Private Transaction Costs in Public Sector Contracting

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Abstract: Private companies contract with governments to deliver a broad range of goods and services such as construction, infrastructure, health care, facility management and much more. Such relationships implicate transaction costs, broadly understood as "all the cost which do not exist in a Robinson Crusoe economy." (Cheung, 1998; 515). However, whereas most previous literature has focused on the transaction cost considerations of governments in the public/private contracting relationship, much less scholarly attention has been devoted to the transaction costs of private companies in the relation. This paper aims to address part of this knowledge gap by examining the pre-contractual transaction costs of private companies vending services and products in contracts with governments. First, we draw on transaction cost theory and broader economics and industrial organization literature to develop a framework that combines theoretical and firm-, contract-, and government-level transaction cost factors. Second, we utilize data from a unique survey of Danish companies to examine the magnitude and determining factors of companies' transaction costs across eight industries that regularly contract with the public sector. Our findings underline the need for taking private companies' transaction costs more seriously in the planning and execution of public sector contracting to maximize the likelihood of win-win outcomes for government and business.

Keywords: Transaction costs, private companies, public contracts, Denmark.

1. Introduction

Government contracting for goods and services represents a major domain of economic activity, accounting for roughly 12 % of GDP across the OECD countries (OECD, 2018). When public organizations approach the private market to purchase a service or product, they seek solutions to specific needs at a favorable price (Brown, Potoski and Van Slyke, 2016). Likewise, private companies search for contracts with public organizations that allow them to sell products at higher price than their production costs, thus resulting in a win-win situation for both parties. However, in some circumstances governments and their private contracting partners find themselves engaged in exchanges beset by high transaction costs on one or both sides of the contract relationship (Melese et al., 2007; Li, Arditi and Wang, 2013; De Schepper, Haezendonck and Dooms, 2015). Such situations are likely to be critical for governments and business alike, because the expenditure spend on carrying out the transaction drains the resources available for production (Sclar, 2000; Bel, Fageda and Warner, 2010).

Transaction costs economics has contributed immensely to analysis of economic exchange between public and private organizations (Coase, 1937, 1960; Williamson, 1979, 1996). In addition to the direct price of purchasing, organizations also need taking into account the costs of making the transaction. In the context of government and business contracting, there is much research into ways of managing service markets to improve outcomes and mitigate relationship specific risks (Romzek and Johnston, 2002; Brown and Potoski, 2004; Girth et al., 2012). Broadly speaking, the advice to organizations is to externalize production ("buy") when products are relatively easy to specify, and internalize production ("make") when products are difficult to contract (Levin and Tadelis, 2010; Brown, Potoski and Van Slyke, 2016). However, missing from these discussions is the perspective of transaction costs among private companies vending their products to governments (De Schepper, Haezendonck and Dooms, 2015). Contractual relationships consists of two (or more) parties. The long-term success or failure of government and business contracting is thus highly dependent on sufficient understanding of transaction costs among private companies as well.

This paper attempts to address part of this knowledge gap by examining the pre-contractual transaction costs of private companies involved in contracting for public goods and services. First, we draw on transaction cost theory and broader economics and industrial organization literature to develop a framework for assessing companies' pre-contractual transaction costs in public service contracting. Our framework combines theoretical, firm-, contract-, and government-level factors of transaction costs. Second, we draw on data from a unique survey of Danish companies to examine the magnitude of companies' pre-contractual transaction costs across eight industries that regularly contract with the public sector. Because we also surveyed companies about the contracts, product specifications and the broader purchasing process, we can also a carry out regression analysis of factors explaining companies' transaction costs. To the authors' knowledge, this is the first international study to examine companies' transaction costs across a range of industries and types of contracts with the public sector [1]

The remainder of the paper is divided into five sections. We first draws on insights from transaction cost economics and related literatures to lay out our framework of theoretical and firm-, contract-, and government-level factors that are associated with private companies' transaction costs with the public sector. We then present the methods, our dependent and independent variables and operationalize our analytical framework. Next, we present our empirical findings with a focus, first, on descriptive findings from the survey of transaction costs among Danish companies, and second,

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[1] Soliño and Santos (2010) examine transaction costs in contracting of transport projects, and De Schepper, Haezendonck, and Dooms (2015) examine transaction costs in the context of Public-Private Partnerships in the construction sector. Dyer & Chu (2003) measure the transaction costs in business-to-business contracts in the automobile industry.

with a focus on our regression analysis of factors associated with companies' transaction costs in contract with the public sector. Finally, we discuss our findings, conclude on the lessons learned, and propose avenues for further research in the field.

2. Private transaction costs in public sector contracting

The transaction cost framework was founded in 1937 with Ronald Coase's famous article "The Nature of the Firm" (Coase, 1937) and further developed by Williamson and many others (Williamson, 1981, 1996). Transaction costs economics frames the fundamental choice between making and buying a product as a function of the sum of two generic types of costs: the costs of production and the costs of transaction. Whereas the concept of production costs is well-established in the economic and business literature, the notion of transaction costs reformed the discussion about the fundamental tradeoff between providing a product by using internal staff ("make") or purchasing the product from external vendors ("buy") (Williamson & Masten, 1999; xi). Broadly speaking, transaction costs are "all the cost which do not exist in a Robinson Crusoe economy." (Cheung, 1998; 515).

Whether the context is public or private organizations, the transaction cost framework advises organizations to make cost considerations that minimize the total costs of providing a service or product. As noted by Williamson, "Transaction cost analysis supplants the usual preoccupation with technology and steady-state production (or distribution) expenses with an examination of the comparative cost of planning, adapting, and monitoring task completion under alternative governance structures" (Williamson, 1985: 2). Choosing between the fundamental methods of production (markets, hierarchy and network) thus requires that organizations, be they public or private, take into consideration the sum of costs relating directly to the price of purchasing and the somewhat more subtle costs of transaction:

(1) Total costs of provision = Costs of production + Costs of transaction

Transaction costs in contract relationships arise from activities that are necessary to prepare and enter the contract (ex-ante transaction costs), and activities relating to monitoring of compliance, sanctioning of contract breaches and general relationship management (ex-post transaction costs) (Petersen et al., 2018). More specifically, ex-ante transaction costs involve activities that are necessary to "discover who it is that one wishes to deal with, to inform people that one wishes to deal and on what terms, to conduct negotiations leading up to a bargain, to draw up the contract" (Coase, 1960: 15), whereas ex-post transaction costs are expenditure necessary "to undertake the inspection needed to make sure that the terms of the contract are being observed, and so on" (Ibid.):

(2) Total transaction costs = Ex-ante costs (pre-contract phase) + ex-post costs (contract phase)

As previously mentioned, our focus here is on companies' pre-contractual (ex-ante) transaction costs, as limited prior research has devoted attention to this important domain of the government and business contracting debate.

2.1 Fundamentals of TCE

Transaction cost economics (TCE) perceives economic actors as opportunistic agents characterized by bounded rationality with regard to their ability to handle complex information (Williamson, 1985). We thus expect parties to a contract to behave opportunistically to maximize their (pecunary) gains while minimizing their costs. Indeed, this also applies to a public contract setting, in which the buyer (the public sector) aims to purchase a product or service from an external part (the private

company). Here, the public organization aims to minimize costs and maximize the quality and quantity of output, while the private company will seek to maximize its profit, which can be done by lowering costs and/or by reducing quality (Domberger and Jensen, 1997). The contractual relationship is thus characterized by a fundamental interest conflict; unless the parties can reach a contractual consensus that allows them to draw win-win solutions (Brown, Potoski and Van Slyke, 2016).

Combined with the fact that public services are often complex to measure in a uniform way (Rainey, 2014), this raises important issues in contracts between governments and business. In the traditional transaction cost economic theory, the focus is on the buying organization and how to reduce their total cost including transaction cost (Williamson, 1985, 1991). There are three main factors driving transaction costs in such relationships: (i) the need for making specific investments necessary to conduct the task and which have little or no alternative use; (ii) uncertainty about the volume, technology and/or performance of the task that the contract concerns, and; (iii) the frequency with which parties exchange producs and services and thereby gain experience of contracting for similar tasks (for a review of the empirical evidence, see David & Han, 2004).

In the sections that follow, we discuss each of these transaction cost drivers in more detail and subsequently use these insights to frame an analytical framework for our empirical analysis.

2.2 Contract specific investments (asset specificity)

Asset specificity connotes the need for making relationship-specific investments. That is whether there is need to be made specific investments in assets that are specific for the task. This can be investment in machines and material but also investments in human assets in time and knowledge of employees (Williamson, 1991). When the organization needs to make asset specific investments, these potentially increase the transaction costs and especially when there is uncertainty related (Williamson, 1991). Regarding vendors' participating in tenders, there is often need for making asset specific investments to participate in a tender. These costs are relationship specific in the sense that they cannot be transferred to other tenders (Erridge, Fee & McIlroy, 1999). De Schepper et al. (2015) focus on relationship specific investments such as physical assets (machinery, equipment and so forth), people (specialized staff) and support (technical, legal and financial). These investments may be substantial when participating in tenders and drive transaction cost up – especially as there are multiple potential vendors (the different bidders) making these transaction specific investments. These transaction specific investments also need to be considered in combination with uncertainty and frequency, because uncertainty may increase the transaction costs of these while frequency may decrease the transaction costs (see below).

2.3 Uncertainty in the contracting relation

There is general different types of uncertainty that can increase the transaction cost of the relationship between buyers and vendors (Williamson, 1991). First of there may be uncertainty about the volume of the task that are going to be conducted; this is especially an issue if there need to be made assets specific investments. Second, there may be technology uncertainty i.e. uncertainty about how the task is going to be conducted. Third, there may be uncertainty about measuring the performance of the task. In general, the argument is that the buyer in case of uncertainty combined with asset specific investment often should internalize the task (Williamson, 1991). Yet, for the vendor uncertainly can also be expected to increase their transaction cost when bidding on tenders. E.g. the tendering material may give uncertainty as it may be difficult to understand the volume needed and how the task need to be conducted, and also there may be uncertainty about measuring the performance of the potential performance and quality of what need to be delivered. Erridge, Fee and McIlroy (1999) identifies seven specific thing that can increase the uncertainty for vendor in

relation to tendering and tendering material. Their empirical study shows that these uncertainties about the tender in general, and the quality of the written material in particular, influence the volume of transaction costs that companies expend in contracts with the public sector.

2.4 Frequency and transaction experience

The third factor in the transaction cost theory is frequency where the argument is that the choice of regulation form depend on the frequency the task is conducted (Williamson, 1985, 1991). The argument is that the more frequent an organization conduct a task the more likely it is that transaction costs are reduced on average. The argument here is that the more often a vendor participates in public sector tenders (especially similar ones) and solves similar task for the public sector, the less transaction cost the vendor will have by participating in tenders. De Schepper et al. (2015) shows that the frequency of transactions between buyer and vendor are helping building knowledge and governance that bring down the transaction cost. This is due to knowledge about the other part's needs, expectations and behaviors. Experience gained through frequent exchange of the same or similar products can thus help mitigate the cost of conducting yet another bid. Especially in public sector tenders, we should expect transaction frequency and experience to be important, as public tenders are heavily regulated by EU procurement directives. There are often argument that frequency will decrease the ex post transaction cost (Erridge, Fee and McIlroy, 1999), though we here are only investigating the ex-ante transaction cost – i.e. the cost until the contract is signed.

2.5 Analytical model

Figure 1 presents our analytical framework that combines insights from transaction cost theory and firm-, contract-, and government-level factors of companies' transaction costs. We examine these factors in our multivariate regression analysis. First, we explain our methods, empirical data and operationalization of variables.

Figure 1: Analytical model of theoretical, firm-, contract-, and government-level factors influencing pre-contractual transaction costs of private companies.
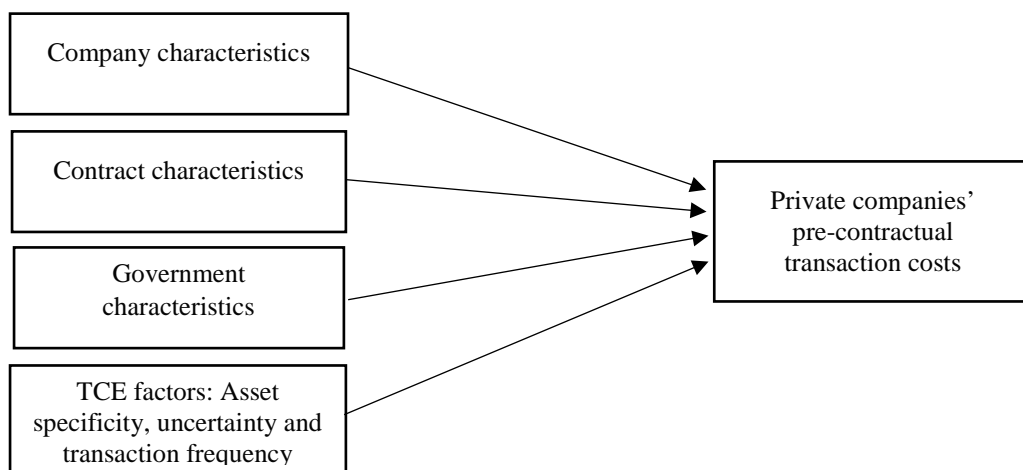
3. Methods and data

The empirical testing bed of our study is Danish companies in eight industries regularly bidding for public contracts. Transaction costs are not registered in the accounts of private companies and are therefore neither available from registers nor from accounts of companies. The data for the analysis

are thus based on original survey data, where we asked companies to assess the transaction costs in the last bid for a public contract that the company participated in. The specific operationalization of the transaction cost measure is presented below.

3.1 Selection of industries and companies

The first criterion for selection of industries has been that all included industries should be industries frequently facing public sector calls for tenders and thus encompassing companies regularly bidding for public contracts. Besides this basic criterion, a number of criteria guided the selection.

First, we wanted to include industries representing variations in factors theoretically affecting transactions costs, i.e. variations in asset specificity, uncertainty and transaction frequency. Building contractors for instance on average are assuming to bid on larger contracts and face higher asset specificity, higher uncertainty and lower transaction frequency than cleaning companies. Second, the industries should be of a certain size and representing competitive markets with a sufficient number of companies bidding for public contracts. Third, to facilitate access to the companies and encourage participating, we cooperated with the main Danish employers' associations in order to have specific contact information on companies and persons with bidding responsibilities in these companies.

Consequently, the sample is restricted to industries organized by these employers' associations and companies that are members of either one or more of these associations. As most companies bidding for public contracts presumably are members of either of these associations, we can assume that most companies in the selected industries are included[2].

Eight industries were finally selected to participate in the survey. In these industries, all companies with five or more employees[3] were invited to participate in an electronic survey focusing on the last bid for a public contract the company participated in. To ensure industry specific understanding of the bidding contexts and enhance the validity of the specific wording of the questions, we conducted focus- group interviews of various representatives from business associations as well as seven in-depth face-to-face pilot interviews with companies within the selected industries before finalizing the questionnaire and sending out the survey. The survey was carried out in November to December 2016 and two rounds of electronic reminders as well as telephone reminders were used to increase response rates. In addition, during the survey period, we asked employers' associations to distribute email to their members, encouraging them to participate in the survey.

Table 1 shows a list of the selected industries and information on the response rate for each of our eight industries. All together, the population consists of more than 4,000 companies in the eight industries. The total response rate across the industries was 34.6 percent, which we consider fairly good given that companies are usually hard to recruit in large-scale survey studies. For example, Li, Arditi and Wang (2013) operates with a response rate of 10.4 %, while De Schepper Hazendonck and Dooms (2015) manages a response rate of 68 % though for a smaller sample of 40 respondents. Around half of the companies that responded to the survey participated in a public tender in the last year and are thus included in the empirical analysis below.

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[2] For the Cleaning/facility management industry the membership lists were supplemented by data from the national Danish register for companies (the so-called "CVR-register") and for the Health/Elder care industry the lists were supplemented by data from the national list of companies approved for bidding on public health services.

[3] Based on advice from the employers' associations about bidding activities in each of our industries, we chose to include companies with less than 5 employees in the Knowledge advice industry and the ICT industry as the companies within these industries are generally smaller and companies with less than 5 employees are more likely to participate in bidding for public contracts than in the other industries.

As seen from Table 1, response rates vary from 26 % in the building industry to 44 % in the Health/Elder care industry.

Table 1. Industries included, population and response rates

Industry	Population of companies	Drop out	Responding companies	Dropout rate (%)	Response rate (%)	Share that did participated in a public tender in 2016 (%)	Share that did *not* participated in a public tender in 2016 (%)
1. Construction industry	301	208	93	69.1	30.9	69.9	30.1
2. Building contractors/developer	192	142	50	74.0	26.0	60.0	40.0
3. Bricklayers	370	247	123	66.8	33.2	72.4	27.6
4. Carpenters	646	444	202	68.7	31.3	69.3	30.7
5. Consulting	1,411	902	509	63.9	36.1	49.1	50.9
6. Cleaning/facility management	602	371	231	61.6	38.4	16.0	84.0
7. Health/Elder care	197	110	87	55.8	44.2	25.3	74.7
8. Information Communication Technologies	393	266	127	67.7	32.3	52.0	48.0
Total	**4,112**	**2,690**	**1,422**	**65.4**	**34.6**	**49.2**	**50.8**

3.2 Variables
The main data for the analysis is survey data. Below we first explain the operationalization of the dependent variable, then the dependent variables.

The dependent variable
As mentioned before, transaction costs are not registered in the accounts of private companies and the size of transactions cost are thus not extractable from the accounts of the individual companies. Neither for researches nor for the companies themselves. In order to recall their latest experiences, we therefore in the survey asked the companies to assess the transaction costs in the latest bid for a public contract. We did this by asking three successive questions:

A. What was the total contract value of the contract in the last bid?
B. What was your company's share of the total contract value in the last bid?
C. (later in the survey) What was the approximate size of your company's transactions costs in the last bid? (including an explanation of transactions costs, underlining that this includes costs at all stages of the pre-contractual process and relate both to internal costs (salaries etc. to own employees) and external costs for legal, financial or other advice regarding the specific bid)

The dependent variable was afterwards calculated as the company's transaction costs in percent of the total contract value for the company, i.e.:

(3) Pre-contractual transaction costs = (C/(A*B))*100.

Independent variables
We first present the operationalization of the variables derived from transaction cost theory, and then the operationalization of the other independent variables. The main theoretic concepts derived

from transaction cost theory is asset specificity, uncertainty and transaction frequency. Regarding uncertainty, in line with David & Han (2004), we distinguish between three subcategories of uncertainty: a) market uncertainty; b) technological uncertainty, and; c) behavioral uncertainty.

Each of the concepts are operationalized by additive indices combining 2-6 survey-items measuring different aspects of each concept, as displayed in Table 2.

Table 2. List of variables from transaction cost theory.

Theoretic concepts	Content	Variables	Operationalization*
Asset specificity	The level of transaction specific investments needed to be able to bid	1a. Investment in specialized means of production 1b. Investment in specialized human resources	1a. The solution of the task requires specialized machinery, equipment or technology 1b. The solution of the task requires employees with specialized knowledge, experience or education
Uncertainty	The level of uncertainty associated with submitting the specific bid	Market uncertainty: 2a. Demands and expectations of the contracting authority 2b. Volume uncertainty 2c. Price setting	2a. The tender material in general had a good quality 2a_2. The requirement specification was unambiguous and easy to understand 2a_3. The requirement specification made fair demands for fulfilment of the task 2b. The amount/size of the task was clearly defined 2b_2. The size of the total economic magnitude of the task in the contract period is clear 2c. It is easy for us to set the bidding price for the task
		Technological uncertainty: 2d. Technologies and means of production 2e. Work processes and competences Behavioral uncertainty: 2f. Responsibility for risks 2g. Risk sharing	2d: It is clear which technologies and means of production it requires to solve the task 2e: Written material (incl. drawings) can easily describe the solution of tasks like this 2f. The responsibility for risks was clearly described in the tender material 2g. Risks were appropriately shared between the contracting entity and the winning company
Transaction frequency	The company's experience with task solution for public authorities	3a. Frequency of similar transactions with specific public authority 3b. Frequency of all transactions with specific public authority 3c. Frequency of similar transactions with all public authorities 3d. Frequency of all transactions with all public authorities	3a. Our company often solve similar tasks for the public authority in question 3b. Our company often solve other types of tasks for the public authority in question 3c. Our company often solve similar tasks for other public authorities 3d. Our company often solve other types of tasks for other public authorities

*: All survey-items measured by 5-point Likert-scales ranging from "fully agree" to "Fully disagree"

In addition to the theoretical variables and industry dummies, we include a number of company-, contract-, and government-level variables in the empirical analyses. The first of these is based on data collected from the National Danish register for companies, the rest on the conducted survey.

- The size of the company measured by the number of employees
- The total number of contract bids for public tenders in 2016
- The contract value of the contract in question
- Repeated tendering of the same service (dummy)
- Tender above EU procurement threshold limits (dummy)
- Awarding criteria (Price, Best relation between price and quality, Other)

- Changes in contract material (Likert-scale from 1-5)
- Degree of digitalization in tender (Likert-scale from 1-5)
- Tendering authority (Municipality, Region, State or Public sector company)

In Table 3 below, we present descriptive statistics for all variables included in the analyses.

Table 3. Descriptive statistics

	N	Mean	Std. Dev.	Min	Max
Dependent variable					
Transaction costs (ln)	261	0.77	1.47	-3.91	4.05
Company characteristics					
< 5 employees	261	0.13	0.34	0	1
5-9 employees	261	0.15	0.36	0	1
10-19 employees	261	0.18	0.38	0	1
20-49 employees	261	0.29	0.45	0	1
100-199 employees	261	0.06	0.24	0	1
200-499 employees	261	0.03	0.17	0	1
>500 employees	261	0.03	0.18	0	1
Building contractors/developers	261	0.05	0.21	0	1
Bricklayers	261	0.10	0.31	0	1
Carpenters	261	0.21	0.41	0	1
Consulting	261	0.37	0.48	0	1
Cleaning/facility management	261	0.03	0.17	0	1
Health/Elder care	261	0.03	0.16	0	1
Information Communication Technologies	261	0.11	0.31	0	1
Number of bids in 2016	259	69.29	632.75	1	10000
Contract and government variables					
Contract value (ln)	261	15.57	2.14	10.74	21.82
Repeated tendering of service	253	0.14	0.35	0	1
EU contract	230	1.45	0.50	1	2
Awarding criteria = only prize	253	0.42	0.49	0	1
Changes in contract material	261	2.05	0.65	1	3
Digitalization	260	4.02	1.15	1	5
Region	259	0.08	0.27	0	1
State	259	0.26	0.44	0	1
Public sector company	259	0.16	0.37	0	1
Transaction cost variables					
Asset specificity	257	3.23	0.95	1	5
Frequency	259	3.63	0.78	1	5
Market uncertainty	261	2.80	0.73	1	4.83
Behavioral uncertainty	255	3.08	0.90	1	5
Technological uncertainty	252	2.67	0.75	1	5

Consistent with the Danish setting, Table 3 shows that most companies are small or medium-sized. Only around 12 percent of the companies have more than 100 employees. In terms of industry, most of the respondents are 'knowledge advisors'. Around 42 percent of the contracts are awarded based on the price only whereas the remaining 58 percent are awarded based on a combination of price and the quality of the bid. We see that most contracts are offered by local governments (the omitted category) while around a quarter of the contracts are from the state. Note that the number of observations differ because of missing values.

4. Empirical findings

4.1 Descriptive results
Before moving to the results of the multivariate statistical analyses, we present some descriptive statistics. Our dependent variable measures costs associated with bidding on a contract in percent of the company's share of the total contract value. Table 4 shows the average transaction costs within the eight industries included in the analysis.

Table 4. Companies' average pre-contractual transaction costs by industry.

Industry	Pre-contractual transaction costs in percent of contract value for each company	Observations
Construction industry	2.44	28
Building contractors/developer	1.26	12
Bricklayers	2.00	27
Carpenters	2.59	54
Consulting	9.04	96
Cleaning/facility management	1.76	8
Health/Elder care	0.99	7
Information Communication Technologies (ICT)	5.48	29
Average transaction costs for each company	**5.08**	**261**

The largest transaction costs are found among companies in the Consulting industry, where each company's transaction costs are reported to account for approximately 9 % of the contract value. The second largest transaction costs are found in the ICT-industry in which they on average account for approx. 5.5 % of the contract value. The lowest transaction costs are on the other hand found in the Health/Elder care industry and the Cleaning/facility management industry, where the transaction costs account for 1-2 % of the contract value. For both these industries, it is however important to point out that less than 10 companies have been able to estimate both the transaction costs and the contract value in absolute terms. The results for these two industries are thus more sensitive to answers from individual companies than the other industries.

The mean value for the dependent variable across all companies is 5.08 percent. This mean value covers substantial variation. The observed minimum is 0.02 percent and the maximum 57.14 percent. This indicates that differences between industries and contract sizes are substantial. We log transform this variable before including it in the analyses.

4.2 Multivariate analysis of transaction costs
The descriptive analysis illustrates that companies' transaction costs are substantial in some industries and more modest in others. These industry differences are noteworthy because they suggest that transaction costs expenditure is a much greater burden for companies in the advisory and ICT industries than in other industries. In order to move on from description to explanation of some of

these differences, Table 5 presents the results of our regression analyses of firm-, contract-, and government-level and theoretical factors that are associated with companies' pre-contractual transaction costs.

Table 5. OLS regression of firm-, contract-, and government-level factors explaining private companies' transaction costs

	Model 1 Company variables	**Model 2** Contract variables	**Model 3** Company + contract	**Model 4** Theoretical variables	**Model 5** Full model
Company characteristics					
Company size (ref.=50-99 employees)					
< 5 employees	0.02		-0.16		-0.23
	(0.35)		(0.31)		(0.31)
5-9 employees	0.54*		0.03		0.17
	(0.31)		(0.30)		(0.28)
10-19 employees	0.37		-0.03		-0.04
	(0.33)		(0.31)		(0.31)
20-49 employees	0.12		0.01		0.10
	(0.30)		(0.27)		(0.29)
100-199 employees	-0.25		-0.30		-0.22
	(0.44)		(0.45)		(0.44)
200-499 employees	-0.01		0.20		0.61
	(0.52)		(0.56)		(0.65)
>500 employees	-1.18**		-0.87**		-0.81*
	(0.48)		(0.42)		(0.47)
Industry (ref.= construction industry)					
Building contractor/developer	-0.02		0.61*		0.60
	(0.33)		(0.35)		(0.37)
Bricklayers	-0.14		0.02		-0.07
	(0.39)		(0.42)		(0.42)
Carpenters	0.04		0.13		0.05
	(0.34)		(0.32)		(0.34)
Consulting	1.50***		1.32***		1.16***
	(0.31)		(0.35)		(0.36)
Cleaning/facility management	0.03		-0.99**		-0.91**
	(0.35)		(0.40)		(0.40)
Health/Elder care	-0.33		-0.20		-0.39
	(0.48)		(0.53)		(0.52)
Information Communication Technologies	0.99**		0.71*		0.74*
	(0.39)		(0.43)		(0.40)
Number of bids in 2016	0.00***				0.00
	(0.00)				(0.00)
Contract and authority characteristics					
Size of contract (ln)		-0.43***	-0.37***		-0.38***
		(0.05)	(0.04)		(0.04)
Repeated tendering of service		0.34	0.68***		0.66***
		(0.24)	(0.20)		(0.21)
EU-contract		0.30	0.24		0.22
		(0.19)	(0.18)		(0.19)
Awarding criteria = only price		-0.97***	-0.43**		-0.46**
		(0.18)	(0.19)		(0.19)
Changes in contract material (scale)		0.27**	0.35***		0.27**
		(0.13)	(0.13)		(0.14)

	Model 1	Model 2	Model 3	Model 4	Model 5
Digitalization (scale)		-0.01	0.01		0.04
		(0.07)	(0.07)		(0.07)
Government level (ref. = municipality)					
Region		-0.53*	-0.54*		-0.77***
		(0.29)	(0.28)		(0.28)
State		0.28	0.14		0.08
		(0.19)	(0.21)		(0.20)
Public sector company		0.20	0.13		0.07
		(0.26)	(0.24)		(0.24)
Transaction cost variables					
Asset specificity				0.15	0.13*
				(0.10)	(0.08)
Frequency				-0.30***	-0.10
				(0.11)	(0.09)
Market uncertainty				-0.00	0.07
				(0.15)	(0.13)
Behavioral uncertainty				0.01	0.05
				(0.12)	(0.11)
Technological uncertainty				0.36***	0.28**
				(0.13)	(0.11)
Constant	-0.02	8.76***	7.17***	1.30**	6.69***
	(0.31)	(1.02)	(0.97)	(0.60)	(1.07)
N	259	216	216	243	204
R^2	0.288	0.391	0.536	0.073	0.588
VIF (highest/mean)	3,10/1,86	1,63/1,32	4,34/1,89	1,78/1,33	4,41/1,88

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Robust standard errors in parenthesis.

Five models are presented in Table 5. In the first four models, independent variables are included in separate blocks. Model 5 is a "full model". We comment on the models but calculate effect sizes based on model 5 that includes more control variables. Note that n varies between the models. Model 1 includes characteristics of the bidding companies. Overall, company size does not seem to play any significant role for the size of transaction costs. There are generally few systematic economies of scale to be reaped by larger companies. Only the very large companies in the group with over 500 employees (3 percent of our sample) report significantly lower transaction costs than in the reference group of companies with 50-99 employees.

This result is further supported by the fact that transaction costs for large companies are significantly lower in Model 5, with more control variables (though at <0.10 level). The regression coefficient for this group of -0.81 corresponds in substantial terms to companies with over 500 employees having approximately 56% lower transaction costs (exp. (-0.81) - 1) * 100) than the reference group of companies with 50-99 employees. Thus, this difference is not only statistically significant but also substantially significant yet based on a small group of large companies.

If we turn to the industries, results are interpreted with "construction contractors" as reference category. Both models 1 and 5 show that the coefficients for knowledge advisory and the ICT industry are positive and significant. In Model 5, the coefficient for cleaning / facility management is negative and significant. Transaction costs in the other industries are not statistically significantly different from construction contractors. Compared to construction contractors, knowledge advisory companies have an average of 3.2 times as high transaction costs (exp (1.16)); and in the ICT industry, the costs are on average 2.1 times as high, while transaction costs for companies in the field of cleaning / facility management are 60% lower than in the construction contractor industry.

Finally, model 1 shows a tendency for companies that highly engaged in public contracting to have higher transaction costs for their latest offer compared to otherwise companies that bid on

few public tenders. This may seem less logical, but since the coefficient is close to zero, it is not an effect of major significance for transaction costs. This effect is also not significant in model 5, where all the other variables are included.

In Model 2 and Model 3 (where company characteristics are controlled in the latter), the importance of contract characteristics are explored. First, we note that transaction costs appear to be related to the contract size. In both models 2, 3 and the full model 5, the coefficient is negative and significant. Since the contract size variable is also logarithmically transformed for linearity, the coefficient can not be interpreted directly but as an elasticity. Model 5 indicates that when the contract size increases by 1%, transaction costs are on average 0.38% smaller. Again, this is a relatively strong connection. For example, comparing two contracts, one of which has a value twice as large as the other, this contract is expected to have 38% lower transaction costs for the bidding companies in our sample.

Repeated tendering is associated with higher transaction costs. In model 5 with multiple control variables, the effect is relatively strong and companies' transaction costs in repeated tenders are 93% higher than in first time tenders (exp. (0.66)). This may be because it requires substantial costs to make a competitive offer on a task already solved by another company.

The awarding criterion also seems to be important for transaction costs. The coefficients are negative and significant in both models 2, 3 and 5. Contracts awarded solely based in price as criteria are predicted to entail 37% lower transaction costs ((exp. (-0,46) -1) * 100) than if the award criterion is best between balance of price and quality.

The questionnaire included a scale for the extent of changes in the contract material during the process. As expected, this variable is positive and significant in all model indicating that changes imposed by the ordering party in a procurement process lead to higher bid costs for the bidders. The last variable in this block refers to which authority is responsible for the tender. It is seen that the contracts offered by the regions leads to lower transaction costs for companies. In model 5, the coefficient of -0.77 indicates that the contracts from the regions on average results in 54% (exp(-0.77)) lower transaction costs for the companies in this study compared with the contracts made by municipalities. Contracts from the state and public companies are not significantly different from municipalities.

Model 4 presents the theoretical variables from the transaction cost theory. The analysis provides limited support for transaction cost theory's predictions. However, two variables yield significant results. Active specificity is insignificant in Model 4, but significantly at $p < 0.1$ level in Model 5 in the expected direction. This is an indication that, with greater asset specificity, public procurement also leads to higher transaction costs for companies.

The other theoretical variable that is significant is technological uncertainty that covers the company's knowledge of the technologies used in the task solution. The analyses indicate that companies experiencing higher technological uncertainty also report higher transaction costs. This is not surprising. The effect is present in models 4 and 5. That is, even when we compare relatively similar companies and relatively similar contracts, the experience of technological uncertainty means that transaction costs for the companies in question are generally higher. Together, however, there is no overwhelming support for transaction cost theory in the analyses. As mentioned earlier, this is not a real test of the transaction cost theory as we only consider a limited portion of the total transaction costs. Thus, we cannot conclude which regulatory structures are most efficient for the overall contract.

It should be noted that especially model 5 may suffer from lack of statistical power. In this model, we include almost 30 variables and estimate it based on only 204 observations. Further, we want to mention that in four of the five models (Model 4 excluded) the explanatory power is quite high as indicated by R square. This is especially noteworthy for model 3 including company and

contract-level variables. This model is able to explain around 53 percent of the variation in company's transaction costs. Little additional explanatory power is added by the theoretical variables, again indicating their limited value in this study. In the next section, we discuss these results and their broader implications.

5. Discussion

The analysis suggests that companies' transaction costs vary considerably across the eight industries included in our survey: from a high of more than 9 % among companies in the consultancy industry to a low of 1 % among companies in the Health/Elder Care industry. When making sense of these results, it is important to recall that our dependent variable measures each company's transaction cost expenditure for a specific contract. However, transaction costs are not merely spend by the company winning the contract, but by all companies that prepare and submit bids for the contract. Because we included an item in our survey that measures the number of bidder for each contract, we can calculate an approximate estimate of the average total pre-contractual transaction cost expenditure of all companies that submit bids for a contract in our eight industries.

Table 6 presents an estimate of the total transaction costs of all companies that submit bids for contracts. The estimation illustrates that the total transaction costs of the companies are approximately 5-10% of the contract value in the Health/Elder care, Building contractors, Facility management/cleaning and Building contractor industries. For Construction contractors, Carpenters and the ICT industry, the total transaction costs are on average 12-16% of the contract value for a common contract. Finally, transaction cost expenditure in the Consultancy industry peak at an average of 45 % per contract. Total industry expenditures on transaction cost activities of this magnitude are obviously non-trivial and very likely to drain substantial resources from the task that the contract concerns, as funds equivalent to almost half of the contract's monetary value are spend on transaction cost activities in the pre-contractual phases.

Table 6. Total transaction costs of companies submitting bids for contracts in eight industries.

Industry	Pre-contractual transaction costs in percent of contract value for each company	Typical number of bidders (modus)	Estimate of total transaction costs per contract
Construction industry	2.44	5	12.20
Building contractors/developer	1.26	5	6.30
Bricklayers	2.00	5	10.00
Carpenters	2.59	5	13.95
Consulting	9.04	5	45.20
Cleaning/facility management	1.76	5	8.00
Health/Elder care	0.99	5	4.95
Information Communication Technologies	5.48	3	16.44

The focus group interviews with industry representatives and our pilot interview confirms the magnitude of pre-contractual costs and points to several explanations of the findings. First, industry representatives point to the intangible nature of many consultancy services, resulting in calls for tenders based on broad and sometimes vague task specifications, which result in significant time spend on writing up proposals. Second, respondents mention that public procurers oftentimes ask private companies to submit bids that include half-finished solutions, which raises the costs of bidding substantially. Third, our survey data suggests that contracts in the Consulting industry are on average smaller (DKK 3.0 Million) than in the other industries (DKK 3.8 Million to 32.7 Million), while the number of companies submitting bids for contracts is roughly the same. Preparing a bid for a contract is likely to a number of start-up costs (such as reading the material,

preparing the organization etc.). The relative small contract volume thus places relative high costs on companies compared to industries where contracts are on average larger.

Overall, the analysis illustrates that the characteristics of companies (size and industries) and characteristics of contracts (types of contract, size, award criteria, etc.) explain much of the variation in our models, suggesting that the survey was relatively successful in capturing key factors of companies' transaction costs. For the total statistical model (model 5), where all variables are included, R-squared is 0.59, suggesting that the model explains a great deal of the variation. In particular, the models with company characteristics and contract characteristics contribute to explaining a significant portion of transaction costs.

The theoretical variables we draw from transaction cost economics, on the other hand, explain relatively little of the variations in companies' transaction costs in comparison with other factors. The relatively modest empirical support to the theoretical factors is somewhat surprising given the enormous use of transaction cost theory in social science literature, but is in line with the meta-analysis of David and Han (2004), finding varied empirical support for key variables of the TCE framework.

6. Conclusion

Our study contributes to the discussion of transaction costs in government/business contracting in several ways. First, by drawing on transaction cost theory and broader economics and industrial organization literature, the paper has supplanted the preoccupation with transaction cost of public organizations with an explicit focus on the costs that arise among private parties to the contract relationship. Our framework is novel in the way that is combines theoretical insights with firm-, contract-, and government-level factors and thus contributes to conceptualize companies' pre-contractual transaction costs. The empirical analysis aimed to put the framework to test, using original survey data from a sample of Danish companies across eight industries that regularly contract with the public sector. As expected, the findings suggest that transaction cost expenditure differs significantly across industries, with consultancy and ICT being the industries beset by the highest costs.

The study also has several limitations. Because no register data is available on companies' transaction costs, in the survey we asked companies to provide an estimate of activities that generated transaction costs in the most recent public contract for which they submitted a formal bid. However, the most recent tender is not necessarily representative of the company's general transaction cost experience, as the most recent contract may have been atypical in terms of content, scope or process. The fact that we survey a rather large sample of companies contribute to minimize this problem, but the caveat nonetheless remains. Another limitation is that we focus merely on the pre-contractual (ex-ante) transaction costs, whereas costs relating to activities such as monitoring compliance, sanctioning, renegotiation and termination - ex-post transaction costs – are not measured. A final limitation of the study is the risk of common source bias in our survey responses, which we attempted to address by focusing survey questions on factual information. Future studies may find themselves able to handle this issue, for example by using multiple surveys of various respondents in the organizations.

Further research into private companies' transaction costs in public sector contracting could extent this study by considering ex-post expenditures as well. Extending the study to additional industries and countries would also add further empirical insights and provide the basis for testing and refinement of our approach across different institutional, regulatory and market settings. Furthermore, in-depth case studies are promising candidates for ways of collecting additional insights about the complex interplay between drivers of transaction costs and the broader economic and organizational mechanisms of government-business contracting in various domains. Last, but

not least, it will be an important task for future research to supplant transaction costs analysis with a broader view to the contribution of public sector contracting to company revenue and long-term outcomes to business and society.

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