You Sponsor Mine, I Procure Yours: Pharmaceutical Sponsorships And Procurement in Public Hospitals

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Abstract

Using unique data linking hospital procurement contracts with sponsorships from pharmaceutical firms, I investigate possible instances of influence peddling and conflict of interest in Romanian hospitals. Procurement contracts related to sponsorships are 11% higher than procurement contracts not related to sponsorships. Sponsorships increase the probability of receiving a procurement contract by 5 percentage points. Sponsoring a doctor in hospital management has a slightly larger effect than sponsoring a regular doctor: the difference is economically significant only for direct contracts, which are the least transparent.
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1 Introduction

Do public servants use public funds to deliver public goods efficiently? Or is money lost due to graft, bribery, preferential treatment and influence peddling? Such questions are particularly relevant for the healthcare sector, where public funds cover a large share of total spending[1] and are rapidly expanding in low- and middle- income countries (Cotlear et al., 2015).

Empirical evidence from infrastructure spending suggests corrupt practices are associated with a lower level of public goods provision (Castro, Guccio, and Rizzo, 2014; Lehne, Shapiro, and Eynde, 2018). Corruption increases the costs of providing public goods, either by awarding contracts to less efficient firms (Burguet and Che, 2004), or by funds disappearing altogether (Olken, 2006). However, due to its illegal and secretive nature, corruption is hard to detect and even harder to quantify. This is particularly true in cases of influence peddling and kickbacks, where buying influence is distinguishable only in a legal sense from legitimate activities such as lobbying or marketing (Goldberg, 2017).

This paper focuses on a setting where the distinction between legitimate marketing and influence peddling is especially hard to make: sponsorships awarded by pharmaceutical firms to doctors. In particular, I study whether private sponsorships such as conference expenses and speaking fees act as kickbacks to doctors in public hospitals in exchange for

[1] In 2017, more than 70% of health expenditure in OECD represented spending covered by government or compulsory insurance schemes. The figures are the result of own calculations using OECD's Health expenditure and financing data. Furthermore, global health expenditures are expected to more than double in the next 20 years (Dieleman et al., 2016).

procurement contracts. I combine a variety of administrative sources to create a unique dataset of 965,662 procurement contracts awarded by Romanian public hospitals in 2015-2016 and link them to the sponsorships awarded by pharmaceutical companies to doctors working in public hospitals. Sponsorships consist mostly of companies paying doctors' conference expenses and awarding them speaking fees for various events.

I document a timing effect: within three months of a sponsorship, there is a 4-5 percentage point increase in the probability of sponsoring firms winning procurement contracts. Also, a 1000 euro increase in sponsorships is linked to a 1 percentage point increase in the probability of obtaining a contract in the next three months. Furthermore, conditional on a procurement contract being signed, procurement contracts linked to sponsorships are 11% larger than those not linked to sponsorships.

Establishing such an association between private sponsorship and procurement is an important finding, as it prompts questions regarding its nature and the effectiveness of the procurement regulation. There are two main explanations for the timing effect: marketing and kickbacks. The marketing explanation consists of pharmaceutical firms investing in doctors' human capital by sponsoring their attendance to various professional events. During the events, doctors obtain information about new products and technologies, including those of the sponsoring firm, which increases the probability that the sponsoring firm receives a procurement contract from the hospital where the doctor works. A second explanation is that sponsorships act as kickbacks to doctors: in exchange for sponsorships, doctors use their influence to manipulate the hospital procurement process for the benefit of their sponsors. Thus, the second aim of the paper is to provide some steps towards disentangling those two explanations.

In order to quantitatively assess the importance of the two explanations, I exploit heterogeneity in the doctors who receive the sponsorships. Cole and Tran (2011) document a case study involving a bribe-paying pharmaceutical firm and identify two types of hospital staff that need to be bribed: the management staff and the prescribing doctors. I follow their example by differentiating between doctors in management position and regular doctors. The former are legally endowed with decision powers in hospital procurement and decide how the hospital allocates resoures, while the latter have at most an advisory role. If sponsorships act as kickbacks, the link between sponsorships and procurement should be stronger in the case of doctors in management positions as opposed to regular doctors.

I collect administrative data on public servants to identify sponsorships to doctors who hold management positions in public hospitals. Conditional on a contract being signed, a 1000 euro increase in the value of sponsorships is linked to a 10.41% increase in the value of the contract if the sponsorship was awarded to a doctor in management and a 9% increase if the sponsorship was awarded to a regular doctor. On the extensive margin, a 1000 euro increase in management sponsorships is associated with a 3.7 percentage point increase in the probability of getting a contract in the next quarter, while for regular sponsorships the increase is only 1.1 p.p. The difference stems mostly from direct contracts, which are awarded without any tender and are the least transparent of all procurement contracts. While the increased probability of obtaining a contract and the larger value of contracts associated with sponsorships is consistent with influence peddling or kickbacks, the similarity of this association between sponsorships in management positions and sponsorships to regular doctors is surprising.

An important argument against the marketing explanation is rooted in the institutional setting. Romanian procurement law restricts the legal avenues allowing pharmaceutical firms to influence hospitals' procurement process and has a wide definition for conflicts of interest. Also, pharmaceutical firms active in Romania are not allowed to condition

prescription behaviour with sponsorships and they are legally required to send Romanian authorities all informational materials of their promotional events, including those occuring during scientific conferences. Taken together, these rules severely limit the scope of legitimate marketing by pharmaceutical firms. Furthermore, the majority of all procurement contracts (88.92%) and of those linked to sponsorships (93.44%) cover products that were bought also in the past three years. This would suggest hospitals are relatively informed about the market, so there is reason to believe the scope of an informational marketing channel is limited.

Finally, I investigate whether contracts linked to sponsorships are less transparent, a situation also consistent with sponsorships acting as kickbacks. Following the literature on red flags in procurement(Fazekas and Toth, 2016), I use several measures of transparency: length of procurement, number of bidders, indicators for single bidder. Contracts linked to sponsorships are associated with shorter procurement times: being linked to a management sponsorship is associated with a decrease of 4 days in the time between announcement and signing. In contrast, the association between non-management sponsorships and the length of the procurement process is insignificant. However, there seems to be no link between sponsorships and the probability of having a single bidder or on the average number of bidders.

This paper makes several contributions. First, the Romanian institutional setting offers a unique chance to study corruption and kickbacks in a setting where high-quality formal legal institutions are in place. On the one hand, as a full-fledged EU member since 2007, Romania has a developed legal system and is bound by EU transparency regulation, regularly publishing data on procurement and spending. On the other hand, perceived corruption is pervasive especially in the healthcare sector, despite a legal system that formally limits conflicts of interest and bribes[2].

While the existence of ties between politicians and and the private sector has been extensively studied both in economics (Asher and Novosad, 2017) and in political science (Desai, Olofsgård et al., 2011), the importance of links between other types of public bodies and firms has received much less empirical attention. Recent work by Tabakovic and Wollmann (2018) showed evidence that the revolving door between the private sector and patent regulators in the US is consistent with regulatory capture. The present paper is in a similar spirit: while outright quantitative identification of corrupt behaviour in complex institutions is virtually impossible to obtain, the question of the extent of private influence in public institutions is important enough to encourage investigation. In the medical literature, DeJong et al. (2016) showed that pharmaceutical industry-sponsored meals influence doctors' prescription behaviour and Larkin et al. (2017) showed modest effects on prescription behaviour after limiting detailing policies, while Abraham (2002) documented the ways in which pharmaceutical companies act as political players. However, to my knowledge, there are no studies linking the pharmaceutical sponsorships to procurement, which is more tightly regulated than individual prescription behaviour. The present paper also includes more diverse types of sponsorships, such as conference expenses and speaking fees and specifically differentiates between sponsorships to doctors in management and regular doctors.

[2]Transparency International's Corruption Perception Index (Transparency International, 2017) routinely scores Romania at the bottom of the EU member states; in 2017, it scored 57th out of 180 countries surveyed. In November 2017, Laura-Codruta Kovesi, the head of the Romanian anti-corruption agency (DNA), declared: "... the bribe is paid in cash, before signing the contract and represents a certain percentage of the value of the contract. In healthcare, the bribe is about 20%, in IT 10% and in infrastructure beween 2% and 5%.

A wide array of topics have recently been studied using procurement data, from waste in public services (Bandiera, Prat, and Valletti, 2009; Palguta and Pertold, 2017), to the effects of regulation on efficiency (Coviello and Mariniello, 2014) and transparency. An emerging strand of literature, pioneered by Mironov and Zhuravskaya (2016) aims to measure instititional quality and corruption at the local level by relating the distribution of procurement contracts to illicit financial flows. The current paper adds to this emerging field, linking legal financial flows (pharmaceutical sponsorships) to the distribution of procurement contracts.

Corruption is notoriously hard to identify due to its illegal nature, which is why early literature focused mostly on corruption perceptions (Reinikka and Svensson, 2006; Fisman and Gatti, 2002) or instrumental variables (Fisman and Miguel, 2007). However, the increase in data availability has made it possible to identify corruption in public spending using audits (Ritva Reinikka, 2004; Olken, 2006; Ferraz and Finan, 2008) or administrative spending data (Lehne, Shapiro, and Eynde, 2018). This paper contributes to this literature by documenting a timing effect consistent with kickbacks.

The present paper is structured as follows. Section 2 presents the institutional setting of hospital procurement and pharmaceutical sponsorships. Section 3 presents the data collection process and describes the final samples, while Section 4 describes the empirical strategy. Section 5 provides an overview of the results, while Section 6 concludes.

2 Institutional setting

In this section, I present the institutional setting in which Romanian public hospitals procure their supplies. I cover three layers of institutions that are meant to improve transparency and avoid conflicts of interest: public procurement law, pharmaceutical sponsorship law and the practice in Romanian hospitals. I also present two very recent case studies, one exemplifying foul play in procurement, the other in pharmaceutical sponsorships.

2.1 Procurement rules

The Romanian law provides a plethora of public procurement procedures, based on the complexity of the contracts to be awarded. I focus on the four main types of procedures used in the dataset for the purchase of goods and services: direct procurement, invitations, negotiations and auctions. In what follows, I will use the words contracting authority and "public body" interchangeably, to mean the hospital which is doing the procurement.

Before organising a procurement procedure, the contracting authority needs to estimate the value of the contract which will be awarded. The estimation is fully under the control of the institution, as the legislation provides solely loose guidelines. Based on the estimated value, the institution can choose the awarding procedure: open auctions are the gold standard, but smaller contracts can be awarded through simplified procedures such as invitations or negotiations. Each simplified procedure is only available below certain thresholds, so high-value contracts are usually awarded using open auctions.

Direct procurement is the simplest procedure. Since June 2013, it is applicable only to contracts below 30,000 euro (RON 132,519 in 2017). Direct procurement requires no auction and no announcement: the institution can choose its preferred supplier. Following Romanian law, I will use the word *tender* to express any procurement procedures that is not direct.

Invitations are simplified procurement procedures, applicable to contracts below 134,000 euro (RON 600,129 in 2017). In the first phase, the contracting authority announces the opening of the procedure, describing the contract to be awarded and the conditions to be fulfilled by firms. Firms send their files, applying for the right to make an offer and the authority selects its preferred candidates. In order to proceed to the second phase, the contracting authority needs to select a minimum of three candidates that it invites to make an offer. In the second phase, the firms send their offers and the contracting authority chooses the best fit according to the conditions set in the announcement.

Open and limited auctions are the most transparent procurement procedures: they are compulsory for contracts above 134,000 euro (RON 600,129 in 2017), but can also be used for smaller contracts. Open auctions have solely one phase, where the contracting authority publishes the announcement setting the contract conditions and deadlines. Any firm can make an offer within the established timeframe, after which the authority makes its choice. Limited auctions have those phases, one for selecting the candidates (similar to invitations) and one where firms bid for the contract.

Contracts above 134,000 euro need to be published in the Journal of the European Union and have strict rules regarding timelines and deadlines, while contracts below that threshold need to be published solely on the national portal and have laxer rules for participation.

Negotiations without participation announcements are procedures used when an auction has failed to supply a successful bid. The contracting authorities negotiate with the selected firms from the previous auction, in order to obtain a better contract than during the first procurement procedure.

It is explicitly forbidden to split large contracts into smaller ones in order to avoid the transparency thresholds. Conversely, splitting contracts into lots is particularly encouraged, as it allows SME's to compete for government contracts. If a large contract is awarded without being split into lots, the National Procurement Agency (ANAP) might classify the procurement as suspicious.

The law is purposefully vague regarding conflicts of interest, in order to capture a wide array of scenarios. It defines the conflict of interest as any situation where the employees of the public body who are involved in the procurement procedure have an economic, financial or personal interest that could compromise their impartiality or independence in the context of the tender. Furthermore, the law specifically forbids the winning firm from signing any commercial contracts related to the tender with the persons involved in the tender. This limitation is valid for 12 months after signing the contract and is aimed at avoiding the revolving door between public and private sector.

2.2 Procurement in hospitals

In order for a doctor's order to become a tender, it needs to pass through several layers of approvals. First, doctors need to explain the need for a certain substance: they need to file a needs report, which then gets approved by hospital management. Then, a team formed of various specialists create the technical requirements for the tender. Once the technical requirements have been set, they are approved by management and sent to the procurement office.

The procurement office is in charge of organising the tender: estimating the value of the tender, choosing the type of procedure, the deadlines and the attribution criteria. In theory, the attribution criteria can be one of the following: lowest price, best quality to price ratio, lowest cost and offer most advantageous from an economic point of view. However, in practice, procurement officers almost always choose the lowest price as the tender

criterium[3]. The reason is that any of the other attribution criteria would be vulnerable to contestation, since it is hard to defend the public body's judgment of quality or economic sense. Thus, procurement officers strongly prefer any kind of quality conditions to be set in the technical requirements. This can also be seen in the data in Table 1: an overwhelming 99% of the contracts attributed through a tender had the attribution criteria set to "lowest price".

Table 1: Type of tender criteria

Name	N	% Total
Lowest price	28,124	99.68
Best quality	48	0.17
Lowest cost	28	0.10
Offer most advantageous from an economic perspective	14	0.05
Total	28,214	

After the tender is set up, it is posted on the national procurement website (www.e-licitatie.ro), together with the deadlines for sending an offer. Once the deadline passes, the office decides which offers satisfy the technical requirements and chooses the offer with the lowest price.

Although it is forbidden by the law, buyers could theoretically influence the chances of preferred suppliers obtaining contracts through modifications of the technical requirements, which are hard to identify ex-ante. According to the Romanian anti-corruption prosecutor's office, this is also one of the main channels through which corrupt officials can manipulate tenders (DNA, 2017a). An illustrative example is a hospital manager convicted of manipulating technical requirements to favor two companies in exchange for 10 and 20% of the contract values, respectively (DNA, 2017b). This added up to 140,000 euros for for the period 2010-2014, or ten times the gross yearly salary of a specialist physician.

2.3 Pharmaceutical sponsorships

Since 2014, all sponsorships offered by pharmaceutical companies need to be reported to the Romanian National Agency of Medicines and Medical Equipment. According to pharmaceutical companies, sponsorships are intended to benefit patients by supporting doctors' continued education.

The law specifically forbids any kind of link between sponsorships awarded by pharmaceutical companies and the medication prescribed by sponsored doctors. Companies are forbidden from sponsoring scientific activities such as congresses and research projects where specific medication is advertised and are required to declare in advance to the Romanian authorities the topics, methods and materials to be used during conferences. In the case of sponsorships from pharma companies directly to hospitals, it is specifically forbidden that the sponsorship refer to any specific medication. Thus, the only legal reason for sponsoring a hospital is the generic "benefit of the patient".

Furthermore, it is specifically forbidden that companies condition doctors' prescription behaviour. Thus, they cannot offer any kind of gift or other benefit to doctors in exchange

[3] I would like to thank the procurement officer in a large Romanian public hospital for taking the time to explain all the practical procedures.

for prescribing a given drug. It is, however, allowed to offer doctors promotional objects of maximum 150 RON (around 30 euros), as long as they are relevant to practicing medicine.

Despite being specifically forbidden by law, there is reason to believe that some pharmaceutical companies have created incentives that encourage doctors to prescribe their drugs, which would go against the spirit of the law. An article published in 2018 by the investigative journalists of RISE Project(RISE Project, 2018) used internal documents of a large pharmaceutical company to show such an incentive scheme. For instance, doctors that had minimum five patients taking specific medication per year could be sponsored to go to national congresses, those that had 10-15 could go to European congresses, while those with an average of 25 per year could go overseas. Special rules applied to Key Opinion Leaders (KOL), who could obtain USD 200-300 in speaking fees per event.

3 Data

I used multiple administrative sources to create a dataset of all procurement contracts and the amount of sponsorships associated with each. Sponsorship data included the names of the doctors, but not their main affiliations. I used data on doctor affiliation and public servants' positions in order to match doctors to hospitals and differentiate between sponsorships to doctors in management (*lead* sponsorships) and regular doctors (*other* sponsorships). Then, I matched the daily firm-hospital sponsorship data with daily firm-hospital procurement data using the contracts dates. In this Section, I give details about the matching process and the assumptions underlying it.

3.1 Main variables: linking procurement to sponsorships

Throughout the analysis, I will use the following definition of a *link*: a procurement contract signed between firm f and hospital h in month m and year y is linked to a sponsorship if a sponsorship from firm f to hospital m occured less than 3 months before the signing date. Legally, the largest minimum time elapsed between announcing a tender and the deadline for making an offer is 35 days. This gives minimum 2 months for the preparation of the tender and establishing a winner, so such a tight window should leave little time for other external factors to interfere with the procurement process, but enough time for sponsorships to affect procurement.

I use two main sources of heterogeneity in the sponsorship contracts. On the one hand, I check whether the timing of a sponsorship contract is related to the timing of a procurement contract. This requires a dummy variable $Spons\_yes\_type_{f,h,m,y}$, which is 1 if there was a sponsorship contract of *type* (leadership sponsorship, other sponsorship or any sponsorship) between firm f and hospital h less than three months before month m, year y. On the other hand, I use the variation in the amount of sponsorships, which is captured by variable $Spons\_EUR1000\_type_{f,h,m,y}$: the amount (in thousands of euros) of *type* sponsorships flowing from firm f to hospital h three months before month m and year y.

The original data was in RON, so for ease of exposition I transformed it into euro using the average exchange rate of €1 = RON 4.4679.

3.2 Data sources

3.2.1 Sponsorships, doctor affiliation and management positions

The sponsorship data was obtained from the website of the official Romanian National Agency of Medicines and Medical Equipment[4] (ANM). The original data included 128,816 sponsorship contracts for the period 2015-2016. The data included *inter alia* the names of the recipients, their specialization (in freeform), the value and date of the contracts, the name of the sponosor and a free-form description of the contract. It also included all sponsorship contracts, including those awarded to institutions such as patient associations, nurses, GP's, doctors, non-medical personnel etc.

The first step in using this data was to link the recipients of the sponsorships to the institutions where they worked. The raw sponsorship data provided only the names of the beneficiaries of each sponsorship, without their institutional affiliations. I decided to focus only on recipients that were medical doctors, as public data on nurses' activities or other personnel (researchers, professors, support staff) is scarce. I also removed all GP's, as they are considered freelancers and are not linked to public hospitals. I used scraped data from the official registry of the Romanian National Doctor's College[5] (CM) in order to match doctors to public hospitals. This was done using vectorial decomposition with a threshold of 1, combined with manual matching using internet searches. The latter was only used if I could find a clear match using a doctor's name, specialisation and something in the address that could pinpoint the hospital. The conservative choice of the matching algorithm threshold was done in order to limit misplacing doctors as much as possible. The CM data included women's previous names, which were only used in case of failing to match the current name. In all cases, I kept solely persons identified as doctors in the sponsorship sample, either by their "Dr." title or by their job description.

A small percentage of the sponsorships were given directly to public hospitals, rather than to specific persons in those hospitals. These sponsorship contracts were deemed *institutional sponsorships*, in order to differentiate them from sponsorships given to persons within the hospitals. They include medicine and equipment donations, renovations etc and tend to be larger than the standard conference or professional association fees. I identified institutional sponsorships using the name (those that had hospital, asociation etc in their name) and matched them to the unique hospital ID's. However, for the purpose of the main analysis, I will ignore institutional sponsorships: they will only be included as a robustness check.

In order to link doctors to management positions, I used data from the Romanian National Integrity Agency[6]. The portal includes all the asset declarations for Romanian public servants who hold management positions. Asset declarations are legally binding and need to be filed at least once a year and upon beginning a new management position. The metadata (name, county, date, position, but not institution) is available on the Agency's data portal. Regretably, hospitals are clustered together under the categories "Health Ministry - other institutions" and "Other institutions subordinated to the county councils". After downloading all the metadata from these categories and homogenizing the county names, I matched the sponsorship data for the doctors with the asset declarations, using the name and the county. I identified leadership positions as any of the following in the year of obtaining the sponsorship: director, president, chief, manager, coordinator, board member. I used very stringent matching criteria for linking the asset declaration

[4]The website can be found at https://www.anm.ro/.

[5]The website was the National Doctor's Registry and can be found at https://regmed.cmr.ro/.

[6]The address can be found at http://declaratii.integritate.eu/

data with the sponsorship data: the name and county of the person had to be exactly the same and only the word order could vary (vectorial decomposition with a threshold of 1). This opens the possibility that some managers might have been excluded, due to spelling errors in the names.

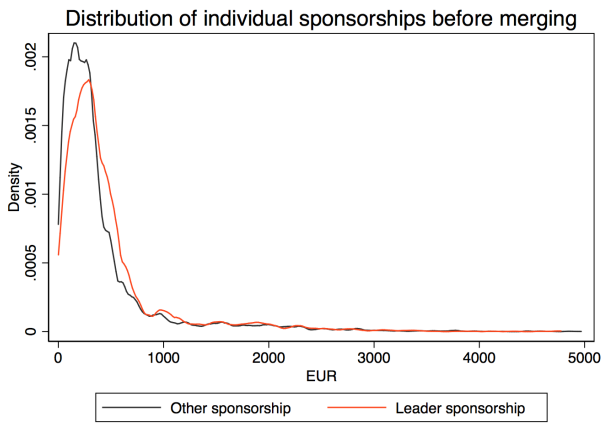
As it can be seen in Table 2, the matched dataset included 22,277 sponsorship contracts over the period 2015-2016. Of these, 3,397 were offered to doctors in management positions and the rest were offered to doctors who did not have management positions (18,880). Throughout the rest of the analysis, a "lead" sponsorship will denote a sponsorship given to someone in management, whereas a sponsorship of the type "other" will denote a sponsorship given to any other doctor in the hospital. The dataset included 94 pharmaceutical companies and 313 hospitals. The contracts went to 4040 doctors, of whom 373 had management positions. In total, the leaders cover 155 hospitals. Figure 1 shows

Table 2: Descriptive statistics, raw sponsorships (in euro)

Sponsorship type	N	Mean	Std.dev	Median	Max
All	22,277	426.7886	557.3152	268.5826	11184.45
Lead	3,397	480.4739	576.191	322.2991	11184.45
Other	18,880	417.1292	553.3137	263.4594	8239.979

an overview of the distribution of sponsorships. The bulk of the sponsorships (99.99%) are under 5,000 euro, with sponsorships to managers tending to be slightly larger.

Figure 1: The distribution of raw sponsorships



3.3 Procurement data

The procurement data (contracts, announcements, subsequent contracts etc) was downloaded from the official open data portal of the Romanian government (data.gov.ro). The data is curated by the the National Public Procurement Agency (ANAP) and updated every three months. The raw data consisted of the universe of procurement contracts in Romania, of which I cleaned solely those signed by the public hospitals in Romania.

The sample was limited to the period January 2015 - December 2016, in order to match the sponsorship data. Public hospitals were identified using public data on the Ministry of Health's portal on hospital expenses (www.monitorizarecheltuieli.ms.ro) and the list

of hospitals bound by an ethics council, which I found on the government's data portal. I excluded clinics, private healthcare providers and GP practices, as the focus of this paper is solely on public hospitals. The final list of hospitals consisted of 400 entities. This left a total of 376 hospitals in the matched sponsorship-procurement sample. Some hospitals were shut down or merged in the period 2008-2014, which explains the smaller number of hospitals present in the procurement data in 2015-2016.

The data was limited to include solely contracts between hospitals and firms who have sold minimum one product whose CPV code starts with 33 (medical equipments, pharmaceuticals and personal care products). This limitation ensured that I would focus only on firms connected to the medical market, excluding firms specialised in other sectors which are not related to sponsorships (industry, legal services, IT etc).

I only took into account the contracts that were for goods and services. Works contracts have different transparency thresholds and rules, tend to be much larger than contracts for goods and services and are part of a completely different market, so I decided to remove them from the sample. This left 965,662 contracts that included goods and services.

An important note is that the final sample includes only the initial tender contracts upon the date of the signing of the contract. I excluded subsequent contracts, as the data quality was uncertain and it was not clear which subsequent contracts were linked to which procedure. Furthermore, subsequent contracts could be signed years after a procedure, which would be hard to detect using only the sample 2015-2016. Focusing solely on the initial contract value mitigates this issue. Further details about the consolidation of lots into contracts and assumptions regarding missing values can pe found in the Appendix.

3.4 Descriptive statistics: main sample

3.4.1 Number of contracts linked to sponsorships

The final sample consists of 965,662 contracts. Table 3 contains a breakdown of each type of contract, by links to sponsorships and by procedure type. It can be observed that the vast majority (97%) of procurement contracts are actually direct contracts, which are not awarded using any kind of tender. Furthermore, a fifth (22.6%) of the hospitals in the sample have at least one contract linked to a sponsorship. Furthermore, as it can be seen

Table 3: Number of entities with at least one linked contract

Contracts	**Linked to a sponsorship in the past 3 months?**					
	Yes		**No**		**Total**	
	N	% Total	N	% Total	N	% Total
Direct procurement	2737	0.3	934708	99.7	937445	100.0
Participation invitation	53	0.9	5953	99.1	6006	100.0
Open auction	340	2.2	15388	97.8	15728	100.0
Negotiation (no ann.)	149	2.3	6331	97.7	6480	100.0
Total	3279	0.3	962380	99.7	965659	100.0
Firms						
	15	0.71		99.29	2105	100
Hospitals						
	85	22.6	291	77.4	376	100

in Table 3, a very small percentage (0.71%) of the firms that were awarded procurement contracts in 2015-2016 also have contracts linked to sponsorships[7]. Figure 2 shows that these 15 firms have won a significant percentage of total procurement: they account for 20.27% of the total value of procurement contracts that occured between 2015 and 2016. Table 14 shows that 7 out of the 15 firms that have linked contracts are in the top 30 of

Figure 2: Contracts going to linked firms

Note: Linked firms are firms with minimum one linked contract in 2015-2016.

the firms with the largest value of total procurement contracts in the sample. The total value of procurement contracts between 2015 and 2016 was 2,970 million euros, of which 3.93% (117 million euros) was linked to sponsorships.

This suggests that although there are very few firms that have linked contracts, they are important players in the procurement market and a significant portion of the sponsorships market.

3.4.2 Distribution of contract values

Tables 4 and 5 show an overview of the main variables of interest[8]: the value of sponsorships in the past three months and the contract value. The majority of contracts (92.94%) are under 1,000 euro, while contracts above 100,000 euro represent less than 1% of the sample. Unsurprisingly, the sponsorship variables follow the distribution of the raw sponsorships: sponsorships to management are fewer, but slightly larger than sponsorships awarded to regular doctors: the mean stands at 596 euros for the former and 544 euros for the latter.

3.4.3 Repeated purchases

As it can be seen in Table 6, more than 80% of the goods and services purchased in the procurement dataset belong to a category (CPV code) that was purchased in the previous years, with the percentage approaching 90% when the past four years of procurement are taken into account. Thus, while it is possible that pharmaceutical companies use

[7]There are also 5 other firms who have both sponsorship and procurement contracts, but those contracts cannot be linked using the window of three months before the signing date. Thus, these firms will be treated as not linked for the remainder of the paper.

[8]More detailed descriptive statistics can be found in the Appendix, in Table 13 and Figures 4.

Table 4: Descriptive statistics, main explanatory variables (in thousands of euro)

Variable name	N > 0	Mean	Std.dev	Median	Max
Spons_EUR1000	3,279	0.5992	1.1614	0.2284	16.6128
Spons_EUR1000_other	3,062	0.5437	1.0789	0.2140	16.6128
Spons_EUR1000_lead	503	0.5959	0.9456	0.2283	7.3646

Table 5: Distribution of contract values

Contract Value (euro)	N	% of total
< 1000	897484	92.94
1,000 – 10,000	53916	5.58
100,000 – 1,000,000	3,214	0.33
> 1,000,000	529	0.55

sponsorships to organize informational events for doctors and persuade them to purchase their products, the extent of this channel is likely to be limited.

Table 6: Previous purchases

Description	# Total	% Total	# Linked	# Not linked
Product purchased past year	804,502	83.31	2,839	801,663
Product purchased past 2 years	842,169	87.21	2,995	839,174
Product purchased past 3 years	855,604	88.60	3,064	855,604
Product purchased past 4 years	866,575	89.74	3,108	866,575

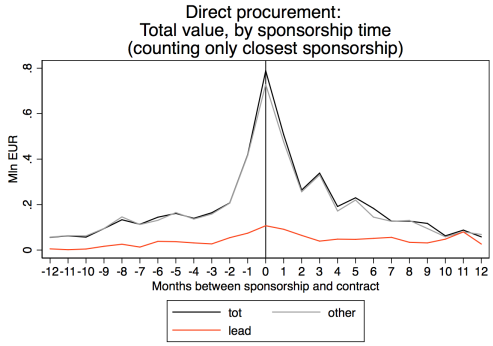
4 Empirical strategy

4.1 Pseudo-event study

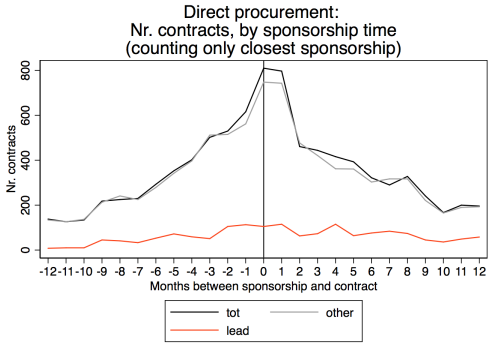
A natural first step towards establishing whether there is an relationship between sponsorships and procurement contract is an event study around the time of the sponsorship. Although the sponsorship decision is likely endogenous, such an exercise can be informative and provide circumstantial evidence of a link between sponsorships and procurement, regardless of the direction of the relationship.

Figure 3 provides such an event study exercise using the number and total value of procurement contracts. In order to establish the timing between a contract and a sponsorship, I chose only the closest sponsorship to the date of the signing. Thus, if a firm gave a hospital sponsorships in February and May and signed a procurement contract in April, that contract would be both one month before the May sponsorship and two months after the February sponsorship. In Figure 3, I assign such a contract value -1, as the absolute value is the smallest in the case of the May sponsorship. I do a similar exercise for all the procurement contracts linked to a sponsorship and sum up over the relative timing categories. As it can be observed in Figure 3, there seems to be a relative timing effect in the number of contracts that get signed: for all the contracts that are possibly linked to a sponsorship one year before and after the signing date, the bulk of the contracts seem

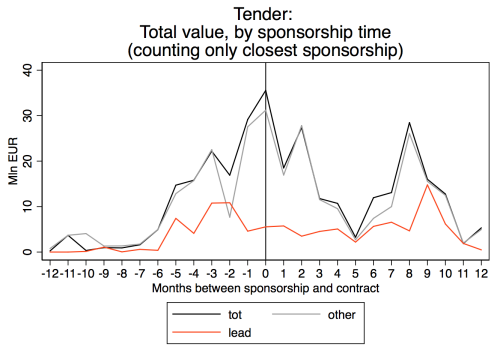
Figure 3: Timing of sponsorships and procurement contracts



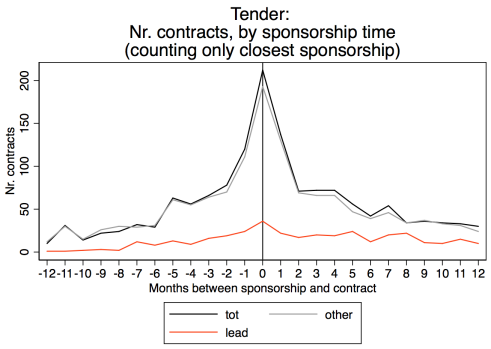
(a) Value of direct contracts



(b) Number of direct contracts



(c) Value of tender contracts



(d) Number of tender contracts

Note: the timing was calculated using the closest sponsorship (in terms of absolute value of the difference between month of signing the sponsorship and the month of signing the procurement contract).

to occur very close to the date of the sponsorship. A similar pattern can be found for the value of contracts, but the variability is much higher in the case of large tender contracts.

4.2 Baseline estimations: intensive margin

The first task is to study whether contracts that are linked to procurement sponsorships have a different value than those that are not. Although this is a question about the intensive margin of the sponsorship, there are several reasons to study it before the extensive margin. First, it shows the link between sponsorships and procurement, conditional on contracts being won, so it can be answered using the variation in contracts that are actually signed. Second, estimating the intensive margin of the relationship helps set up the framewework that will also be used to estimate the extensive margin.

The unit of analysis is the procurement contract between firm f and hospital h and it includes the value of all lots associated with this contract. I estimate the following equation:

$$\begin{aligned}\log V_{f,h,p,m,y} =& \beta_1 SponsPast3Months_{f,h,p,m,y} \\ &+ \sum_i \gamma_i Procedure^i_{f,h,p,m,y} + \eta_f + \eta_h + \eta_p + \eta_m + \eta_y + \varepsilon_{f,h,p,m,y} \end{aligned} \tag{1}$$

The left-hand side ($\log V_{f,h,p,m,y}$) is the log value of the procurement contract and the main variable of interest is $SponsPast3Months_{f,h,p,m,y}$: the total value of sponsorships in the three months preceding the procurement contract. The rich data allows for controlling for a large range of fixed effects (firm f, hospital h, product p, month m and year y) and for procedure type, so this should limit other channels that link sponsorships to procurement contracts.

The parameter of interest is β_1, which shows whether contracts related to sponsorships are larger than contracts not related to sponsorships. The parameter β_1 can be interpreted as the strength of the link between sponsorship and contract value. Conditional on a number of factors including time-, firm- and hospital- specific effects, there is no a priori reason why contracts linked to sponsorships should be any different than those not linked. Thus, a statistically significant β_1 would be consistent with influence peddling by the recipients of the sponsorships who lobby for their sponsoring firms within their hospitals. This leads to Hypothesis 1:

Hypothesis 1. $\beta_1 > 0$*: Procurement contracts that are linked to sponsorships have larger values than contracts that are not linked to sponsorships.*

After establishing whether there is indeed an association between the procurement value and having been sponsored, I study the heterogeneity of this link across different types of sponsorships. In other words, I estimate the following equation:

$$\begin{aligned}\log V_{f,h,p,m,y} =& \beta_2 LeadSponsPast3Months_{f,h,p,m,y} + \beta_3 OtherSponsPast3Months_{f,h,p,m,y} \\ &+ \sum_i \gamma_i Procedure^i_{f,h,p,m,y} + \zeta_f + \zeta_h + \zeta_p + \zeta_m + \zeta_y + \varepsilon_{f,h,p,m,y} \end{aligned} \tag{2}$$

The left-hand side ($\log V_{f,h,p,m,y}$) is the log value of the procurement contract and is the same as in equation (1). The sponsorship variable $SponsPast3Months_{f,h,p,m,y}$ from equation (1) has been split into two types of sponsorships: sponsorships to management (*LeadSponsPast3Months*) and sponsorships to other doctors in the hospital (*OtherSponsPast3Months*), in order to capture the different decision powers of the sponsorship recipients.

Again, there is no a priori reason to believe contracts linked to sponsorships would be any different than those not linked to sponsorships, so a positive association would provide evidence for foul play. Furthermore, if there were preferential treatment for the sponsors, the link between procurement value and leadership sponsorships would be larger than that between procurement values and sponsorships to other doctors, as this reflects the larger decision power of the hospital management compared to regular doctors. This leads to Hypothesis 2:

Hypothesis 2. *1. $\beta_2 > 0$, $\beta_3 > 0$: Sponsorships are positively related to the procurement contract values.*

2. $\beta_2 > \beta_3$: The link between leadership sponsorships and procurement contract value is larger than that between other sponsorships and procurement contract value.

5 Results

5.1 Intensive margin

Table 7 gives an overview of the main regression results. Sponsorship variables are measured using both dummies indicating whether a sponsorship took place in the three months prior to the signing of the contract (variables with suffix *_yes*) and as the total value of sponsorship contracts, in thousands of euros (variables with suffix EUR1000). It can be

Table 7: Intensive margin: main results

	(1) lnV	(2) lnV	(3) lnV	(4) lnV
Spons_yes	0.1100* (0.0582)			
Spons_yes_lead		0.0594 (0.1124)		
Spons_yes_other		0.1001 (0.0610)		
Spons_EUR1000			0.0921*** (0.0277)	
Spons_EUR1000_lead				0.1041** (0.0508)
Spons_EUR1000_other				0.0900*** (0.0313)
Observations	964952	964952	964952	964952
R^2	0.551	0.551	0.551	0.551
clustvar	spit_id	spit_id	spit_id	spit_id
Month f.e.	Yes	Yes	Yes	Yes
Year f.e.	Yes	Yes	Yes	Yes
Firm f.e.	Yes	Yes	Yes	Yes
Hospital f.e.	Yes	Yes	Yes	Yes
Product f.e	Yes	Yes	Yes	Yes

observed from Table 7 that sponsorships and procurement contracts do seem to be related: procurement contracts linked to sponsorships are 11% larger than those not linked to sponsorships and a 1000 euro increase in sponsorships three months prior to a contract is associated with a 9.21% increase in the value of that contract. Thus, Hypothesis 1 can be confirmed on both counts: contracts linked to sponsorships are associated with larger values and the marginal effect of a sponsorship is positive and significant.

Due to the relatively small number of linked contracts in the sample, there is not enough variation in the existence of a sponsorship to precisely estimate the association between contract values and the two different types of sponsorships (lead and other). However, when the variation in the amount of sponsorship is taken into account, as it is in the fourth column of Table 7, precision improves significantly: both the sponsorships awarded to management and those awarded to other doctors are correlated with larger contract values. Although on the intensive margin, being linked to a management sponsorship seems to be correlated with a larger contract than being linked to a regular sponsorship (10% larger as opposed to 9% larger), the difference is of limited economic significance. Thus, while the first part of Hypothesis 2 can be confirmed by arguing that there is a positive association between sponsorships and contract values, the second part is harder answer unambiguously.

Tables 16 and 18 in the Appendix provide further detail into the association between sponsorships and procurement values by estimating non-linear specifications that use polynomials of second and third degree. Since the coefficients of the higher-order polynomials are insignificant, it can be concluded that the association between sponsorships and contract values is best estimated by the log-lin specification in Table 7.

5.2 Extensive margin

5.2.1 Balanced panel: descriptive statistics

Since the dataset used for estimating the link between contracts and sponsorships along the intensive margin consists only of contracts that have been won, no counterfactuals are readily observable. Consequently, in order to estimate the relationship between the likelihood of getting a procurement contract and pharmaceutical sponsorships, one needs to exploit variability in getting a contract. To this end, I create a monthly balanced panel of firm-hospital pairs, where I record whether a sponsorship or a procurement contract occured in month m between firm f and hospital h. Since firms needs to register on the procurement portal prior to obtaining a contract, the set of firms that have sold anything in 2015-2016 would be a good approximation for the universe of firms who could have received such a contract. However, due to memory and computational limitations, I could not create a balanced panel that would include product codes: such a panel would have quickly run into the curse of dimensionality, since there are 4,070 different CPV codes in the dataset.

The balanced panel includes 1,203,096 observations of hospital-firm pairs, observed through the 24 months between January 2015 and December 2016. Table 8 presents the descriptive statistics of the balanced panel created for this purpose: 238,198 observations with a procurement contract and 3,686 observations with minimum one sponsorship contract.

5.2.2 Balanced panel: empirical strategy

In this section, I establish the extensive margin of the relationship between sponsorships and procurement, i.e., whether sponsorships are related to a higher likelihood of obtaining

Table 8: Balanced panel descriptive statistics

Statistic	Value
No. firm-hospital-time pairs	1,203,096
No. firm-hospital pairs	50,129
No. obs with min. 1 procurement contract	238,198
No. obs with min. 1 direct contract	23,920
No. obs with min. 1 tender contract	23,920
No. obs with min. 1 sponsorship	3,686
No. obs with min. other sponsorship	3,448
No. obs with min. leadership sponsorship	653
No. months	24

procurement contracts in the quarter after they are signed. In order to obtain an answer. I estimate equations similar to the intensive margin:

$$\mathrm{I}(Contract)_{f,h,m,y} = \alpha_1 SponsPast3Months_{f,h,m,y} + \eta_f + \eta_h + \eta_m + \eta_y + \varepsilon_{f,h,m,y} \quad (3)$$

$\mathrm{I}(Contract)_{f,h,m,y}$ is an indicator variable which takes value 1 if a procurement contract took place between firm f and hospital h on month m in year y and is 0 otherwise, while $SponsPast3Months_{f,h,m,y}$ is the standard sponsorship variable. In order to estimate equation 3, I used a standard linear probability model with a rich level of fixed effects (firm f, hospital h, month m, year y), which should control for a large proportion of unobserved heterogeneity. Similarly to Hypothesis 1, a positive coefficient for sponsorships is consistent with influence peddling:

Hypothesis 3. $\alpha_1 > 0$*: Sponsorships less than 3 months before the contract date are correlated with an increase in the probability of receiving a procurement contract.*

Similar to Hypothesis 2, I also test for heterogeneous effects of different types of sponsorships. To do so, I estimate the following equation:

$$\begin{aligned}\mathrm{I}(Contract)_{f,h,m,y} = {} & \alpha_2 LeadSponsPast3Months_{f,h,m,y} + \alpha_3 OtherSponsPast3Months_{f,h,m,y} \\ & + \zeta_f + \zeta_h + \zeta_m + \zeta_y + \varepsilon_{f,h,m,y} \quad (4)\end{aligned}$$

In order to be consistent with influence peddling, the link between leadership sponsorships and the likelihood of getting a contract should be stronger than the link between other sponsorships and the likelihood of getting a procurement contract and both should be positive:

Hypothesis 4. *1.* $\alpha_2 > 0$, $\alpha_3 > 0$

2. $\alpha_2 > \alpha_3$*: The link between leadership sponsorships and the probability of getting a procurement contract is stronger than that between other sponsorships and the likelihood of obtaining a procurement contract.*

5.2.3 Balanced panel: extensive margin results

Table 9 provides the estimation results of the linear probability models described in equations (3) and (4). The variable $\mathrm{I}(Contract)_{f,h,m,y}$ on the left-hand side of the equations takes value 1 if a contract was signed in between firm f and hospital h in month m and

year y. In order to take into account the possible heterogeneity in the association between sponsorships and controls for tenders and direct contracts, I use three different specifications for contracts: *Any* is 1 if any type of contract occurred, *Direct* is 1 only if a direct contract occurred and *Tender* is 1 if any type of contract but direct ones occurred.

It can be observed from Table 9 that sponsorships are associated with higher probabilities of a procurement contract occurring within the next three months, confirming Hypothesis 3. However, it is harder to establish whether Hypothesis 4 should be rejected: while the marginal effect of increasing management sponsorships with 1000 euros is associated with a significantly larger increase in the probability of obtaining a procurement contract than the marginal effect of increasing regular sponsorships (i.e, 3.7 percentage points increase as opposed to 1 p.p), contracts linked to management sponsorships are statistically indistinguishable from contracts that are not linked to any sponsorships. This lack of precision could once again be due to the limited amount of contracts which can be linked to management sponsorships, which increases the standard errors.

Table 9: Extensive margin results

	(1) Any	(2) Any	(3) Direct	(4) Direct	(5) Tender	(6) Tender
Spons_yes	0.0555***		0.0338***		0.0471***	
	(0.0107)		(0.0107)		(0.0077)	
Spons_yes_lead		0.0374		0.0253		0.0296*
		(0.0266)		(0.0249)		(0.0150)
Spons_yes_other		0.0520***		0.0327***		0.0427***
		(0.0106)		(0.0105)		(0.0083)
Observations	1203096	1203096	1203096	1203096	1203096	1203096
R^2	0.130	0.130	0.131	0.131	0.064	0.064
clustvar	spit_id	spit_id	spit_id	spit_id	spit_id	spit_id

	(1) Any	(2) Any	(3) Direct	(4) Direct	(5) Tender	(6) Tender
Spons_EUR1000	0.014***		0.008*		0.008***	
	(0.005)		(0.004)		(0.002)	
Spons_EUR1000_lead		0.037*		0.033*		0.004
		(0.019)		(0.018)		(0.008)
Spons_EUR1000_other		0.010**		0.004		0.009***
		(0.005)		(0.004)		(0.002)
Observations	1203096	1203096	1203096	1203096	1203096	1203096
R^2	0.130	0.130	0.131	0.131	0.064	0.064
clustvar	spit_id	spit_id	spit_id	spit_id	spit_id	spit_id

All regressions include the following fixed effects: month, year, hospital, firm

5.3 Association between red flags and sponsorships

The procurement literature (Fazekas and Toth, 2016) has identified a number of red flags that seem to correlate with corruption in public procurement. Examples such red flags are: small number of bids, unexpected changes in tender requirements and/or documentation, tight deadlines for bidders or highly complex tender documentation. Since no tender texts are available in my sample, I use three red flags which can be easily quantified: single-bid auctions, average number of bidders per firm-hospital-contract and procurement length. Since deadlines were not observable, I used the time elapsed between the contract announcement and its signing as a proxy for procurement length.

The estimation results can be seen in Tables 10 and 11. Since announcement dates are only observable for invitations and open auctions, the sample size is significantly reduced compared to the previous estimations. While there is no reason to believe that sponsorships are related with single-offer procurements, contracts related to management sponsorships are associated with auctions that are 4.5 days shorter than contracts not related to any sponsorship. Further robustness checks are provided in the Appendix (Tables 21, 22, 23, 24), both for auctions and for a sample containing both auctions and invitations. However, the results are the same: sponsorships are not consistently related to less competitive procurements, but leadership sponsorships seem to be associated with shorter procedures.

Table 10: Are sponsorships associated with single-offer auctions?

	(1) SingleOffer	(2) SingleOffer	(3) SingleOffer	(4) SingleOffer
ContractValue1000	0.0000**	0.0000**	0.0000**	0.0000**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Spons_yes	0.0214			
	(0.0131)			
Spons_yes_lead		0.0202		
		(0.0191)		
Spons_yes_other		0.0143		
		(0.0150)		
Spons_EUR1000			-0.0017	
			(0.0033)	
Spons_EUR1000_lead				0.0057
				(0.0071)
Spons_EUR1000_other				-0.0028
				(0.0037)
Observations	15439	15439	15439	15439
R^2	0.385	0.385	0.385	0.385
clustvar	spit_id	spit_id	spit_id	spit_id

All regressions include the following fixed effects: month, year, hospital, product, firm

Table 11: Are sponsorships associated with shorter auctions?

	(1) ProcLength	(2) ProcLength	(3) ProcLength	(4) ProcLength
ContractValue1000	-0.0004	-0.0004	-0.0004	-0.0004
	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Spons_yes	-1.9939			
	(1.2724)			
Spons_yes_lead		-4.5764**		
		(1.8561)		
Spons_yes_other		-1.1402		
		(1.2892)		
Spons_EUR1000			-0.6303	
			(0.4624)	
Spons_EUR1000_lead				-2.8466**
				(1.1873)
Spons_EUR1000_other				-0.3138
				(0.4434)
Observations	15405	15405	15405	15405
R^2	0.619	0.619	0.619	0.619
clustvar	spit_id	spit_id	spit_id	spit_id

All regressions include the following fixed effects: month, year, hospital, product, firm

6 Conclusion

This paper has studied the association between pharmaceutical sponsorships and the procurement patterns of public hospitals. It documented a timing effect: sponsorships are associated with a 5% higher probability of the sponsoring firm obtaining a procurement contract within the next quarter. Furthermore, conditional on winning the procurement, sponsorships are associated with a 10% larger contract value. While selection issues are likely to be problematic on an econometric level, the relatively small increase in the effect of sponsorships on the probability of obtaining a contract limits their economic significance.

Next, I aimed to explain the reasons behind this timing effect. On the one hand, sponsorships could be related to procurement contracts because of legitimate marketing campaigns. The main mechanism put forward is that pharmaceutical firms sponsor doctors' attendance to informative scientific events where they are convinced of the value of the firms' products. However, this explanation is quite unlikely due to the legal limits placed on pharmaceutical sponsorships and procurement regulation aimed at limiting conflicts of interest.

On the other hand, sponsorships could act as kickbacks to doctors either by incentivising the prescription of sponsors' products or by encouraging the manipulation of tenders in the sponsors' favor. To test whether the later is more likely, I looked at whether the magnitude of the association between sponsorships and procurement is larger in the case of doctors holding management positions as opposed to regular doctors. However, since there was a relatively small sample of procurements linked to sponsorships, precise estimates of heterogeneous effects were difficult to obtain. On the intensive margin, the difference between sponsorships to doctors in management and those awarded to regular doctors is both statistically and economically insignificant. However, on the extensive margin, sponsorships to management seem to be associated more to an increase in the probability of awarding a contract, with the effect stemming mostly from direct contracts, which are the least transparent.

Finally, I investigated whether contracts linked to sponsorships are less transparent, which would be consistent with the kickbacks mechanism. Using red flags commonly used in procurement corruption studies, I looked at whether sponsorships are associated with more red flags. The difficulty in obtaining precise estimates of the heterogeneity in the association between sponsorships and procurement was also apparent when studying red flags. However, the red flags are known to the literature for their imprecision, which is why several of them need to be checked in order to reach a clear conclusion. In the current case, sponsorships do not seem to be clearly related to the number of offers a procurement contract is made, but sponsorships to management do seem to be related to tighter procedures.

Overall, it would seem that although there is clear reason to believe that there is a timing effect between sponsorships and procurement contracts, it is hard to establish that this is entirely due to corrupt behaviour such as kickbacks. However, given the institutional setting and the association between management sponsorships and the likelihood of obtaining a procurement contract, this would still be a highly likely explanation. Further research is required to establish clear mechanisms.

Furthermore, given the importance of healthcare in public spending across the world, a natural question arises as to how do the links between sponsorships and procurement translate to patient outcomes. Future research should shed light on this association and further help in disentangling the information and corruption mechanisms.

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A Data

A.1 Procurement dataset: further details

For procedures that are not direct procurement, there is usually a tender announcement that is recorded in the database. However, many of the announcement numbers for open tenders and invitations were missing. I updated the data on these missing announcement numbers using the list of tender calls available at data.gov.ro. However, for negotiations that do not need a participation announcement, no announcement ID was available. I created unique ID's for these tenders using the combination of public body, CPV code (EU-wide code for classifying all procurement products), contract date, contract number and contract type (procurement/framework). I also excluded contracts that should have had a tender ID but did not (invitations, open procurements etc), which left 965,662 contracts.

The procurement dataset included all the lots won by a specific company, which was shown as multiple contracts. For some of the contracts, the value of each lot was not given: only the final tender value was observed. In order to ensure the homogeneity of the data, I created a tender identifier using the estimated value, the hospital ID, CPV code and the tender date. Then, I created a total value for each company that won minimum one lot in that tender. If all lots had the same value, the value given was actually the total value of the contracts, so I approximated the total value of lots awarded to each company by dividing the total contract value by the number of winners.

If a company had won multiple lots, I collapsed them into a single value. I consolidated all procurement at the tender level (using the tender id): thus, if a tender organised by hospital h resulted in 3 lots worth 1000 euro being allocated to firm f_1 and 5 lots worth 2000 euro being allocated to firm f_2, the data would show only 2 observations: one worth 1000 euro organised between hospital h and firm f_1 and one contract worth 2000 euro between hospital h and firm f_2. This ensures that I take the total value earned by a firm from a specific tender. The final result is the "Contract Value" variable that will be used throughout this paper.

A small proportion of the contracts in the procurement dataset are framework contracts, as it can be seen in Table 12. Those contracts are not always cleanly recorded: there are multiple instances when a large tender is won by multiple firms, but the value of each hospital-firm pair is recorded as the total value of the contract[9]. For those contracts, I assumed that the lots were evenly spread among the firms and divided the repeating value of the contract by the number of firms which won it.

Table 12: Types of contracts

Type of contract	N	% Total
Direct procurement	937,445	97.07
Framework agreement	18,094	1.87
Regular contract	10,124	1.05

[9]This is quite clear, since the repeating value is usually close to the announcement value and there are many firms that won the contract. Adding up those values would result in a value that is multiple times larger than the estimated value

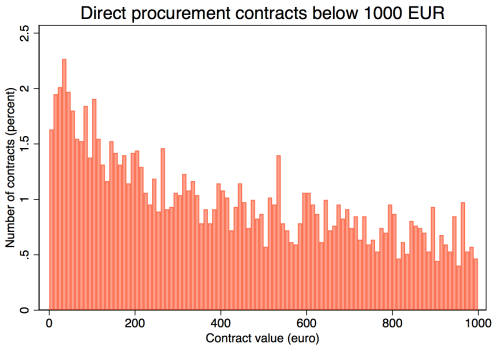
B Descriptive statistics

B.1 General descriptive statistics

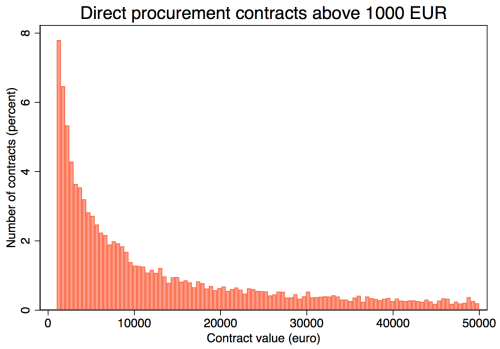
Table 13: Descriptive statistics, main explanatory variables (in thousands of euro)

Variable name	N > 0	Mean	Std.dev	Median
Contract value	965,652	3.1971	95.2479	0.0616
Contract value|Spons_EUR1000 > 0	3,279	35.7739	312.132	0.2058
Contract value|Spons_EUR1000_other > 0	3,062	33.01608	292.3752	0.2053
Contract value|Spons_EUR1000_lead > 0	503	64.8998	529.3049	0.2619
Contract value|Spons_EUR1000 = 0	962,373	3.0861	93.6354	0.0616
Contract value|Spons_EUR1000_other = 0	962,590	3.1023	93.9486	0.0615
Contract value|Spons_EUR1000_lead = 0	965,149	3.1650	94.4943	0.6155

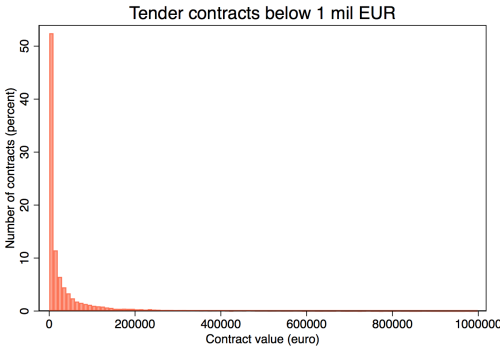
Figure 4: Distribution of procurement contract values



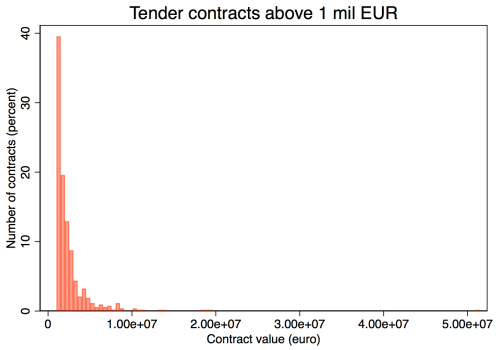
(a) Distribution of value of direct contracts below 1000 euro



(b) Distribution of value of direct contracts above 1000 euro



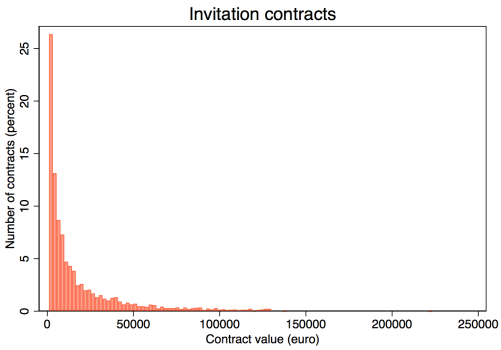
(c) Distribution of value of tenders below 1 mil euro



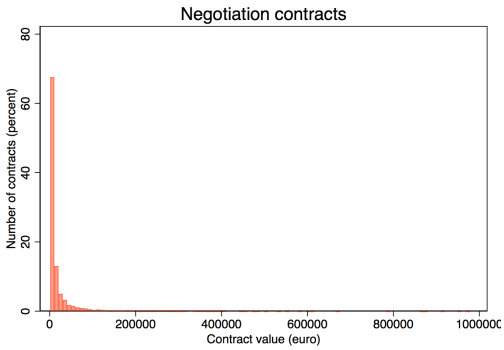
(d) Distribution of value of tenders above 1 mil euro

B.2 Distribution of procurement values

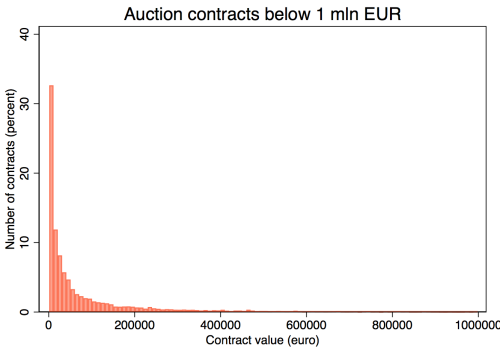
Figure 5: Distribution of tender contract values: by tender type(continuation)



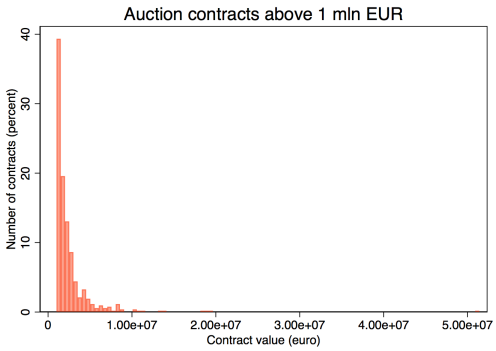
(a) Distribution of value of invitation contacts



(b) Distribution of value of negotiation contracts

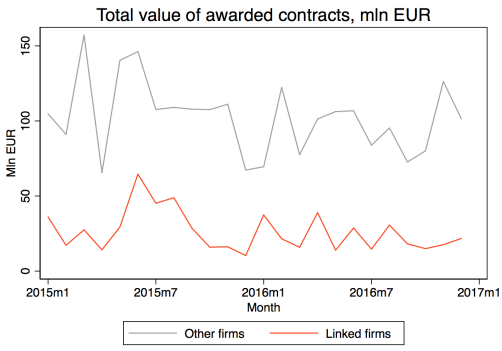


(c) Distribution of value of auction contracts below 1 mil euro



(d) Distribution of value of auction contracts above 1 mil euro

Figure 6: Value of procurement contracts



Note: Linked firms are firms with minimum one linked contract in 2015-2016.

Table 14: List of firms with highest value of procurement contracts

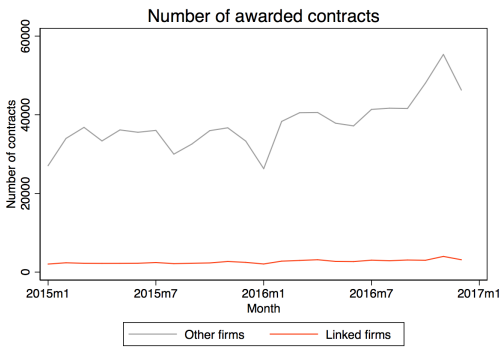
Nr.	Firm name	Contracts (mln EUR)	% Total	% Direct
1	**Farmexpert D.C.I.**	383.79	12.4	2.3
2	Mediplus Exim	355.05	11.5	2.2
3	Farmexim	177.66	5.8	5.1
4	Polisano	91.41	3.0	6.6
5	Gadagroup Romania	62.35	2.0	2.5
6	**Fresenius Kabi Romania**	57.35	1.9	3.8
7	Pharmafarm	53.66	1.7	5.9
8	Timi Med	51.41	1.7	0.0
9	**B.Braun Medical**	46.15	1.5	10.5
10	Farmaceutica Remedia Distribution & Logistics	42.43	1.4	3.3
11	**Actavis**	39.79	1.3	2.8
12	Fildas Trading	38.00	1.2	5.9
13	Compania Nationala Unifarm	34.15	1.1	7.4
14	Romastru Trading	33.74	1.1	3.1
15	Silva Trading	31.56	1.0	1.3
16	Sante International	31.37	1.0	3.7
17	Medical Technologies International	31.19	1.0	2.3
18	**Merck Romania**	30.64	1.0	1.7
19	Farmaceutica Remedia	28.36	0.9	2.7
20	Europharm Holding	28.26	0.9	12.4
21	**Roche Romania**	23.89	0.8	2.6
22	Geneva Romfarm International	22.75	0.7	0.6
23	Medical Ortovit	22.44	0.7	4.2
24	Clini-Lab	21.06	0.7	9.8
25	Pharma	20.79	0.7	19.4
26	**Pfizer Romania**	20.26	0.7	1.8
27	Top Diagnostics	20.19	0.7	3.5
28	Cortech Med	19.54	0.6	0.3
29	Siemens	19.34	0.6	1.9
30	One Pharm Grup	18.53	0.6	1.5

Note: bold names indicate the firm has also contracts linked to sponsorships

Table 15: List of product categories with highest value of procurement contracts

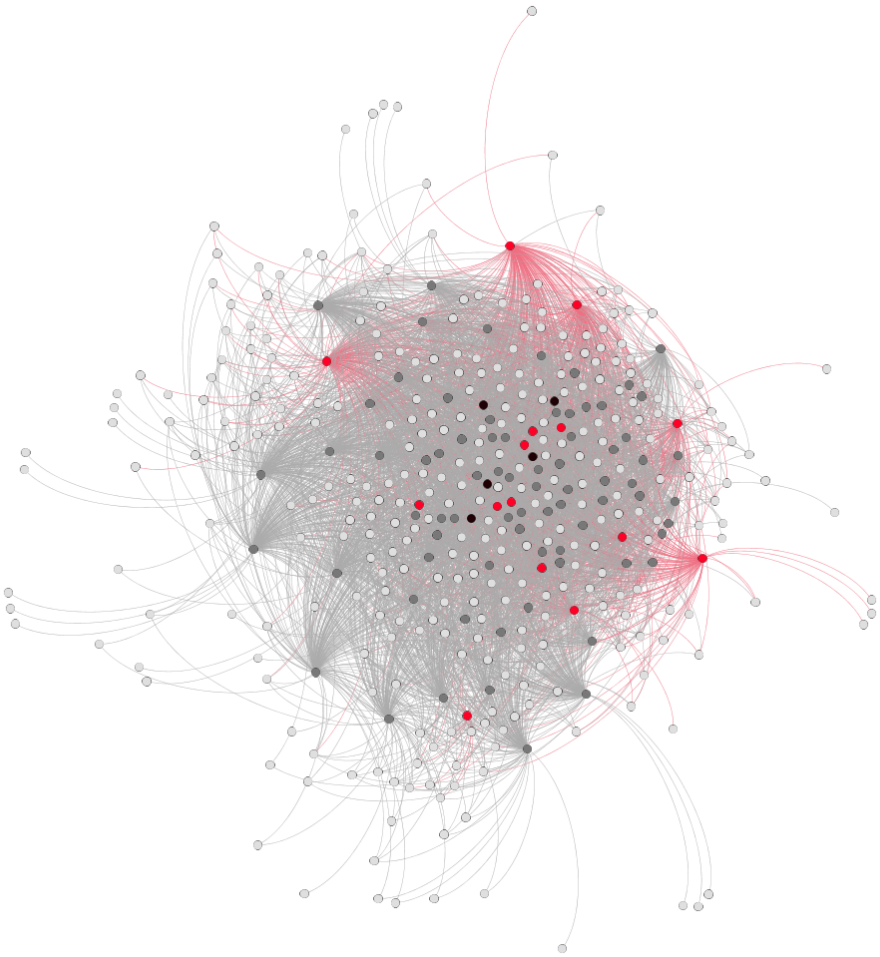
Description	Contracts (mln EUR)
Various Medicinal Products	328.47
Antineoplastic Agents	291.46
Pharmaceutical Products	243.58
Medical Consumables	166.93
Antineoplastic And Immunomodulating Agents	151.94
Laboratory Reagents	109.52
Angioplasty Supplies	90.11
Antivirals For Systemic Use	73.37
Blood-Testing Reagents	70.57
Antibacterials For Systemic Use	68.88

Figure 7: Number of procurement contracts



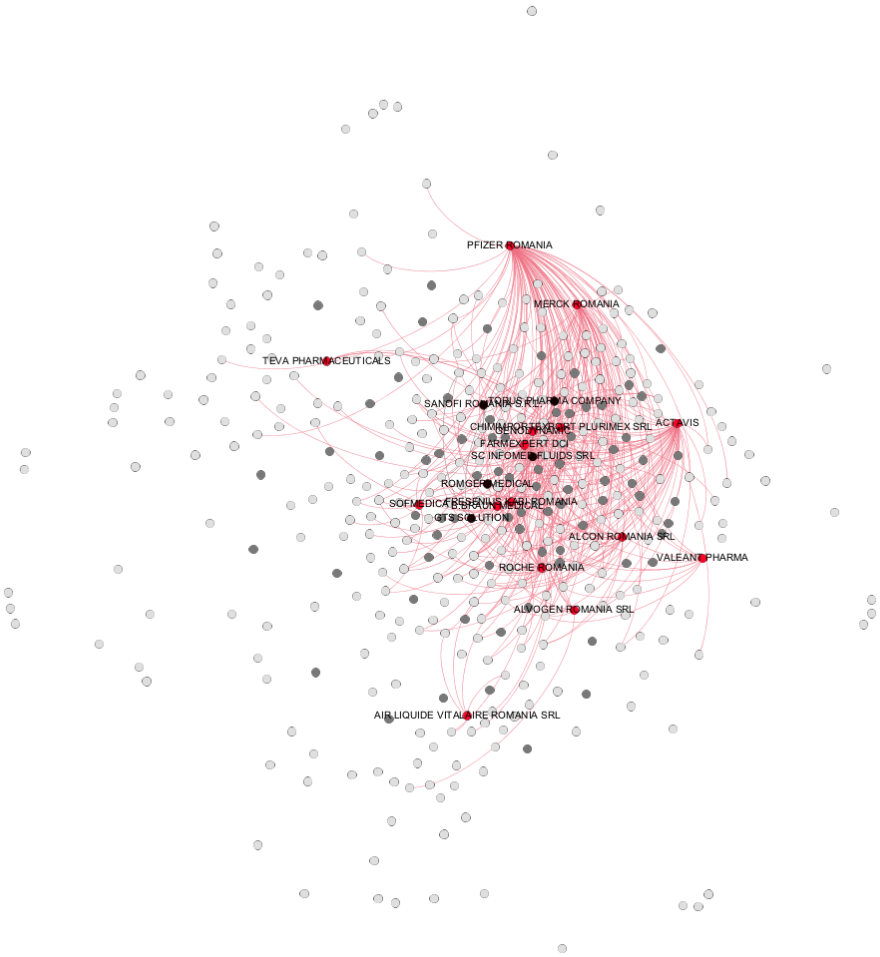
Note: Linked firms are firms with minimum one linked contract in 2015-2016.

Figure 8: Network visualisation: all sponsorships



Note: Light grey dots are hospitals, red dots are hospitals with at least one linked contract, black dots are firms that gave sponsorships and received unrelated procurement contracts, dark grey dots are firms that only gave sponsorships. Red lines mean that there is at least one linked contract between the entities, black lines mean that there is a procurement unrelated to the sponsorship, light grey lines are simple sponsorships.

Figure 9: Network visualisation: only sponsorships and procurement



Note: Light grey dots are hospitals, red dots are hospitals with at least one linked contract, black dots are firms that gave sponsorships and received unrelated procurement contracts, dark grey dots are firms that only gave sponsorships. Red lines mean that there is at least one linked contract between the entities, black lines mean that there is a procurement unrelated to the sponsorship, light grey lines are simple sponsorships.

C Robustness checks

C.1 Robustness checks: intensive margin

Table 16: The association between sponsorships and contract values: non-linear specification

	(1) lnV	(2) lnV	(3) lnV	(4) lnV
Spons_yes	0.110*			
	(0.058)			
Spons_EUR1000		0.092***	0.122**	0.199**
		(0.028)	(0.055)	(0.092)
Spons_EUR1000_2			-0.004	-0.032
			(0.005)	(0.025)
Spons_EUR1000_3				0.002
				(0.001)
Observations	964952	964952	964952	964952
R^2	0.551	0.551	0.551	0.551
clustvar	spit_id	spit_id	spit_id	spit_id

All regressions include the following fixed effects: month, year, hospital, product, procedure, firm

Table 17: The association between sponsorships and contract values: including institutional sponsorships

	(1) lnV	(2) lnV	(3) lnV	(4) lnV
spons_all_yes	0.1346***			
	(0.0503)			
Spons_yes_lead		0.0552		
		(0.1112)		
Spons_yes_other		0.0986		
		(0.0607)		
Spons_yes_inst		0.2309***		
		(0.0878)		
spons_all_EUR1000			0.0109	
			(0.0067)	
Spons_EUR1000_lead				0.1032**
				(0.0505)
Spons_EUR1000_other				0.0883***
				(0.0313)
Spons_EUR1000_inst				0.0051
				(0.0053)
Observations	964952	964952	964952	964952
R^2	0.551	0.551	0.551	0.551
clustvar	spit_id	spit_id	spit_id	spit_id

All regressions include the following fixed effects: month, year, hospital, product, procedure, firm

Table 18: The association between sponsorships and contract values: non-linear specification, heterogeneous effects

	(1) lnV	(2) lnV	(3) lnV	(4) lnV	(5) lnV	(6) lnV	(7) lnV	(8) lnV	(9) lnV	(10) lnV
Spons_yes_lead	0.0594									
	(0.1124)									
Spons_yes_other	0.1001									
	(0.0610)									
Spons_EUR1000_lead		-0.1338	0.0681	0.1041**	0.0074	0.1160	0.1230**			
		(0.2961)	(0.1279)	(0.0508)	(0.2999)	(0.1345)	(0.0546)			
Spons_EUR1000_lead_2		0.1230	0.0084		0.0681	0.0020				
		(0.1436)	(0.0238)		(0.1455)	(0.0245)				
Spons_EUR1000_lead_3		-0.0132			-0.0078					
		(0.0148)			(0.0151)					
Spons_EUR1000_other		0.2498**	0.1291**	0.0900***				0.2530**	0.1366**	0.0933***
		(0.1011)	(0.0616)	(0.0313)				(0.1001)	(0.0621)	(0.0315)
Spons_EUR1000_other_2		-0.0476*	-0.0057					-0.0477*	-0.0064	
		(0.0254)	(0.0063)					(0.0253)	(0.0063)	
Spons_EUR1000_other_3		0.0026**						0.0026**		
		(0.0013)						(0.0013)		
Observations	964952	964952	964952	964952	964952	964952	964952	964952	964952	964952
R^2	0.551	0.551	0.551	0.551	0.551	0.551	0.551	0.551	0.551	0.551
clustvar	spit_id	spit_id	spit_id	spit_id	spit_id	spit_id	spit_id	spit_id	spit_id	spit_id

All regressions include the following fixed effects: month, year, hospital, product, procedure, firm

Table 19: The association between sponsorships and contract values: only direct contracts

	(1) lnV	(2) lnV	(3) lnV	(4) lnV
Spons_yes	0.0614			
	(0.0604)			
Spons_yes_lead		-0.0354		
		(0.1036)		
Spons_yes_other		0.0690		
		(0.0625)		
Spons_EUR1000			0.0886***	
			(0.0340)	
Spons_EUR1000_lead				0.1107*
				(0.0572)
Spons_EUR1000_other				0.0838**
				(0.0389)
Observations	936780	936780	936780	936780
R^2	0.449	0.449	0.449	0.449
clustvar	spit_id	spit_id	spit_id	spit_id

All regressions include the following fixed effects: month, year, hospital, product, procedure, firm

Table 20: The association between sponsorships and contract values: only tender contracts

	(1) lnV	(2) lnV	(3) lnV	(4) lnV
Spons_yes	0.1698			
	(0.1211)			
Spons_yes_lead		0.0823		
		(0.2096)		
Spons_yes_other		0.1538		
		(0.1390)		
Spons_EUR1000			0.0676	
			(0.0413)	
Spons_EUR1000_lead				0.0494
				(0.1236)
Spons_EUR1000_other				0.0698
				(0.0448)
Observations	27837	27837	27837	27837
R^2	0.506	0.506	0.506	0.506
clustvar	spit_id	spit_id	spit_id	spit_id

All regressions include the following fixed effects: month, year, hospital, product, procedure, firm

C.2 Robustness checks: extensive margin

	(1) Any	(2) Any	(3) Direct	(4) Direct	(5) NotDirect	(6) NotDirect
Spons_EUR1000	0.0138***	0.0231***	0.0079*	0.0112	0.0080***	0.0185***
	(0.0051)	(0.0077)	(0.0044)	(0.0079)	(0.0024)	(0.0032)
Spons_EUR1000_2		-0.0011*		-0.0004		-0.0013***
		(0.0006)		(0.0006)		(0.0003)
Observations	1203096	1203096	1203096	1203096	1203096	1203096
R^2	0.130	0.130	0.131	0.131	0.064	0.064
clustvar	spit_id	spit_id	spit_id	spit_id	spit_id	spit_id

All regressions include the following fixed effects: month, year, hospital, product, procedure, firm

C.3 Robustness checks: red flags

Table 21: Are sponsorships associated with less offers for auctions?

	(1) AvgNrOffers	(2) AvgNrOffers	(3) AvgNrOffers	(4) AvgNrOffers
ContractValue1000	-0.0001	-0.0001	-0.0001	-0.0001
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Spons_yes	-0.7927			
	(0.4979)			
Spons_yes_lead		-1.1444		
		(0.8791)		
Spons_yes_other		-0.6848		
		(0.5534)		
Spons_EUR1000			-0.2379	
			(0.2034)	
Spons_EUR1000_lead				-0.6411
				(0.8608)
Spons_EUR1000_other				-0.1803
				(0.1738)
Observations	15439	15439	15439	15439
R^2	0.623	0.623	0.623	0.623
clustvar	spit_id	spit_id	spit_id	spit_id

All regressions include the following fixed effects: month, year, hospital, product, firm

Table 22: Are sponsorships associated with single-offer tenders?

	(1) SingleOffer	(2) SingleOffer	(3) SingleOffer	(4) SingleOffer
ContractValue1000	0.0000**	0.0000**	0.0000**	0.0000**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Spons_yes	0.0210*			
	(0.0126)			
Spons_yes_lead		0.0220		
		(0.0172)		
Spons_yes_other		0.0136		
		(0.0130)		
Spons_EUR1000			-0.0008	
			(0.0037)	
Spons_EUR1000_lead				0.0056
				(0.0071)
Spons_EUR1000_other				-0.0017
				(0.0040)
Observations	21368	21368	21368	21368
R^2	0.383	0.383	0.383	0.383
clustvar	spit_id	spit_id	spit_id	spit_id

All regressions include the following fixed effects: month, year, hospital, product, procedure, firm

Table 23: Are sponsorships associated with less offers for tenders?

	(1) AvgNrOffers	(2) AvgNrOffers	(3) AvgNrOffers	(4) AvgNrOffers
ContractValue1000	0.0001	0.0001	0.0001	0.0001
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Spons_yes	-0.4712			
	(0.4280)			
Spons_yes_lead		-0.8492		
		(0.8541)		
Spons_yes_other		-0.3003		
		(0.4605)		
Spons_EUR1000			-0.1482	
			(0.2043)	
Spons_EUR1000_lead				-0.2969
				(0.9136)
Spons_EUR1000_other				-0.1272
				(0.1740)
Observations	21368	21368	21368	21368
R^2	0.562	0.562	0.562	0.562
clustvar	spit_id	spit_id	spit_id	spit_id

All regressions include the following fixed effects: month, year, hospital, product, procedure, firm

Table 24: Are sponsorships associated with shorter tenders?

	(1) ProcLength	(2) ProcLength	(3) ProcLength	(4) ProcLength
ContractValue1000	-0.0002	-0.0002	-0.0002	-0.0002
	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Spons_yes	-1.9866*			
	(1.1370)			
Spons_yes_lead		-4.4282**		
		(1.9897)		
Spons_yes_other		-1.0720		
		(1.1832)		
Spons_EUR1000			-0.7103	
			(0.4486)	
Spons_EUR1000_lead				-3.1462***
				(1.1466)
Spons_EUR1000_other				-0.3664
				(0.4324)
Observations	21334	21334	21334	21334
R^2	0.695	0.695	0.695	0.695
clustvar	spit_id	spit_id	spit_id	spit_id

ProcLength = absolute difference between Announcement Date and Contract Date. All regressions include the following fixed effects: month, year, hospital, product, procedure, firm