

Chapter 12

SOURCING FOR GOVERNMENT GOODS AND SERVICES: THEORY AND EVIDENCE FROM SWEDISH CITIES AND AUTHORITIES

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INTRODUCTION

According to the European public procurement Directive 2004/17/EC and Directive 2004/18/EC, procuring authorities have the option of awarding the contract on the basis of lowest price or to the economically most advantageous tender (EMAT). A naïve interpretation would be that when quality is of little importance the authority would choose lowest price while an authority that cares a lot for quality would rely on EMAT and would give a large weight to quality and a small weight to price. Possibly zero weight could be given to price if quality is important enough. Since quality can be safeguarded by minimum quality standards, however, the principles that should guide the choice between lowest price and EMAT – and that should be decisive for the weight given to quality – are more complex. We seek to contrast these principles against the practices of a sample of procuring authorities.

We focus on two well-known problems that a procuring authority has to face. First, when quality is non-verifiable there is often an incentive for the supplier to shirk on quality after the contract has been secured – i.e., the procurer has to deal with moral hazard. Second, the procurer may face a substantial uncertainty concerning the cost of meeting alternative quality levels. If quality standards are set too high, quality may on the margin cost more than the worth of

the value it adds. How best to handle these problem depends on the tightness of the procuring authority's budget and on how critical it is that the product meets a specific quality level.

We have detailed information on about 650 public procurements of a wide range of products, including type of product, type of procuring authority, award methodology, relative weights for price and quality (if applicable), duration of contract and other contract characteristics. The sample is representative for virtually all purchases made by local, regional and central government authorities in Sweden during 2007 and 2008. A survey was sent to the responsible authorities, asking for their opinion on the severity of the moral hazard problem and the cost uncertainty problem, as well as on the importance of meeting budget targets relatively to the importance of meeting quality targets.

Based on our survey data and using a simple empirical framework with logistic and ordered logistic regressions our main findings are that more complex scoring rules are used when framework agreements are procured and less weight is given to price when the procuring authority reports that it experiences uncertainty about the delivered quality (moral hazard).

Securing quality in procurement is complex, especially when non-verifiable quality dimensions are important. There is a trade-off between detailed rules and discretion that allows procuring authorities to base the allocation of contracts on reputation or to effectively blacklist providers known to perform poorly in non-verifiable quality dimensions (Tadelis, 2012). Due to stricter rules in public than in private procurement, the risk of quality degradation is higher in the former. Also, the risk of degradation of non-contractible quality is perceived to be higher with outsourcing than with in-house production, since private providers have stronger cost-savings incentives (Hart, Schleifer, and Vishny, 1997).

The US and the EU have moved in opposite directions in recent reforms of public procurement policies. The US has sought to strengthen executive leadership, shifting focus from detailed rules and regulations to a more flexible, dynamic and entrepreneurial approach in its government management¹ (See e.g. Kelman, 2002, Potoski, 2008 and Schooner, 2010). In contrast, the EU procurement directives have become stricter in stipulating that the call for tender specify how bids will be evaluated in terms of a scoring rule, giving

less room for discretion while seeking to reduce the risk for undue discrimination. See Arrowsmith (2006).²

Although the procurement auction and the principles for allocation of contract are regulated by EU directives and national laws within Europe, they still leave the contracting authority substantial freedom in designing the bid evaluation process and in choosing what qualification and award criteria to consider. The tension between different objectives and the diverging policies across the Atlantic motivate the current study. We seek an understanding of the procuring authorities' perception of the relative importance of price and quality and how this relates to revealed behavior in the choice of award methods and scoring rules.

The outline of the chapter is as follows. A theoretical background on procurement and the quality – price trade-off follows the introduction, where we also formulate the hypotheses we will test. The survey and the data are presented in the next section. Finally, the two last sections include the empirical analysis and concluding remarks.

THEORY AND HYPOTHESES

A procuring authority faces two fundamental problems: asymmetric information, in particular concerning delivered quality, and pre-procurement uncertainty about the cost of different quality levels. Asymmetric information, in this context, is a situation where the procuring authority cannot verify – and perhaps not even observe – the quality level even after the product has been delivered. Therefore the authority cannot use bonuses or penalties to give the supplier direct incentives to provide the agreed-upon quality. Uncertainty about the cost of quality, in contrast, refers to a situation where the authority is uninformed when it sets up the criteria and the award mechanism, but where quality is verifiable *ex post*. The nature and severity of these problems influence the optimal procurement mechanism in a particular situation.

In addition, the authority's own preferences will have an impact. Sometimes it will be critical to reach a threshold quality level and sometimes, perhaps due to "silo budgeting", the authority will have little interest in reducing the cost below a certain level. In this section we will first address theory related to cost uncertainty and formulate

testable hypotheses on the relation between cost uncertainty and procurement design. Subsequently we will discuss the impact of asymmetric information on procurement design and, again, formulate testable hypotheses.

Cost Uncertainty

Assume that quality is verifiable *ex post* but that prior to the tendering the cost of quality is unknown to the procuring authority. One alternative open to the authority is to select bid on the basis of lowest price while using minimum quality stipulations to reach a desired quality level. Alternatively, a scoring rule that combines price and quality into an overall score – EMAT – can be used so that, explicitly or implicitly, a price per unit of quality is set.³

As long as quality is determined *ex ante*, i.e., before the delivery contract is signed, the choice between the two methods and, more generally, the choice of weights for quality and cost, respectively, would be inconsequential if there were no uncertainty concerning the cost of quality. We focus on the situation where there *is* uncertainty concerning the cost of quality.

Assume that the procuring authority is restricted to either stipulating minimum quality *or* assigning a per-unit-of-quality (explicit or implicit) price. With uncertainty and if the marginal cost of quality rises more steeply than the marginal value of quality falls, the procurer is better off fixing the per-quality compensation than fixing the quality. If the marginal cost of quality changes less than the value of quality the opposite is true: the procurer should fix quality and have the bidders compete in price.⁴ The per-quality compensation corresponds to the discount in the evaluation price per quality increase; see Bergman and Lundberg (2011).⁵

Even better would be to let the per-quality compensation vary to reflect the diminishing value of successive quality increments. Then valuation can correspond to the procurer's valuation – at least locally – and the outcome will in principle be *ex-post* optimal also with uncertainty concerning costs. The marginal benefit of quality should equal the marginal cost of quality. This situation has been the centre of attention for theoretical studies of procurement auction design. Che (1993) shows that the authority has strategic incentives to deflate its valuation of quality since this will stiffen competition. However, this will only be possible if the authority can commit not to

renegotiate the quality.⁶ Also, a truthful representation of the authority's preferences will induce the first-best quality level. Asker and Cantillon (2010) extend the analysis and argue that the benefit of strategically undervaluing quality is small.⁷

Bergman and Lundberg argue that with or without uncertainty, the procurer is better off using a scheme where quality is evaluated in monetary terms, than with a scheme where the price bid is transformed into a quality score. This conclusion is based on practical considerations rather than on formal deduction from a set of assumptions since, of course, the transformation from price to quality is just the inverse of the transformation from quality to price. For example, with quality-to-price scoring it will be relatively easy to let the incremental quality value decrease with the quality level.⁸

If (marginal) quality is given a price tag there is no role for quality and price weights. However, if price is transformed to quality there is a role for weighing price relative to quality but since the *de facto* value given to quality will depend also on how the quality and price scoring functions are designed there is no simple mapping from quality weight to quality value. Therefore, to send appropriate signals to prospective bidders, the procurer needs to specify not only price and quality weights but also how the quality scoring function is designed.⁹

Asymmetric Information and Non-Verifiable Quality

If important quality aspects are non-verifiable (i.e., if there is moral hazard or adverse selection), the procuring authority may *not* want to specify the scoring function in too much detail, in order to be able to use reputational mechanisms to maintain quality; such mechanisms require a certain degree of discretion on behalf of the buyer. In private transactions, where buyers have substantial discretion and can react to non-verifiable quality signals, reputation, brand names and long-term informal relations are used to sustain high-quality equilibria through a link between current performance and future sales (Klein and Leffler, 1981; Macaulay, 1963; MacLeod, 2007). There exists an implicit contract or a market mechanism that ensures that high quality will be rewarded by large sales in the future.¹⁰

In contrast, public procurement legislation requires procedures to be objective and transparent for accountability reasons, limiting

discretion and thereby the scope for such mechanisms (Banfield, 1975; Kelman 1987; Tadelis, 2012). In most countries a public procurer is in principle not allowed to discriminate in favour of strong brand names, nor of providers that performed well in the past on non-verifiable performance dimensions. Similarly, while a public procurement contract can give the buyer an option to extend the duration of the supply contract, the exact length of the extension must typically be specified in the original contract. Under many public procurement legislations – although not the Swedish – the criteria driving the decision to award the extension must be ‘objective’, that is, verifiable. Even where a public procurer has the possibility of linking future sales to provided quality, e.g., via vendor rating and contract renewal schemes, existing regulations make this link very tenuous for non-contractible dimensions that cannot be audited by third parties and therefore generate accountability concerns.

A possible way to reward non-verifiable quality that has not received much attention in the academic literature is intentional vagueness as to the definition and measurement of quality. If the procuring authority retains the right to award quality scores that does not correspond to objectively verifiable criteria it can, in fact, screen for low-quality providers and implement a mechanism that gives the winning bidder incentives to maintain quality throughout the contract period. Other mechanisms that have been proposed in the literature include “relational” procurement, i.e., procurement with explicit discrimination in favour of bidders with a good performance track record (Albani et al, 2011) and “reputational” procurement, i.e., procurement from a pool of eligible bidders under the threat of exclusion from the pool if they provide deficient quality (Calzolari & Spagnolo, 2009; Spagnolo, 2012).

Additional Considerations: Simplicity, Budgeting and the Procuring Authority’s Preferences

When designing bid selection schemes simplicity will be of independent value. For this reason the procurer may want to use lowest price for a given quality standard. Highest quality for a given price may be relatively simple but it is a method of questionable value if there is significant uncertainty concerning price. With this method not only uncertainty concerning the marginal cost of quality will impact on the outcome, but also uncertainty concerning the infra-marginal cost. Still, if cost uncertainty is a small concern relative to

moral hazard and if simplicity is important this method may be relevant.

In many procurement settings there is a need to renegotiate the specifics of the contract due to unforeseen contingencies and incomplete contracts (Tadelis, 2012). This will be easier under cost-plus contracting than with a fixed-price contract. However, we intentionally ignore contracting issues and focus on the bid selection and award process.

Some procuring authorities may be subject to “silo budgeting”, i.e., to static budget allocations to divisions within an authority. For such authorities highest quality may be a (locally) rational response – in particular if the procured item is the major expense for that division. For example, care of the elderly may be the dominant cost of a local municipality’s social board and if the budget allocation is fixed the board’s best response may be to seek the highest available quality within the available budget.¹¹

For other authorities it may be imperative to reach a minimum quality threshold, a situation that has already been discussed. This is not easily reconciled with a situation where the budget restriction is the most pressing concern, as in the “silo budgeting” situation discussed above.

Hypotheses

The mechanisms that are available to the authority are the choice of award mechanism (lowest price or EMAT, with sub-categories such as price-to-quality scoring and quality only), options to extend the duration of the contract, and the level of “fuzziness” or “clarity” in quality scoring. Based on the theory discussed above, Table 1 tabulates the procurement mechanisms that would be the most appropriate choices under different assumptions on the severity of ex-ante cost uncertainty and asymmetric information concerning non-verifiable quality dimensions, respectively.

Any mechanism will do when there is neither a moral-hazard risk, nor significant cost uncertainty. However, lowest price offers the benefit of simplicity. With cost uncertainty and ex-post verifiable quality (little asymmetric information) it is optimal to rely on quality-to-price scoring. With this mechanism it will be clear to the bidders how

TABLE 1
Choice of Procurement Mechanism, Non-Verifiability and Cost Uncertainty

		Cost uncertainty	
		High	Low
Asymmetric information/non-verifiable quality	High	Price-and-quality scoring	Price-and-quality scoring, highest quality
	Low	Quality-to-price scoring	Lowest price (any award mechanism)

quality will be valued. If the procuring authority truthfully represents its utility, it will be in the interest of the bidders to offer first-best quality levels. With asymmetric information, however, the procuring authority may want to use a less transparent mechanism, such as highest quality or price-and-quality scoring with poorly defined quality scales. It may use quality-to-price scoring, but then it should retain discretion in setting quality scores. With both asymmetric information and cost uncertainty the authority should avoid highest-quality procurement but may still want to use a method that is partially non-transparent.

In addition, anytime asymmetric information is a concern an option to extend the contract will help to reduce moral hazard problems and should therefore be considered.

Table 1 assumed “normal” procurer preferences. We will have to adjust the analysis if we assume that it is important to reach a threshold quality level, in the sense that the marginal value of quality is high for low quality levels and then, when the target level has been met, rapidly falling. The authority should now be less prone to use highest quality and more inclined to use lowest price, since its prediction of the optimal quality level will be more accurate than its prediction of the optimal expenditure level.

If we instead assume that there is an inflexible budget constraint – “silo budgeting” – the main thing to note is that a highest-quality procurement would be a good representation of the procuring authority’s preferences. This mechanism will also be able to deal with informational asymmetries, as it gives the authority discretion in its choice of provider.

Based on the above discussion, the hypotheses we test are the following:

- (i) Uncertainty about the cost of different levels of quality makes the procuring entity less prone to use lowest price. (A more complex scoring rule is needed to represent the authority's utility function.)
- (ii) Non-verifiable quality (asymmetric information) makes the procuring entity more prone to use high quality weights, including highest-quality procurement, and/or to use qualitative methods to assess quality.
- (iii) Non-verifiable quality makes the use of contract extension more likely.
- (iv) Contract extension clauses and selection by lowest price are negatively correlated, since these are alternative means to maintain non-verifiable quality.
- (v) High priority for reaching a minimum quality makes lowest price more likely, at least if quality is verifiable.
- (vi) High priority for keeping within the budget constraint should be associated with selection by highest quality.

THE SURVEY AND THE DATA

We asked the manager in charge of procurement to answer the survey questions or to delegate that task to an experienced procurement officer. We called the manager first and then sent an e-mail with a link to a web-based survey, followed by three reminders.

The survey was sent to 14 local authorities, 6 regional authorities and 19 central-government authorities. The questions were based on actual procurements undertaken during the 2007-2008 period. For each of the authorities we had previously identified up to 20 procurements for which we had detailed data concerning the nature of the product, the design of the procurement and the bids (See Bergman & Nilsson, 2011). In total, we had detailed information for 651 procurements from the 39 authorities. The overall response rate was 77 percent, corresponding to 30 responding authorities which, between them, had undertaken almost 500 procurements on which

we had data. However, we received only about 400 answers to our questions. That is, the response rate for individual questions, conditional on responding to the survey, was just over 80 percent and the total response rates for individual questions were over 60 percent.

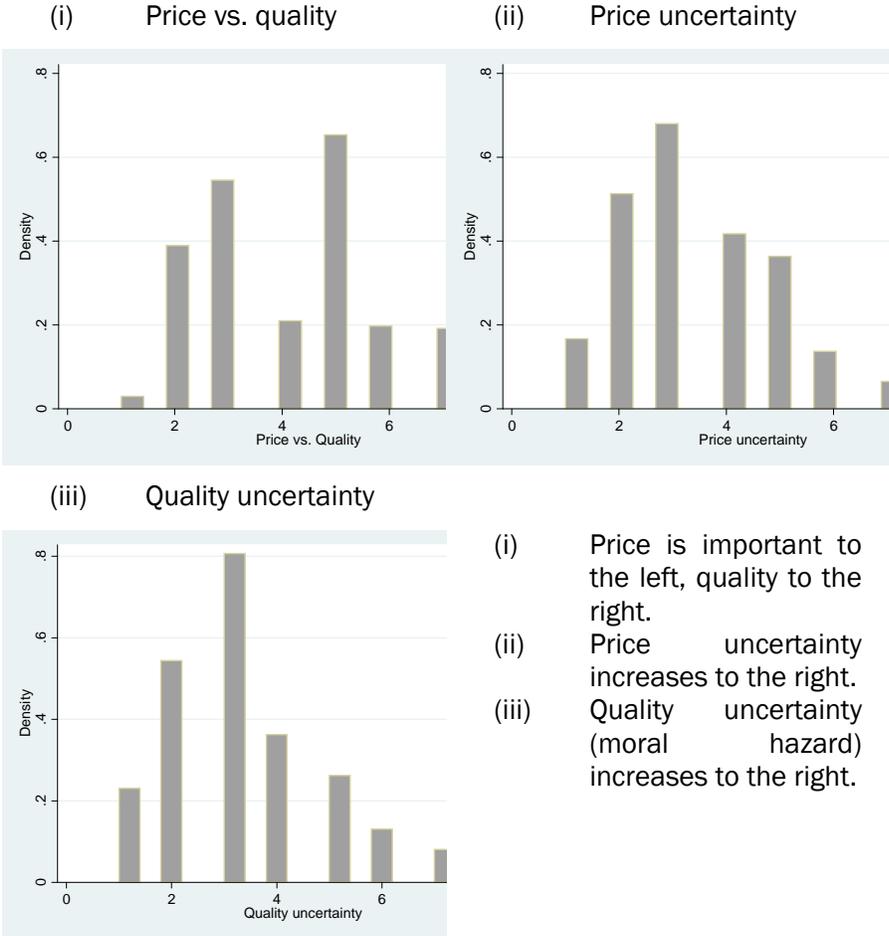
For each of the procurements we identified a main product and for this product we asked the respondent to assess three main questions on a 1-9 scale. First, to what extent it was important to get exactly the sought-for quality versus how important it was to keep within the budget (Quality vs. budget). Second, how knowledgeable the authority was about the cost, for different quality levels, for the product (Price uncertainty). Third, to what extent the quality of the product was *verifiable* ex post (Quality uncertainty). The scale for each question had the following meaning:

- (i) Quality vs. price: 1 = Price is irrelevant. Quality is crucial. 9 = Price is crucial. Quality is irrelevant.
- (ii) Price uncertainty: 1 = No uncertainty. 9 = Extreme uncertain.
- (iii) Quality uncertainty: 1 = No uncertainty about delivered quality. 9 = Extremely high uncertainty about delivered quality.

The distributions of the responses for the three survey questions are displayed in Figure 1. Very few of the authorities reported price to be irrelevant and quality to be crucial, corresponding to response 1 in Figure 1.i. No uncertainty about price and no uncertainty about delivered quality, respectively, were more common, according to graphs ii and iii. A small fraction stated price to be crucial and quality to be irrelevant. Extreme uncertainty about price was rare and extremely high uncertainty about delivered quality was only somewhat more common.

Maximum focus on quality is found in procurements concerning printed matter and related products; chemical products; architectural, construction engineering and inspection services; research and development services; agricultural, forestry, horticultural, aquacultural and apicultural services; and business services (e.g. law, marketing). Extreme uncertainty about price is found in procurements of construction works and of financial and insurance services. Extreme uncertainty about delivered quality is found when health and social work services are the subject of the contract.

FIGURE 1
Distribution for Survey Questions



Due to the comprehensive nature of the population from which the tenders were drawn, the products in the sample are extremely diverse. Table A1 in the Appendix reports the number of tenders per two-digit level according to the CPV nomenclature.¹² The most common product categories are business services (12 percent), construction works (11 percent), medical equipment and pharmaceuticals (9 percent), health and social works services (9

percent) and architectural, constructions, engineering and inspection services (6 percent). Three of the CPV codes are not observed in our sample.¹³

Table 2 reports the prevalence of the main award methods in the sample. Lowest price was used in 38 percent of the procurements and the economically most advantageous tender, EMAT, was used in the remaining 62 percent. Within the latter category, price-to-quality scoring dominated with more than half of all tenders. Quality-to-price scoring came second, being used in about one tenth of all tenders, while quality only was used in no more than 2 percent of the procurements.¹⁴

About 7 percent of the tenders were jointly organized by two or more procuring authorities and about a quarter were tenders for framework agreements. Two out of five tenders were for service contracts, one out of five was for goods contracts and the rest was a combination of goods and services.

TABLE 2
Descriptive Statistics

Variable	Mean	Std.dev.	Min	Max	N
Award method					
Lowest price	0.38	0.49	0	1	651
EMAT	0.62	0.49	0	1	651
<i>Price to score</i>	0.51	0.50	0	1	651
<i>Quality to price</i>	0.10	0.29	0	1	651
<i>Quality only</i>	0.02	0.13	0	1	651
Other variables					
Joint procurement	0.07	0.26	0	1	651
Framework contract	0.26	0.44	0	1	651
Service contract	0.39	0.49	0	1	651
Goods contract	0.19	0.39	0	1	651
Quality vs. budget	4.39	1.90	1	9	396
Price uncertainty	3.48	1.55	1	9	398
Quality uncertainty	3.41	1.68	1	9	400
Contract period	1.59	1.30	0	7	648
Extension period 1	0.79	0.74	0	4	648
Extension period 2	0.31	0.55	0	3	647

Table 3 reports descriptive statistics for the three survey questions: (i) Budget versus quality (ii) Price uncertainty and (iii) Quality uncertainty. The statistics are reported separately by type of product (services and goods), by choice of award method (lowest price and EMAT) and by scoring rule (quality only, quality to price and price to score). A comparison of mean outcomes is found in Table A2 in the Appendix.

The authorities seem to be relative certain about price as well as quality. The averages for “Price uncertainty” and “Quality uncertainty” range approximately between 3 and 4 with somewhat higher values (higher uncertainty) for goods contracts and quality-only procurements. The lowest figure is found for lowest-price procurements (2.92) and the highest is found in procurements of goods (4.20). It seems reasonable that the procuring authorities report low price uncertainty when the lowest-price award method is applied.

Comparing the reported values for “Price uncertainty” and “Quality uncertainty” across procurements that used the lowest-price criteria and those that used EMAT reveals a significant difference in mean. Lowest-price procurements are located closer to “No uncertainty about price” and “No uncertainty about delivered quality” than EMAT procurements are.¹⁵

That quality uncertainty is higher for goods than for service contracts is somewhat surprising.¹⁶ One would typically expect higher levels of quality uncertainty for products that to a larger extent are characterized by non-verifiable quality – as services are likely to be. The difference in mean in “Budget vs. Quality” between Service and Goods contracts is significant at the 10 percent level. The focus on price is on average stronger for service contracts than for goods contracts.

On average, quality is perceived as less important than keeping within the budget. The highest focus on quality is found when the lowest-price principle is applied. Although this may at first seem counter intuitive, it is consistent with the theory outlined above, at least if quality is verifiable.

Comparing the mean responses between the three questions, we find that “Budget vs. Quality” is on average graded significantly higher

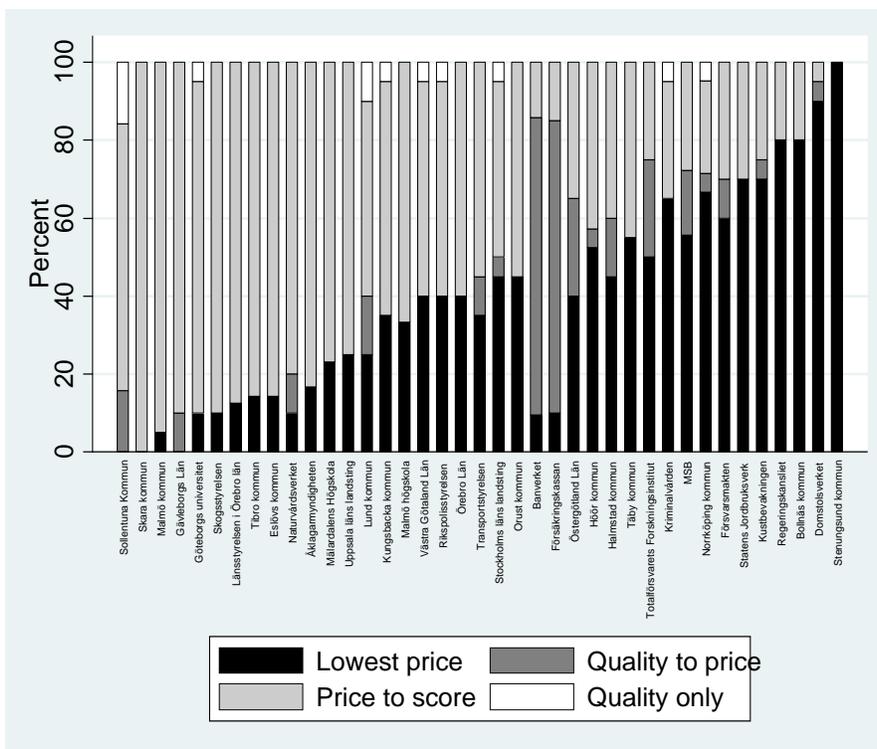
TABLE 3
Descriptive Statistics, the Survey Questions

		Budget vs. Quality	Price uncertainty	Quality uncertainty
Service contracts	Obs.	145	145	145
	Mean	4.18	3.42	3.83
	Std.dev.	1.86	1.53	1.83
	Min	1	1	1
	Max	9	9	8
Goods contracts	Obs.	64	64	64
	Mean	4.03	3.28	4.2
	Std.dev.	1.51	1.47	1.98
	Min	1	1	2
	Max	7	7	8
Lowest Price	Obs.	147	146	147
	Mean	4.56	3.12	2.92
	Std.dev.	2.18	1.52	1.58
	Min	2	1	1
	Max	9	8	8
Emat	Obs.	248	252	253
	Mean	4.30	3.68	3.69
	Std.dev.	1.72	1.53	1.68
	Min	1	1	1
	Max	9	9	9
Quality only	Obs.	4	4	4
	Mean	4.5	4	4
	Std.dev.	1.73	1.83	1.83
	Min	2	2	2
	Max	6	6	6
Quality to price	Obs.	35	35	35
	Mean	4.14	3.58	3.43
	Std.dev.	1.46	1.63	1.52
	Min	1	1	1
	Max	7	7	8
Price to score	Obs.	211	214	215
	Mean	4.32	3.69	3.72
	Std.dev.	1.76	1.51	1.7
	Min	1	1	1
	Max	9	9	9

than “Price uncertainty” for both contract types, both award methods and for the “Price to score” scoring rule. “Budget vs. Quality” is on average graded significantly higher than “Quality uncertainty” for both award methods and for the “Price to score” scoring rule. Otherwise there are no other significant differences.

The choice of award method differs significantly between authorities, as seen in Figure 2. Regional authorities tend to prefer methods that transform the price to a score that can be added to the quality score; the average county used this method for about 70 percent of the procurements. Local authorities also use this method predominately, on average in about 55 percent of the procurements. In contrast, central government authorities have a higher tendency to use lowest price; the average central government authority uses lowest price in almost 50 percent of the procurements.

FIGURE 2
Tender Award Method by Authority



Two central government authorities stand out in predominantly using quality-to-price scoring: the Swedish National Rail Administration and the Swedish Social Insurance Agency. Only two authorities rely (in our sample) on one method only: Skara municipality uses only price-to-quality scoring and Stenungsund municipality uses only lowest price. However, both cities are relatively small and, according to our data, Skara did only five procurements and Stenungsund only four.

EMPIRICAL METHODS

The choice of award method is modeled in three different ways:

- (i) As a choice between EMAT and lowest price, with EMAT assumed to be the method that best preserves non-verifiable quality. Estimation method: Logit.
- (ii) As a choice between three ordered alternatives: lowest price, a (weighted) combination of price and quality and, finally, quality only. Estimation method: Ordered logit.
- (iii) As a choice between four ordered alternatives: lowest price, price-to-quality scoring, quality-to-price scoring, and quality only: Estimation method: Ordered logit.

The choice of award method – lowest price or EMAT – is estimated as a discrete choice with the standard logit model. The dependent variable takes the value one if the observed choice of method is EMAT. This is explained with the outcomes from the three survey questions, Contract period, extension periods (two), dummy variables for type of contract (service, goods or mixed, which is the reference category), dummy variables for framework agreement (yes = 1), a dummy variable that measures if the contract value is above the so-called threshold value so the call for tender is published in Tenders Electronic Daily (TED) (if the value is such that the call for tender needs to be published =1), a time dummy variable (2008 = 1) and finally a population weight that is assumed to reflect the size of the procuring authority.

The choice of evaluation method is treated as a ranked variable ranging from 100 percent weight on price (lowest price) to no weight on price (quality-only scoring). Two models are estimated, one with four rankings and one with three rankings. In the first case the choice

alternatives are lowest price, quality to price, price to quality and quality only scoring. Since the two mid categories potentially are problematic to rank an alternative specification, where these are merged into one category, is used. The same set of variables as in the logit regression described above constitutes the controls.

In addition to this the determinants of the price weight is estimated with ordinary least square regression. Again the same set of explanatory variables as in the logit regression is used.

RESULTS

The results from the logit and ordered logit regressions are presented in Table 4. The ordered logit regression results are based on the specification with four alternatives. The results indicate that the probability that EMAT is the choice of award method increases if the contract is a framework agreement. EMAT is also the likely choice of award method when the uncertainty about quality is ranked high. The contract period and first extension period have no significant impact on the probability of observing a specific choice of award method but the second extension period do. The longer the second extension period is, the more likely is a choice of EMAT over lowest price.

Turning to the four right-most columns in Table 4 we find the results from the ordered logistic regression. According to our findings a scoring rule with more importance given to quality is more likely in joint procurements, when quality uncertainty is high and the longer the second extension period is. It is less likely in the case of framework agreements. These results basically confirm the findings from the logistic approach and the choice between EMAT and lowest price. The exception is the finding that joint procurements are associated with scoring rules that gives more importance to quality.

We have argued above that lowest price may in fact be a good mechanism to ensure high quality, if quality is verifiable. Therefore, a positive (but insignificant) relation between the importance of quality and the price weight is not surprising.

Similar results are found using the second specification with three alternatives (not reported).

TABLE 4
Estimation Results

Dependent	Logistic regression				Ordered logistic regression			
	EMAT	Robust Std. Err.	Z	P>z	Evaluation method			
					Coef.	Robust Std. Err.	z	P>z
Controls	Coef.	Err.	Z	P>z	Coef.	Err.	z	P>z
Year (2008=1)	-0.32	0.25	-1.27	0.20	-0.33	0.23	-1.44	0.15
TED (Abovetreshold=1)	0.42	0.34	1.23	0.22	0.19	0.35	0.55	0.58
Population weight	-0.01	0.01	-0.86	0.39	0.00	0.01	-0.27	0.78
Framework (Yes=1)	-0.72	0.37	-1.93	0.05	-0.59	0.34	-1.74	0.08
Joint (Yes=1)	0.17	0.49	0.34	0.73	0.93	0.41	2.25	0.03
Budget vs. quality	-0.04	0.09	-0.47	0.64	-0.03	0.09	-0.35	0.73
Price uncertainty	0.18	0.12	1.51	0.13	0.12	0.11	1.18	0.24
Quality uncertainty	0.27	0.15	1.77	0.08	0.28	0.14	2.06	0.04
Contract period	-0.21	0.15	-1.44	0.15	-0.20	0.14	-1.43	0.15
Extension period 1	0.10	0.31	0.33	0.74	0.02	0.23	0.07	0.95
Extension period 2	1.07	0.42	2.57	0.01	0.86	0.34	2.54	0.01
Mixed contract	Reference							
Service contract	-0.16	0.37	-0.42	0.68	0.01	0.35	0.03	0.98
Goods contract	0.52	0.74	0.70	0.48	-0.12	0.57	-0.22	0.83
Constant	-0.44	0.95	-0.46	0.65	-	-	-	-
/cut1							0.34	0.95
/cut2							0.74	0.94
/cut3							5.78	1.10
Number of obs				392.00				392.00
Wald chi2(13)				82.85				85.72
Prob> chi2				0.00				0.00
Pseudo R2				0.11				0.07
Log pseudolikelihood				-278.76				-350.47

Note: Standard errors are adjusted for 30 clusters in procuring authorities.

The findings from the estimation of the determinants of the price weight are displayed in Table 5. The only significant result is that low priority given to price is found in procurements with high uncertainty concerning delivered quality. The same tendency is found when we use a Tobit regressions approach (not reported).

TABLE 5
Estimation Results

Dependent	Price weight		t	P>t
	Coef.	Robust Std. Err.		
Controls				
Year (2008=1)	1.98	3.56	0.56	0.58
TED	-4.70	5.04	-0.93	0.36
Population weight	0.10	0.19	0.52	0.61
Framework	4.24	5.15	0.82	0.42
Integrated	0.83	6.90	0.12	0.91
Budget vs. Quality	1.54	1.07	1.44	0.16
Price uncertainty	-1.78	1.56	-1.14	0.26
Quality uncertainty	-3.94	1.86	-2.12	0.04
Contract period	2.37	1.62	1.46	0.15
Extension period 1	-0.69	4.01	-0.17	0.86
Extension period 2	-8.12	5.17	-1.57	0.13
Service contract	1.63	5.82	0.28	0.78
Goods contract	-4.94	8.30	-0.60	0.56
Constant	79.64	13.17	6.05	0.00
Number of obs				347
F(13,29)				4.12
Prob> F				0.00
R-squared				0.12

Note: Standard errors are adjusted for 30 clusters in procuring authorities.

SUMMARY AND CONCLUSIONS

In this chapter, we focus on two well-known problems that a procuring authority faces. First, when quality is non-verifiable there is often an incentive for the supplier to shirk on (ex post) quality after the contract has been secured – i.e., the procurer has to deal with moral hazard – as well as a risk for adverse selection. Second, the procurer may face a substantial uncertainty concerning the providers’ – and, eventually, its own – cost of meeting alternative (ex ante) quality levels. If quality standards are set too high, quality may on the margin cost more than it is worth. How best to handle these problem

depends on the tightness of the procuring authority's budget and on how critical it is that the product meets a specific quality level.

We have detailed information on about 650 public procurements of a wide range of products, including type of product, type of procuring authority, award methodology, relative weights for price and quality (if applicable), duration of contract and other characteristics of the contract. The sample is representative for virtually all purchases made by local, regional and central government authorities in Sweden during 2007 and 2008. A survey was sent to the responsible authorities, asking for their opinion on the severity of the moral hazard problem and the cost uncertainty problem, as well as on the necessity of reaching budget targets and quality targets. We received about 400 answers.

Based on our survey data and using a simple empirical framework with logistic and ordered logistic regressions our main findings are that more complex scoring rules are used when framework agreements are procured, while simpler methods are used when the procuring authority reports that they experience substantial uncertainty about the delivered quality. Low importance given to price is found to be associated with authorities reporting high uncertainty concerning delivered quality, as we predicted.

Finally, note that there is no simple relation between the importance of quality and the weight given to price, as expected. If quality is verifiable, awarding the contract on the basis of lowest price may in fact be favourable. However, if quality is to a large extent non-verifiable it may be better to use a *low* price weight.

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NOTES

1. This was the result of the so-called Winter Commission in 1993 (Kelman, 2002). See e.g. Coggburn (2003), Kelman (2007), Potoski (2008), Thompson (2008) and Orszag (2009) for readings and analyses of the results of the US reform.

2. An evolution in this direction has been endorsed by the academic community, see e.g., Chen (2008), Mateus et al, (2010), Telgen and Schotanus, (2010).
3. EMAT has been the most common principle in most EU member countries (Verdeaux 2003). The principle has been perceived as allowing wide discretion to the procuring authorities to select the winner but rules are sharper today. Results based on Swedish data from the period with more lax regulation suggest that the authorities used the freedom the law gave them in picking the winner (Hyytinen, Toivanen, and Lundberg, 2007).
4. This follows from Weitzman, 1973, who studied the choice between fixing emission standards or charging emission fees.
5. If the evaluation price is calculated as $EP = P - bQ$, where P is the bid price and Q is the quality measure associated with the bid, then b is the per-quality compensation.
6. Under EU's procurement directives, the procuring authority is not allowed to substantially change the terms set out in the call for tender and may, therefore, be able to commit not to renegotiate the quality level.
7. See also Cripps and Ireland , (1994). Estache and limi, (2012), estimate the cost of quality from procurement bids for infrastructure projects.
8. See Lundberg and Marklund (2011) for an application on green public procurement.
9. See references in note 2 above.
10. Bajari et al, 2009, presents empirical evidence that supports the proposition that auctions tend to be inferior to negotiations for complex projects where a need for post-contractual adaptations may arise.
11. Note that silo budgeting corresponds neither to a situation where the *marginal* value of quality is constant, nor to a situation where the marginal value of quality falls sharply; it corresponds to a situation where, from the authority's point of view, there is a kink in the marginal value of money, in the extreme case from zero to infinity at the point where the budget is exhausted.

12. "The CPV consists of a main vocabulary for defining the subject of a contract, and a supplementary vocabulary for adding further qualitative information. The main vocabulary is based on a tree structure comprising codes of up to 9 digits (an 8 digit code plus a check digit) associated with a wording that describes the type of supplies, works or services forming the subject of the contract." See http://simap.europa.eu/codes-and-nomenclatures/codes-cpv/codes-cpv_en.htm.
13. These are: Agricultural, farming, fishing, forestry and related products; Installation services (except software); Public utilities.
14. Note that since the original sample of 39 authorities was established with probability sampling, with a probability proportional to the size of the authority, we cannot claim that the numbers reported in Table 1 are best estimates of the distribution in the population of all Swedish procurements. However, our sample can be used to draw inferences on marginal effects of explanatory variables. See Bergman and Nilsson, 2011.
15. The t -values are |3.52| and |4.52|, respectively.
16. The difference is significant with a t -value of |4.23|.

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APPENDIX

TABLE A1
Product Categories, Based on the CPV-Codes

Category	Freq.	Percent
<i>CPV classification missing</i>	7	1.08
Agricultural, farming, fishing, forestry ...	1	0.15
Petroleum products, fuel, electricity ...	6	0.92
Mining, basic metals and related products	2	0.31
Food, beverages, tobacco and related products	12	1.84
Agricultural machinery	3	0.46
Clothing, footwear, luggage articles and accessories	10	1.54
Leather and textile fabrics, plastic, rubber materials	3	0.46
Printed matter and related products	15	2.30
Chemical products	3	0.46
Office and computing machinery, equipment ...	15	2.30
Electrical machinery, apparatus, equipment ...	5	0.77
Radio, television, communication, telecommunication	12	1.84
Medical equipments, pharmaceuticals products	58	8.91
Transport equipment and auxiliary products to transportation	20	3.07
Security, fire-fighting, police and defense equipment	12	1.84
Musical instruments, sport goods, games, toys, handicraft, art materials and accessories	1	0.15
Laboratory, optical and precision equipments ...	11	1.69
Furniture (incl. office furniture), furnishings, domestic appliances (excl. lighting) and cleaning products	18	2.76

TABLE A1 (Continued)

Category	Freq.	Percent
Industrial machinery	9	1.38
Machinery for mining, quarrying, construction equipment	1	0.15
Construction structures and materials; auxiliary products to construction (except electric apparatus)	10	1.54
Construction work	72	11.06
Software package and information systems	6	0.92
Repair and maintenance services	13	2.00
Hotel, restaurant and retail trade services	12	1.84
Transport services (excl. Waste transport)	21	3.23
Supporting and auxiliary transport services ...	5	0.77
Postal and telecommunications services	2	0.31
Financial and insurance services	10	1.54
Real estate services	4	0.61
Architectural, construction, engineering and inspection ...	40	6.14
IT services: consulting, software development ...	20	3.07
Research and development services ...	4	0.61
Administration, defense and social security services	5	0.77
Agricultural, forestry, horticultural, aquacultural and apicultural services	9	1.38
Business services: law, marketing, consulting, recruitment, printing and security	75	11.52
Education and training services	9	1.38
Health and social work services	56	8.60
Sewage, refuse, cleaning and environmental services	31	4.76
Recreational, cultural and sporting services	13	2.00
Other community, social and personal services	10	1.54
	651	100.00

TABLE A2
Comparison of Means: Survey Questions for Categories of Contract
and Award Method, t-Values

		Price uncertainty	Quality uncertainty
Service contracts	Budget vs. Quality	4.03	1.48
	Price uncertainty	-	-2.51
Goods contracts	Budget vs. Quality	2.78	-0.47
	Price uncertainty	-	-3.27
Lowest Price	Budget vs. Quality	7.10	7.64
	Price uncertainty	-	2.20
EMAT	Budget vs. Quality	4.33	3.64
	Price uncertainty	-	-0.10
Quality only	Budget vs. Quality	1.00	0.57
	Price uncertainty	-	0
Quality to price	Budget vs. Quality	1.87	1.33
	Price uncertainty	-	0.48
Price to score	Budget vs. Quality	4.16	3.20
	Price uncertainty	-	-0.27