* (0.016)	0.004 (0.029)	−0.018 (0.047)	−0.045 (0.055)
Geographical embeddedness square	0.0005** (0.0002)	0.0001 (0.0002)	0.0002 (0.0004)	0.0004 (0.0004)
Avg no. bidders in submarket	−0.224 (0.300)	−1.175* (0.579)	−0.705 (0.779)	−0.947 (0.760)
Herfindahl index	−0.815 (1.168)	0.487 (1.916)	4.230 (2.637)	5.930* (2.759)
(Intercept)	16.024 (3.910)	11.308 (9.977)	17.522 (14.634)	34.738* (17.119)
Weights	No	No	No	Yes
Year FE	Yes	Yes	Yes	Yes
Product market FE	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes
R2 (%)	6.3	6.6	9.5	13.6
Observations	14,538	4340	2416	2416
Unique firms	6589	1728	933	933

Estimation results from OLS models regarding the impact of corruption risk on sales margins among firms in the construction industry. Standard errors clustered at the firm level in parentheses. *FE* fixed effects

Significance: $*p<0.05$, $**p<0.01$; $***p<0.001$

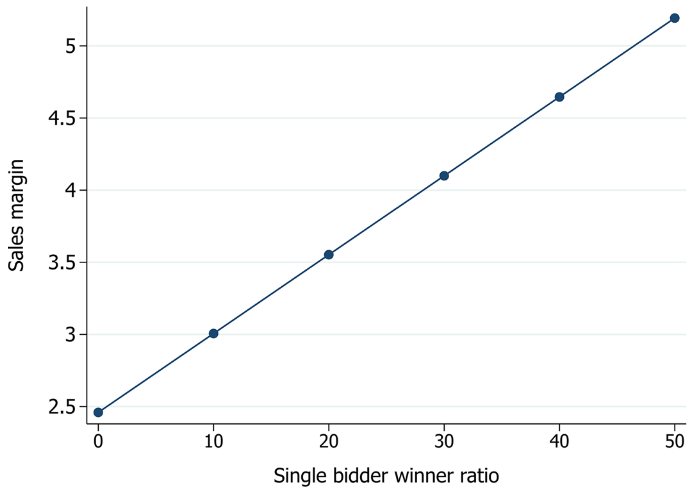


Fig. 2 Predictive margins for single bidder winner ratio and sales margin based on Model 4

GMM is based on a within-estimation of coefficients and is well suited to handle problems with autocorrelation. The results of the system GMM estimations are consistent with the OLS estimations and confirm a significant relationship between SBWR and sales margin. Given the consistency of OLS and system GMM, we exclude the latter results from the main paper in light of space constraints. The system GMM results can be found in Appendix 3.

5.3 Robustness tests

We conducted several robustness tests. First, to ensure that our results are not driven by our choice of the dependent variable, we re-estimated Models 1–4 and the system GMM estimations with ROA (EBIT/total assets) as the outcome variable. Two lags of the dependent variable had to be included in the system GMM models since ROA is subject to second-order autocorrelation. The results of these robustness tests are consistent with previous findings and are available in Appendices 4 and 5. Second, to ensure that the results were not driven by variations in the number of submitted contracts but by the number of single bidder contracts won, we re-estimated the OLS and system GMM models with the number of single bidder contracts won and the total number of bids as separate variables. These results are also consistent with our main findings and available from the authors on request.

6 Exploration of mechanisms

In this section, we present a complementary analysis that examines the institutional and structural factors that explain the probability of single bidder contracts in the Swedish construction industry. Corruption is one potential cause of single bidder contracts, but the occurrence of single bidder contracts could also be explained by other factors, such as few eligible bidders or lack of competence among public officials. To elaborate on this, we estimate logit models to test whether the risk that a contract only has one bidder can be explained by (perceived) corruption levels at the municipality level or alternative explanations. We only include contracts issued by local authorities in this analysis since we do not have appropriate data on explanatory variables for other types of organizations.

Focusing on the term of office between the elections of 2010 and 2014, for our corruption variable, we use data from the Quality of Government Institute's dataset, Politics, Institutions and Services in Swedish Municipalities, 1980–2015 (Dahlström & Tyrberg, 2016). The corruption variable is a self-designed "procurement corruption index," which was created with data from a survey sent to all Swedish local councilors in 2012–2013. We use questions that specifically concern corruption in public procurement and create an additive corruption index. The additive index is based on the survey questions "A businessperson has offered a gift or service to a civil servant in connection with a public procurement" and "To what extent do you perceive that procurement is handled impartially in your municipality?"

The first question concerns bribery and was originally constructed with a scale of 1–7. The second question is based on a broader assessment of the general level of impartiality in handling procurement processes and is on a scale of 1–5. Given the different scales of these variables, we first conducted a z-score transformation so that both variables had a mean of 0 and a standard deviation of 1. We then added them up and divided by 2, to get a general index aiming to gauge corruption in procurement.

Our analysis includes all contracts related to the construction industry issued by municipal authorities during the period 2011–2014. We focused on this time period because it was the political mandate period when the survey was conducted. Our dependent variable is a binary (1/0) variable, indicating whether a contract only had a single bidder. We also control for several other factors including the type of contract and municipality characteristics. Fixed effects are included for different product markets, years, and NUTS 3 regions (only Model 6). Model 5 shown in Table 4 reveals that the procurement corruption index positively and significantly correlates with the probability for single bidder contracts. In addition, single bidder contracts are slightly less common in municipalities with higher levels of public employees with higher education. However, the latter effect is nonsignificant.

Next, we elaborate whether the characteristics of the winning firm can explain the probability of single bidder contracts. First, we test whether there are indications of favoritism of local firms by including the variable "local winner," which takes the value 1 when the winning firm is located within the same municipality as the buying authority. Second, we test whether single bidder contracts tend to be won by the dominant firms in the construction industry by including the dummy variable "leading firm," which takes the value 1 for the 10% of all firms that won the most procurement contracts during the studied period. The variable "local winner" is positive and significant, possibly indicating a pattern of favoritism of local firms. In contrast, the coefficient for the variable "market leader" is negative and nonsignificant, meaning that it is not the most dominant firms that tend to win single bidder contracts.

In terms of controls, all dummies related to population size are nonsignificant in Model 5, while rural municipality is positive and highly significant. Median income is also positive and significant. Unfortunately, we cannot fully control for contract value, since prices are missing for most tenders. However, we include an indirect proxy for this by controlling for whether tenders were advertised in the European Union's Tenders Electronic Daily (TED) database. Advertising in TED is mandatory when the contract exceeds a threshold value, and therefore, this can be used as a rough measure of contract value. We expect EU tenders to increase the risk for single bidder contracts since fewer

Table 4 Corruption level and the probability that a contract has only one bidder

	Model 5 Estimate (std. error)	Model 6 Estimate (std. error)
Corruption index	0.096* (0.045)	0.125* (0.052)
Municipal employees with post-secondary education (%)	−0.014 (0.097)	−0.003 (0.010)
Local firm	0.310** (0.097)	0.292** (0.099)
Market leader	−0.224 (0.176)	−0.251 (0.180)
Population		
5000–9999	−0.235 (0.330)	−0.095 (0.345)
10,000–14,999	−0.318 (0.322)	−0.068 (0.348)
15,000–29,999	−0.089 (0.318)	0.163 (0.348)
30,000–249,999	−0.275 (0.317)	−0.088 (0.351)
> 250,000	−0.082 (0.342)	−0.007 (0.383)
Rural municipality	0.651** (0.213)	0.457* (0.217)
(ln) Median income	1.320** (0.492)	−0.017 (0.649)
EU tender	0.697 (0.734)	0.616 (0.728)
Buyer is municipal corporation	−0.183 ** (0.067)	−0.205** (0.072)
Constant	−0.421 (1.339)	−0.299 (1.397)
CPV4 FE	Yes	Yes
Year FE	Yes	Yes
County FE	No	Yes
Pseudo R % (McFadden)	3.98	4.37
Observations	12,266	12,266

Estimation results from logit models on the relationship between perceptions of corruption and the likelihood for a single bidder contract. Robust standard errors clustered on municipalities in parentheses. *FE* fixed effects

Significance: *$p<0.05$, **$p<0.01$; ***$p<0.001$

firms have the capacity to carry through the largest projects. The coefficient for EU tender is positive, in line with our expectations, but it is also nonsignificant. Apart from this, single bidder contracts are significantly less common in procurements issued by municipal corporations. The latter result is unexpected, as previous research (e.g., Bergh et al., 2021) has highlighted municipal corporations as a danger zone for corruption.

Model 6 introduces a fixed effect at the NUTS 3 level to further reduce unobserved heterogeneity between different regions. The coefficient for corruption is still significant and increases in Model 6, while the local winner also remains significant. Apart from this, most variables, including the share of public employees with higher education, become nonsignificant in Model 6. This probably indicates that these variables have a low level of variation within NUTS 3 areas.

Overall, the results in this section strengthen the notion that single bidder contracts ought to be viewed as a reasonable and relevant corruption risk indicator in the low-corruption Swedish case as well. In addition, these corruption risks seem to predominantly evolve around favoritism vis-á-vis locally based firms rather than dominance by one or a few firms.

7 Conclusions

We have analyzed corruption risks in public procurement in Sweden, a low-corruption and mature democracy. While previous research has already explored how political and institutional factors lead to corruption risks in mature democracies (cf. Dahlström et al., 2021; Broms 2019), our paper offers a complementary perspective by focusing on how corruption risks affect firms' profitability and market behavior. Combining contract-level procurement data and company performance data, we introduced a novel corruption risk measure called single bidder winner ratio to analyze whether firms that win a higher share of single bidder contracts are more profitable than other firms. Our theoretical expectation was that corruption risks, as measured by restricted competition, lead to increased profitability since lack of competition distorts incentives to reduce costs and innovate. The results confirm our theoretical expectations: the more single bidder contracts a firm has won, the more its sales margins increase. Further, validation analysis confirms that single bidder contracts are more common in Swedish municipalities with higher levels of perceived corruption, thus supporting our independent variable as a relevant proxy for corruption risk in the Swedish setting. The findings underscore that corruption risks in public procurement can skew markets and economic incentives on a broader scale, as countries with higher levels of corruption than Sweden are likely to be more affected by such mechanisms.

Our findings also suggest that corruption may take slightly different forms in low-corruption contexts. In a high-corruption environment, we would expect corruption risk to be strongly associated with the leading actors of the market, for two reasons. First, leading market actors have stronger economic means to influence the political system and are therefore at an advantage in a system dominated by bribes and kickbacks (Campos et al., 2010). Second, in a high-corruption environment, corruption tends to dominate market fundamentals such as productivity and efficiency, thus over time leading to an increase in market power among historically favored firms (Fazekas et al., 2017). Interestingly, and in contrast to this, the corruption-related practices in play in the Swedish low-corruption environment tend to be unsystematic and of relatively low impact at the market level. We find that a high share of won single bidder contracts increases profitability margins, but the single bidder phenomenon favors local firms rather than the leading firms in the market. Based on this insight, it seems reasonable to assume that the most significant negative aspect of single bidder contracting in low-corruption contexts is likely to be cost overruns. On the one hand, they increase profitability for individual firms, and on the other hand, they lead to overly expensive goods and services for the public sector (cf. Spagnolo, 2020).

We suggest that future research should analyze procurement markets for alternative forms of corruption with complementary indicators. While measures based on single bidder contracts have proven to be relevant in a variety of contexts, it is nevertheless a conservative approach which is unlikely to capture all forms of corruption risk, especially grand corruption schemes with organized cover-ups. A rigged procurement may, for example, be complemented with 2–3 pre-organized fake bids (Fazekas & Tóth, 2016b). One known example of grand corruption with an organized cover-up in the Swedish context is the so-called asphalt cartel, which involved all large contractors in the Swedish asphalt market and is believed to have lasted for over a decade (Bergman et al., 2020; Jakobsson, 2007). While the cartel members bribed non-members to not enter into bidding for tenders, they also ensured that fake bids were submitted for each contract in order to avoid suspicion. Interestingly though, our analysis shows that the construction industry in Sweden is relatively competitive and that 99.3% of the contracts came from submarkets with at least 10 unique bidders during the period 2010–2015. It would generally be difficult to sustain a cartel with 10 unique bidders or more. This contradicts the notion that cartels are common within the Swedish construction industry.

Appendix 1

See Table 5

Table 5 Descriptive statistics

	Mean	SD	Min	Max
Sales margin	4.10	9.18	−43.22	32.89
Return on assets	9.64	15.69	−49.61	54.91
Single bidder winner ratio	7.16	22.90	0.00	100
(Ln) Firm age	2.67	0.94	0.00	4.77
(Ln) Turnover (standardized)	0	1	6.48	5.04
(Ln) No. of employees	2.89	1.41	0.00	9.89
(Ln) Total assets	9.66	1.70	2.83	19.65
Geographical embeddedness	80.78	35.59	0.00	100
Geographical embeddedness square	7792.86	3841.66	0.00	10,000
Avg. no. bidders in regional market	3.67	0.57	1.00	7.00
(Ln) Herfindahl index	−1.70	0.79	−3.45	0.00
Number of SBC won	4.20	20.07	1.00	758
Number of bids	0.20	0.85	0.00	30
Observations	14,538			

SD standard deviation, *SBC* single bidder contracts

Appendix 2

See Figs. 3, 4 , identifying geographical markets.

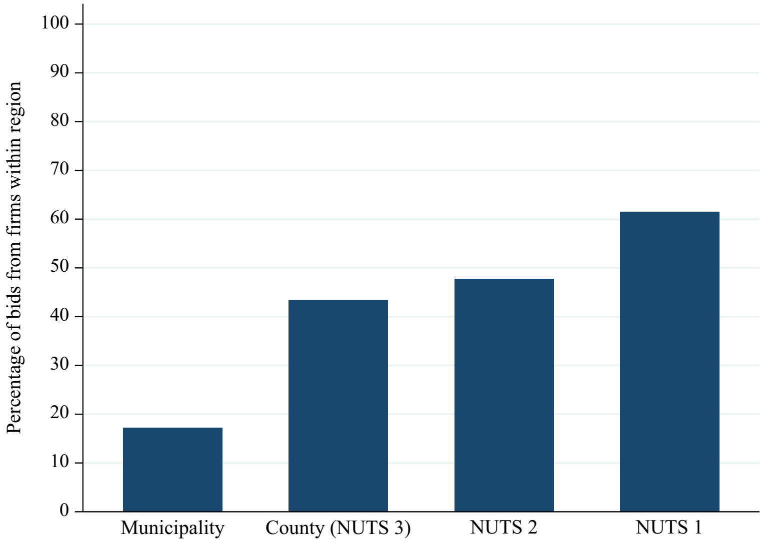


Fig. 3 The percentage of bids that are submitted by firms in the same geographical region as the buyer

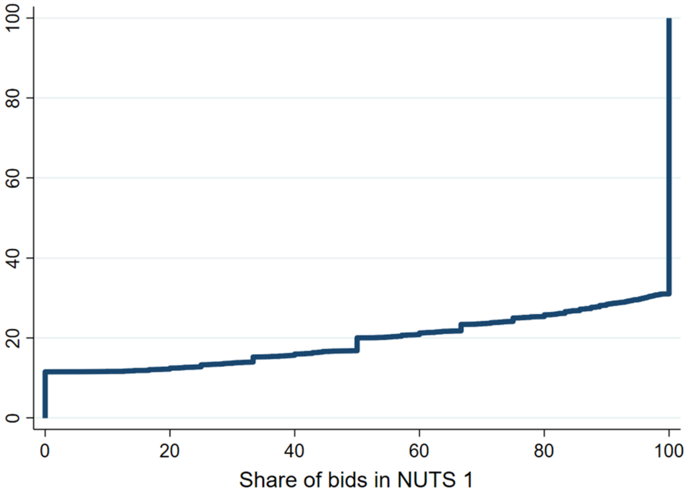


Fig. 4 Cumulative distribution function of share of bids in the NUTS 1 as where the bidding firm is located

Appendix 3

See Table 6

Table 6 System GMM estimations with sales margin

	GMM, > 2 bids/year full sample Estimate (std. error)	GMM, > 2 bids/year Estimate (std. error)	GMM, > 4 bids/year Estimate (std. error)	GMM, > 4 bids/year and weights Estimate (std. error)
Sales margin$_{t-1}$	0.225*** (0.046)	0.325*** (0.076)	0.314*** (0.087)	0.317* (0.019)
Single bidder winner ratio	0.019*** (0.004)	0.027** (0.010)	0.045** (0.017)	0.046* (0.019)
(Ln) Firm age	0.199 (0.194)	0.536* (0.254)	0.609* (0.298)	0.420 (0.290)
(Ln) Turnover (centered)	1.356* (0.594)	1.485* (0.721)	1.835 (0.966)	1.816 (0.976)
(Ln) No. of employees	−1.980*** (0.299)	−1.872*** (0.398)	−2.361*** (0.526)	−2.237*** (0.606)
(Ln) Total assets	0.364 (0.547)	0.132 (0.702)	0.270 (0.949)	0.192 (0.962)
Geographical embeddedness	−0.036* (0.016)	0.004 (0.023)	0.022 (0.030)	0.003 (0.032)
Geographical embeddedness square	0.00040** (0.00014)	0.00001 (0.0002)	0.0001 (0.0002)	0.0003 (0.0003)
Avg. no. bidders in regional market	−0.632** (0.238)	−0.755* (0.341)	−0.729 (0.486)	−0.720 (0.472)
Herfindahl index for national market	3.266* (1.497)	3.585 (1.981)	5.523*(2.387)	5.470*(2.719)
(Intercept)	6.692 (4.985)	6.512 (6.183)	5.136 (8.011)	6.710 (8.174)
Weights	No	No	No	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	6296	3173	1950	1950
Number of firms	2570	1289	793	793
Number of instruments	28	28	28	28
Arellano-Bond test for AR(2) (p value)	0.856	0.891	0.861	0.454
Hansen test (p value)	0.450	0.381	0.838	0.179

Estimation results from system GMM models of the impact of corruption risks on sales margin among firms in the construction industry. Standard errors clustered at the firm level in parentheses. *FE* fixed effects

Significance: *$p < 0.05$, **$p < 0.01$; *** $p < 0.001$

Appendix 4

See Table 7

Table 7 OLS with ROA as the dependent variable

	OLS, full sample	OLS, > 2 bids	OLS, > 4 bids	OLS, > 4 bids and weights
	Estimate (std. error)	Estimate (std. error)	Estimate (std. error)	Estimate (std. error)
Single bidder winner ratio	0.040*** (0.007)	0.049* (0.020)	0.101** (0.038)	0.094* (0.037)
(Ln) Firm age	−1.282*** (0.240)	−0.745 (0.433)	−0.367 (0.572)	−0.059 (0.592)
(Ln) Turnover (centered)	5.118*** (0.312)	4.972*** (0.543)	5.737*** (0.745)	5.556*** (0.753)
(Ln) No. of employees	−3.788*** (0.315)	−4.241*** (0.544)	−4.996*** (0.722)	−4.874*** (0.743)
(Ln) Total assets	−1.843*** (0.214)	−1.292** (0.384)	−1.364** (0.476)	−1.384** (0.432)
Geographical embeddedness	−0.066** (0.023)	0.031 (0.040)	−0.015 (0.059)	−0.036 (0.057)
Geographical embeddedness square	0.00078*** (0.00022)	−0.00001 (0.00032)	0.00034 (0.00047)	0.00047 (0.00046)
Avg. no. bidders in regional market	−0.228 (0.522)	−0.876 (1.066)	−1.201 (1.352)	−1.276 (1.301)
Herfindahl index for national market	−3.096 (2.138)	−0.943 (3.542)	5.732 (4.599)	6.931 (4.537)
(Intercept)	46.897*** (3.248)	41.151*** (5.956)	41.304*** (7.418)	41.466 (7.125)
Weights	No	No	No	Yes
Year FE	Yes	Yes	Yes	Yes
Product market FE	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes
R2 (%)	6.5	7.6	9.2	9.3
Observations	14,538	4340	2416	2416
Unique firms	6589	1728	933	933

Estimation results from OLS models of the impact of corruption risks on return on assets (ROA) among firms in the construction industry. Standard errors clustered at the firm level in parentheses. *FE* fixed effects

Significance: *$p < 0.05$, **$p < 0.01$; ***$p < 0.001$

Appendix 5

See Table 8

Table 8 System GMM with ROA as dependent variable

	GMM, full sample Estimate (std. error)	GMM, > 2 bids/year Estimate (std. error)	GMM, > 4 bids/year Estimate (std. error)	GMM, > 4 bids/year and weights Estimate (std. error)
ROA_{t-1}	0.215*** (0.044)	0.288*** (0.048)	0.276*** (0.062)	0.307*** (0.068)
ROA_{t-2}	0.113** (0.041)	0.117* (0.046)	0.083 (0.056)	0.126 (0.068)
Single bidder winner ratio	0.047** (0.016)	0.082*** (0.023)	0.109** (0.042)	0.098* (0.041)
(Ln) Firm age	0.020 (0.436)	0.057 (0.472)	−0.052 (0.546)	−0.113 (0.543)
(Ln) Turnover (centered)	3.030*** (3.031)	2.655*** (0.660)	2.738** (0.909)	2.139* (1.028)
(Ln) No. of employees	−2.430*** (0.428)	−2.345*** (0.564)	−2.974*** (0.712)	−2.475** (0.741)
(Ln) Total assets	−1.245*** (0.340)	−0.800 (0.429)	−0.379 (0.560)	−0.098 (0.554)
Geographical embeddedness	−0.012 (0.036)	0.010 (0.050)	−0.024 (0.060)	−0.011 (0.057)
Geographical embeddedness square	0.0002 (0.0002)	0.0000 (0.0004)	0.0003 (0.0004)	0.0002 (0.0005)
Avg. no. bidders in regional market	−1.631** (0.498)	−1.915** (0.682)	−1.594 (0.985)	−1.915* (0.895)
Herfindahl index for national market	3.484 (3.646)	4.286 (4.538)	6.855 (5.135)	4.899 (5.055)
(Intercept)	30.311*** (4.208)	24.559*** (5.500)	21.016** (7.154)	18.384 (7.590)
Weights	No	No	No	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	3610	2286	1519	1519
Number of firms	1484	979	669	669
Number of instruments	30	30	30	30
Arellano-Bond test for AR(2) (*p* value)	0.890	0.841	0.557	0.667
Hansen test (*p* value)	0.033	0.448	0.513	0.289

Estimation results from system GMM models on the impact of corruption risks on return on assets (ROA) among firms in the construction industry. Robust standard errors in parentheses

Significance: *$p < 0.05$, **$p < 0.01$; ***$p < 0.001$

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