# Ex-ante and ex-post outsourcing in public procurement:

## Temporary Partnership *vs* subcontracting[1]

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**ABSTRACT:** In this paper, we empirically study *ex-ante* and *ex-post* outsourcing in Italian procurement for public works. Investigating a dataset on auctions for the awarding of public works, and exploiting the regulation on firms' qualification which allow firms to bid individually or in partnership with other firms, we disentangle three types of outsourcing in the completion of public works. We empirically find that Temporary Partnerships (*ex-ante* outsourcing, TPs) offer prices lower than partially qualified firms that have to proceed with *ex-post* mandatory subcontracts as well as large firms in a position to optionally subcontract. We also find that TPs execute contracts with lower probability of cost-overruns than firms in a position of mandatory subcontracting. This result indicates that voluntary *ex-ante* Temporary Partnerships tend to improve market performance in public procurement supply-chain, representing a better alternative than *ex-post* mandatory subcontracting.

**Keywords:** public procurement, regulation on entry, temporary consortium, outsourcing, subcontracting, supply chain, firm boundaries.

**JEL-code**: H57, L23, L24, D44.

## 1. Introduction: supply chain and outsourcing in public procurement

Public spending typically represents 15–30 percentage of national GDP, giving public procurement an important leverage to gain *value for money* in purchasing services, goods and furniture and also to drive resources towards innovation and sustainability (i.e., green procurement; disadvantaged business' participation in procurement, etc.).[4]

When it comes to its implementation, however, public procurement results to be a very complex process, consisting at least of two main phases: the awarding stage and the execution stage. These two phases are separated, but tightly related by the fact that the firm, awarded the contract at the *best price* in the first phase, should then execute it by providing the *best quality* in the second phase. In this process, the firm's decision whether to outsource and/or subcontracting part of the contract's execution is crucial in both the phases, as such decision could lead to a reduction of the supply chain costs and to an optimal allocation of resources in performing the contractual tasks.

Differently from *private* procurement where reputational forces and relational contracts are usually adopted, in *public* procurement this kind of "discretion" is typically very limited in the aim *i)* to prevent favoritism and corruption, and *ii)* to keep public buyers accountable in the allocation of public funds (Spagnolo, 2011). Thus, in public procurement practice, open and transparent awarding procedures (i.e., auctions) as well as legal frameworks (i.e. detailed regulations) for firms' qualification to entry the awarding phase are typically implemented. Regulations for firms' qualification have the purpose to reduce the default risk in public procurement performance by screening firms with the appropriate characteristics (i.e. technology, size, experience, financial status, etc.) in completing the tasks included in the contract. These regulations usually include rules on outsourcing/subcontracting that ultimately define the firms' qualification profile to enter the awarding mechanism and perform the contract.

Empirical analyses on the *optimal* rules for firms' qualification in public procurement are scarce (see discussion about in Section 2). In this paper, we investigate how the Italian qualification system in public procurement affects bidding firms' outsourcing/subcontracting position, the firms' bids and the winners' contract performance (i.e., cost and time overruns).

The remaining of the paper is organized as follows. In Section 2, we first discuss our research question and relate it to the existing literature; in Section 3, we describe the institutional features of the Italian public procurement setting, the dataset and the main characteristics of the data. In Section 4, we illustrate our empirical strategy and discuss our results. In Section 5, we conclude.

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[4] Tirole and Saussier (2015) contributed to the recent debate on the use of public procurement for policy goals; they highlighted that pursuing innovation or social/environmental goals could lead to inefficient outcomes, being public procurement to be driven by efficiency in costs and optimal quality in performance.

## 2. Literature review and our research question

Since the seminal paper by Ronald Coase (1937) on firm boundaries, many theoretical contributions have addressed the determinants of contract outsourcing as based on transaction costs (Williamson, 1971 and 1985), property rights (Grossman and Hart, 1986) and the knowledge-based view of the firm (Kogut and Zander, 1992 and 1996). Holmstrom and Roberts (1998) highlighted how the interest on firm boundaries' has progressively moved from their role in coordination problems to their weight in rising incentives (i.e., hold-up issues). Empirical research has documented how and when firms adopt outsourcing to efficiently organize production in different economic sectors (Novak and Stern, 2008; Macher, 2006; Quinn and Hilmer, 1994): Joskow (1988) proposed a seminal empirical survey on firms' vertical arrangements *vs.* spot market transaction and long term contracts in different sectors; more recently, Lafontaine and Slade (2007) have provided a thoughtful empirical survey on backward/forward vertical integration.

These theoretical and empirical contributions are all based on the firm's *voluntary* choice of internal or external sourcing, in different timings and formats. In public procurement contracts, however, firms are often constrained by many rules that - on the one side - limit their decision making, and – on the other side – affect the efficiency (i.e. cost) of the public-private transaction and the overall social welfare.

The highly regulated procurement procedures on the firm's entry in the auction and on the firm's decision to outsource part of the contract in its execution can be explained by the goal to maintain fairness in the procurement transactions in order to prevent favoritism, collusion, corruption, and/or poor performance of public resources allocated through these contracts (OECD, 2007).[5] Typically, frameworks for firms' qualification screening are adopted to implement the verification of a firm's financial status, references, product and surge capacity. Moretti and Valbonesi (2015), exploiting a newly assembled dataset on procurement auctions for public works in Italy and information about bidding firms' qualification, found that firms fully qualified and thus in a position to choose whether to subcontract part of the work (i.e., optional subcontract) offer lower prices to execute the contract than firms obliged to subcontract part of the work (i.e., mandatory subcontracting). This result highlights the direct cost of regulatory burden on procurement costs: it shows on the one hand, that the firms' voluntary arrangements tend to improve market performance but, on the other hand, any imposed arrangements that either prohibit or mandate relationships tend to worsen market performance. Their results are consistent with Lafontaine and

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[5] Another reason of the regulatory burden on public procurement contracts is that these contracts are often specifically intended to be affirmative action policies that indirectly enhance the participation of disadvantaged business enterprises (DBEs) directly or through outsourcing schemes (see, among others, on DBEs and preferences policy: Marion, 2007 and 2009; Krasnokutskaya and Seim, 2011; on mandatory subcontracting: De Silva et al. 2012; on set-aside: Athey, Coey and Levin, 2013).

Slade's (2008) findings from an empirical survey on vertical restraints, concluding that when manufactures choose to impose vertical restraints, their impact on market performance is positive by implication, and if vertical restraints are prohibited, then the impact is negative.

In this paper, working on the same dataset exploited by Moretti and Valbonesi (2015), we investigate how rules on firms' qualification determine *ex-ante* outsourcing in the form of Temporary Partnerships (TPs) and *ex-post* outsourcing in the form of (mandatory or optional) subcontracting. Our testable hypothesis is that there could be significant difference in production efficiency between - on one hand - firms that organize themselves in partnerships to bid and to complete the contracted work (i.e. *ex-ante* binding agreement for Temporary Partnership), and – on the other hand - firms that – after the bidding in the awarding auction - are obliged to outsource (i.e. firms in *ex-post* position of mandatory subcontract), or that are in a position to complete the contracted work themselves or outsource part of the work (i.e. firms in *ex-post* position of optional subcontract).

In the Italian public procurement system, all the parts of the awarded project must be executed by qualified firms, i.e. firms capable of executing efficiently all aspects of the project. Thus, when a firm is not fully qualified to execute the public contract, Italian regulation on public contracts allows firms to bid either individually (having to outsource then to qualified subcontractors) or in partnerships with other firms (participating to the auction as a Temporary Partnership where member firms cover the required qualification). These Temporary Partnership (TPs) are created for the sole purpose of bidding in a specific auction, and do not give the start to a new legal business entity. They represent a sort of binding agreement through which a group of firms commit to a certain bid and, in case of winning, to a certain production planning to execute the awarded contract. If the TP loses the auction, the partnership dissolves. In Moretti and Valbonesi (2015), TPs have been included in the analysis in the group of fully qualified firms: indeed, they manage to bid as partnership to cover all the qualifications required to executing the contract; accordingly, each TP will have the option to subcontract once it wins the contract.

In this paper, we aim to empirically disentangle bids by TPs from bids by firms in the position of either optional or mandatory subcontracting, thus focusing on the *ex-ante* outsourcing vs the *ex-post* subcontracting. Considering the bid as a *proxy* for the firm's expected cost to complete the tendered contract, our purpose is to investigate differences, if any, in bidding for contracts by firms adopting different outsourcing formats. Our results will therefore contribute to design optimal rules for outsourcing in public procurement.

An additional goal of this paper is to investigate TPs' performance in executing public procurement: we thus compare TPs' time- and cost-overruns with those incurred by firms in a

position of optional and mandatory subcontracting. This analysis is meant to highlight if the TP's production planning results in a more/less efficient execution with respect to that of firms in a position of *ex-post* - optional and mandatory - subcontracting.

We find that bidding rebates by *ex-ante* outsourcing in the form of TPs are not statistically different from firms in a position of *ex-post* <u>optional</u> subcontracting, but are significantly higher (i.e. leading to lower bidding prices) than those by firms in a position of *ex-post* <u>mandatory</u> subcontracting. This suggests that the *voluntary vs mandatory* outsourcing dimension is more critical than the *ex-ante* or *ex-post* outsourcing dimension, since both TPs and firms in position to optionally subcontract would exploit voluntary agreements among firms in executing the contract. However, when we split the sample of optional subcontractors firm size, our estimates show that TPs bid higher rebates than large firms in a position of optional subcontracting. This finding suggests that TPs – in that they are free to choose their boundaries for each auctioned project – enter the auction with an efficient size, and this efficiency results particularly relevant with respect to the traditional and larger fully qualified firms.

Our empirical analysis on TPs' performance in the execution of the contract highlights that these partnerships i) execute the contract with lower probability of cost-overruns than firms in a position of mandatory subcontracting, but also that ii) they record higher probability of time-overruns, thus suggesting that coordination among firms in the TPs might increase the duration of contracts' execution.

Our paper mainly contributes to two strands of economic literature. First, we add to the extensive economic literature on firm boundaries and vertical restraints, contributing with some empirical results to the scarce investigations on Temporary Partnerships. In this field, make-or-buy and outsourcing decisions can be driven by cost structures (Spiegel, 1993; Shy and Stenbacka, 2003; Kamien and Li, 1990; Van Mieghem, 1999; Marechal and Morand, 2003), technology spillover (Van Long, 2005), learning by doing (Chen, 2006), hold-up (Rey and Tirole, 2007; Miller, 2014) and strategic motives (Arya et al. 2008). In our setting, we find that outsourcing through TPs - where liabilities are differently and ex-ante distributed among participants to the consortium – can increase efficiency in procurement production chain and hold-up problems might result limited.

Second, our paper contributes to the literature assessing the cost and benefit of rules in procurement. In this field, Spagnolo (2012) highlighted the international debate referring to *pros* and *cons* from the inclusion of discretionality and flexibility in public procurement regulation to make possible the use of reputational forces in procurement management. Recently, other contributions investigate how to support SMEs' participation in public procurement. Loader (2013) and Flynn and Davis (2015) provide empirical evidence that i) contract size is commonly regarded

as the main impediment to SME involvement in public procurement, and ii) regulations which promote contracting authority actions to reduce the issue - i.e. dividing contracts into lots and encouraging consortium bidding – are not often implemented. Our paper contribute to this literature providing empirical evidence on the costs arising from the regulatory burden on firms' qualification which limits the discretion of economic agents in procurement transactions; our results support the design of measures directly facilitating bidding (temporary) consortium to increase SMEs' capabilities to efficiently match contract size. [6]

## 3. Institutional Features, Data and Descriptive Statistics

In the aim to investigate *ex-ante* and *ex-post* outsourcing in executing public procurement contracts, in this Section we first briefly describe regulations on supply and demand sides of this market in Italy. Then, we present our dataset on procurement auctions awarded by the Regional Government of Valle d'Aosta in the period 2000-2009, consisting of public works worth more than 150,000 euros. Firms must be qualified to bid in these auctions and all the contract's parts should be executed by qualified firms: firms' qualification status for each contract permits us to disentangle three outsourcing positions (i.e., TPs, mandatory and optional subcontracting) and to run our empirical analysis on their comparisons.

**Supply side.** The aim of the Italian system regarding firms' qualification is to restrict the participation to the call for bids to firms capable of executing efficiently all aspects of the awarded project. In the period our data refer to, the Italian qualification system has been operated by 37 private companies - called SOA (Società Organismo di Attestazione) - accredited and monitored by AVCP (Autorità per la Vigilanza dei Contratti Pubblici)[7], the national authority in charge of regulating the national market for public works, supplies and services. Firms qualifications refer to i) *general requirements* concerning the firm's financial standing and criminal records (e.g., anti-Mafia); and ii) *technical requirements* which refer to the specific technical skills needed to perform certain works and which are usually assessed on the firm's documented expertise and observable items.[8] The qualification for each category and size (i.e., value) of work is a costly process for the firm (i.e., different fees for different categories of works/size), and remains valid for 3 or 5 years, after which it must be renewed.

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[6] See Albano et al. (2009) for a survey the literature on joint bidding in auctions.

[7] Since August 2014, AVCP is part of the Italian National Anti-Corruption Authority (ANAC). The regulation on firms' qualification has not changed as well as the regulation on the public contracts' awarding.

[8] Specifically, in the Italian public works have been defined 46 "categories of works" over which firms can accordingly get qualifications.

**Demand side.** In awarding a public work contract, the Contracting Authority (CA) should specify all the tasks (i.e., the categories of works) involved in the project and distinguish which is the "main category" from which are the "secondary categories" of work to be executed in the completion of the work. For example, consider a contract for the building of a road in a new residential area; the fulfilment of this contract contains three tasks: $t_A$ (road works), $t_B$ (water works), $t_C$ (sewage works). Accordingly, in the requests for tenders, the CA will present the former task $t_A$ as the main category of work and the remaining two ($t_B$ and $t_C$) as secondary categories of work. Such distinction is relevant as participation in tenders is restricted to firms qualified for the main work category. Alternatively, firms that lack this qualification can participate as part of Temporary Partnerships (TP)[9]: these partnerships are created *ad hoc* to bid for a given contract, and involve firms qualified for the main task and the secondary task(s) of the awarded contract.

Notice that for the secondary categories of works involved in a public contract up for tender, the bidding firm may either be qualified or not. If the bidding firm is fully qualified and it wins the contract, it can choose either to complete all the works on its own or to subcontract parts of the works to other similarly qualified firms (i.e., rival firms with much the same qualifications), giving the rise to an optional subcontracting. If the winning firm is not qualified for one or more secondary categories, it has to declare it will subcontract the works for which it lacks qualifications to qualified firms, and if it wins, it is required to subcontract (i.e. mandatory subcontracting).

Since the categories of qualification to enter the awarding auction are announced, a noteworthy direct consequence of this regulation of the public procurement market is that, when a contract is tendered, the potential position of each bidder concerning any outsourcing/subcontracting results defined. In particular, each firm willing to participate in the auction for the contract awarding could verify if it is fully qualified to bid or – if not – could alternatively choose if to organize a TP or to proceed for mandatory subcontracting. Thus, the regulation on qualification for bidders to public contracts allows firms' assessment of their own production strategy at the bidding stage: this permits us to observe the outsourcing formats and, accordingly, the firms' bids.

**Data.** Our dataset collects public works awarded by the Regional Government of Valle d'Aosta in the period 2000-2009 - data are from Moretti and Valbonesi (2015) - by means of open tenders, where firms participate by offering a price (i.e., a percentage reduction on the reserve price set by the CA).[10] Thus, our dataset contains all bids submitted in each auction, together with several

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[9] In Italian it is called "Associazione Temporanea d'Impresa", ATI.
[10] Once the CA has verified the bidders' legal, fiscal, economic, financial and technical requirements, the contract is awarded according to the rules governing the competitive auction. In this procurement setting, Average Bid Auction (ABA) and Average Bid Auction with Lottery (ABA with Lottery) are adopted. These mechanisms work as follows.

detailed information at the firm- and auction-level. In particular, for each participating firm, we know its identity (i.e., company name), its size, its location, its distance from to the site of the CA awarding the contract, the number of pending public procurement projects (i.e. backlog), its (optional or mandatory) outsourcing position and, finally, if it is a TP or not. For each auction, we have information on the reserve price defined by the CA, all the rebates offered by participants in the auction as well as the winning rebate, the task of the tendered project and the estimated duration of the work. Furthermore, we do have some information on the contract's execution: for each contract we can estimate if it has been completed with time and/or cost overruns[11].

Finally, for each tendered contract, we have information on all the qualifications required to complete the tasks involved in the contract and all the actual qualifications hold by each bidding firm. This information enables us to separate the bidding firms that would *ex-post* have the *option* to subcontract from those which would *ex-post* be mandated to subcontract for part of the works. Moreover, we can observe if the bidding firm in each auction is a TP [or not], i.e. if it participates in the auction with an *ex-ante* binding but temporary agreement with other firms, which allows the full qualification for the execution of that contract.

**Descriptive Statistics.** We run our empirical analyses on TPs by exploiting the dataset on public contracts awarded by the Regional Government of Valle d'Aosta by means of open tenders in the form of average bid auctions (89.2% of the sample) and average bid auction with lottery (10.8%). This dataset consists of 269 auctions awarding public contracts for road works (37.2%), river and hydraulic works (29.7%), and buildings (14.9%). In these auctions, a total of 13,331 bids were offered by 892 firms and 1,777 Temporary Partnerships. As highlighted in Table 1, the average reserve price is about 1.18 million euro (min 155,000, max about 5.25 million euro), and the expected duration of completion is on average 322 days. The market is essentially a local one, being the average distance between the bidder's location (i.e. the closest capital city) and the CA location (i.e. the city of Aosta) about 310 kilometers, with a standard deviation of about 399 kilometers). The average number of firms participating in auctions is 74, being the auction's format

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ABA: Given the distribution of all bids received in an auction, a first average (A1) is computed by averaging all the bids, except those located in the first and last deciles. A second average (A2) is then computed by averaging all of the bids above A1 (again, excluding those bids located in the last decile). The winning bid is the one immediately below A2.

ABA with lottery: given A2 computed as above, a random integer R between 1 and 9 is extracted. The R-th number among the nine equidistant numbers between the bid just above the first decile and the bid just below A2 is averaged with A2 to obtain the winning threshold. The winning bid is the bid immediately above this winning threshold. As shown in Galavotti et al. (2014), the mean rebate is lower in the ABA format that is combined with a type of lottery than in the other ABA format; however, the bidding behavior is similar in both formats. For further analysis on these mechanisms, see Albano et al. (2006) and Decarolis (2009).

[11] Following Moretti and Valbonesi (2015), we define time overruns as the probability of completing the project after the expected (contracted) deadline and cost overruns as the probability that the final cost of the project is greater than the winning bid.

an Average Bid Auction in the 83% of cases and an Average Bid Auction with Lottery in the remaining cases. The 12% of these firms are small-sized, 53% medium-sized; 22% large-sized; and for about 13% are TPs. Considering firm performance in executing the contract, we note that the probabilities of cost- and time-overruns are quite large (0.859 and 0.895, respectively).

**Table 1 – Summary statistics: Full Sample**

|  | No. Obs. | Mean | *Std. Dev* | Min | Max |
|---|---|---|---|---|---|
| Rebates (%) | 13331 | 17.210 | *4.831* | 0.00 | 43.00 |
| Winning Rebates (%) | 13331 | 17.996 | *4.360* | 3.62 | 32.25 |
| Reserve price (euro) | 13331 | 1182926 | *833891* | 155526 | 5267860 |
| Expected Duration (days) | 13331 | 322.575 | *155.176* | 79 | 1440 |
| Distance (km) | 13331 | 310.398 | *398.783* | 30 | 1762 |
| No. of Participants | 13331 | 74.848 | *31.842* | 3 | 155 |
| Average Bid Auction | 13331 | 0.831 | *0.375* | 0 | 1 |
| Average Bid Auction+Lottery | 13331 | 0.169 | *0.375* | 0 | 1 |
| Firm Size Dummy: Large | 13331 | 0.220 | *0.414* | 0 | 1 |
| Firm Size Dummy: Medium | 13331 | 0.529 | *0.499* | 0 | 1 |
| Firm Size Dummy: Small | 13331 | 0.118 | *0.323* | 0 | 1 |
| Temporary Partnership (TP) | 13331 | 0.133 | *0.340* | 0 | 1 |
| Prob. Cost Overrun | 12944 | 0.859 | *0.348* | 0.00 | 1.00 |
| Prob. Delayed Delivery | 13331 | 0.895 | *0.307* | 0.00 | 1.00 |

As reported in Moretti and Valbonesi (2015), each firm in the sample participated on average in about 5 auctions (13 auctions, if we exclude TPs from the sample). Focusing on firm qualifications and on the individual firm's outsourcing position it leads to, it is relevant to notice that each firm maintains the same qualifications from one year to the next, and this leads to potentially different outsourcing position of the same firm in different contracts (as contracts vary according to the tasks to be performed).

Table 2 shows the sample's descriptive statistics, as presented by firms' outsourcing position. In our sample, about 73.8% (9839 out of 13331 total observations) of the bids were offered by firms in optional subcontracting position (of which 26.6% are large firms); 12.86% by firms in a mandatory subcontracting position; and about 13.32% of the bids were offered by firms organized as TPs. In what follows, we consider each bid as a *proxy* for the firm's expected costs to execute the tendered contract and we investigate differences across different outsourcing/subcontracting positions of the firms, in particular: i) *ex-ante* outsourcing in the form of TPs, and ii) *ex-post* outsourcing - in the form of either *mandatory* or *optional* subcontracting. Indeed, in the firm's supply chain, TPs and optional subcontracting are planning alternatives, while mandatory subcontracting is a planning constraint. Finally, we also consider differences in the bidding strategy of TPs and large qualified firms that may optionally subcontract, the idea being that large firms are more efficient and better equipped, hence may bid more aggressively.

**Table 2: Summary Statistics by outsourcing positions (sub-samples)**

| | Temp Partnerships (TPs) | | | Optional – (No TPs) | | | Large Optional (No TPs) | | | Mandatory | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No.Obs. | Mean | Std. Dev. | No.Obs | Mean | Std. Dev. | No.Obs | Mean | Std. Dev. | No.Obs | Mean | Std. Dev. |
| Rebates | 1777 | 17.396 | 4.708 | 9839 | 17.339 | 4.847 | 2635 | 16.836 | 4.986 | 1715 | 16.272 | 4.759 |
| Winning Reb | 1777 | 18.139 | 4.390 | 9839 | 18.164 | 4.838 | 2635 | 18.000 | 4.410 | 1715 | 16.889 | 4.006 |
| Reserve Price | 1777 | 1663345 | 993998 | 9839 | 1104538 | 764945.3 | 2635 | 1393471 | 890525 | 1715 | 1134852 | 865321 |
| Exp. Duration | 1777 | 377.454 | 175.068 | 9839 | 312.019 | 143.152 | 2635 | 340.296 | 151.565 | 1715 | 326.266 | 184.702 |
| Distance (km) | 1777 | 292.122 | 440.547 | 9839 | 312.93 | 383.927 | 2635 | 310.272 | 236.685 | 1715 | 314.755 | 435.007 |
| Pr. Cost Over | 1669 | 0.872 | 0.334 | 9573 | 0.846 | 0.3613 | 2554 | 0.862 | 0.345 | 1702 | 0.920 | 0.272 |
| Pr. Delay Deliv. | 1777 | 0.928 | 0.259 | 9839 | 0.891 | 0.312 | 2635 | 0.908 | 0.289 | 1715 | 0.885 | 0.319 |

In Table 2, we observe that – on average - firms in mandatory subcontracting position offer smaller rebates (i.e. higher prices) than TPs and firms in position of optional subcontracting. Smaller rebates are also to be recorded once - in the group of firms in position of optional subcontracting - we disentangle large from medium and small size: in contrast with the idea that large firms bid more aggressively, we find that they offer lower rebates than TPs and the other firms in position of optional subcontracting. Moreover, TPs record slightly lower cost-overruns and higher time-overruns, while the opposite is true for firms in position of mandatory subcontracting.

The differences in rebates suggest us to compare cross-samples means differences in order to test the bidding behavior of TP *vis-à-vis* other contractual forms. The results are in Table 3. They show that, overall, average rebates by TPs are significantly higher (implying lower prices) than the firms in mandatory subcontracting position. Moreover, if we separate firms in optional subcontracting position by size, we find that TPs' rebates are significantly higher than rebates offered by Large firms in optional subcontracting position (Large Optional).

**Table 3: Mean comparisons**

| | Temporary Partnerships | Mean Comparison | Other Forms |
|---|---|---|---|
| | *Mean Rebate* | | |
| Temporary Partnerships (TPs) | 17.395 | | |
| Mandatory | | > *** | 16.272 |
| Optional (excl. TPs) | | ~ | 17.339 |
| Large Optional (excl. TPs) | | >*** | 16.836 |
| | *Mean Pr_winning (% amongst winners)* | | |
| Temporary Partnerships (TPs) | 0.023 | | |
| Mandatory | | ~ | 0.0186 |
| Optional (excl. TPs) | | > ** | 0.0164 |
| Large Optional (excl. TPs) | | > * | 0.0151 |

Note: $^*$ $p < 0.1$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$.

As a further test of the bidding behavior, we also conduct a mean comparison test of the probability of winning. We consider all the participants by outsourcing position (TPs, firms in the position of Optional and Mandatory subcontracting) and size (Large firms in position of Optional

subcontracting) in each auction, and we compute the number of winnings over the number of participants. We find that TPs have a larger probability of winning as compared to all other outsourcing formats, and that this difference is statistically significant with respect to firms in position of optional subcontracting (also larger ones), but not w.r.t. firms in mandatory position. Results from this table suggest that not only TPs tend to bid more aggressively, but that they are successful when they do it. However, if we are to confirm this descriptive evidence we have to rely on regression analysis, which allows us to control for other influencing forces in the bidding process.

## 4. Empirical Model and Results

In this Section, we present our empirical model to investigate *ex-ante* outsourcing in the form of TPs, and compare it with *ex-post* outsourcing in the form of optional or mandatory subcontracting. We simply assume that the firm's bid is a *proxy* for each firm's expected costs to complete the tendered contract.

We estimate the following model specification of the rebate of firm $i$ in each auction for project $j$:

$$Rebate_{ij} = \alpha + \beta\ TP_{ij} + \gamma\ Q_j + \theta X_i + \delta Z_{ij} + \varepsilon_{ij}$$

where *TP* is a binary variable that takes value 1 when the bidder $i$ in the auction for project $j$ is a Temporary Partnership, and 0 otherwise, i.e. the bidder is either a fully qualified firm that can optionally decide *ex-post* whether to subcontract (*Optional*), or a partially qualified firm that should proceed to mandatory subcontracting (*Mandatory*). $Q_j$ is a set of variables that control for the characteristics of the project and the nature of the auction, such as the size of the project, its length in terms of expected duration,[12] the category of the works (i.e. tasks to be executed), the type of auction (Average Bid Auction or Average Bid Auction + Lottery) and the toughness of competition (i.e. number of bidders). $X_i$ is a set of variables that measures the characteristics of the bidder, such as its size (as measured by dummies, see Moretti and Valbonesi, 2015) and the distance between its location (i.e. the closest capital city) and the CA's location (i.e. the city of Aosta). $Z_{ij}$ controls for the bidder's capacity constraints as measured by the firm's backlog when it bids for the project $j$ and $\varepsilon_{ij}$ is the error component. Finally, we add year dummies, since the auctions took place from 2000 to 2008, and we include dummies for sixteen categories of work, firm size and a dummy denoting the winning firm. Robust standard errors are clustered by firm, to account for the fact that each bidder may contemporarily decide to bid on more than one auction, and its decision on

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[12] Notice that in the procurement literature the length of a project – along with its price - is usually considered a *proxy* for the complexity of the project (Lewis and Bajari, 2011).

the bidding price (or about the participation) is likely influenced by the current status of its business. Moreover, to control for correlation across bidding behavior of firms within auctions, we control whether the results hold clustering the standard errors by auction.

Because our focus is on *ex-ante* outsourcing in the form of TPs, and on TPs' differences with respect to firms in *ex-post* outsourcing positions, we present regression results from various sub-samples that allow us to estimate the differences in β, the coefficient of our variable of interest. Specifically, β indicates whether the firm's *ex-ante* or the *ex-post* outsourcing position affect its bids: differences in the coefficient would record differences between firms that commit to a TP to bid and execute the contract as fully qualified, and firms having the status of optional or mandatory subcontracting.

**Results**. In Table 4, we present the first set of results. Our benchmark is the regression in Column (1) where, similarly to Moretti and Valbonesi (2015), we find that firms that are fully qualified to complete a project and, accordingly, may decide whether or not subcontract part of the work, do present significantly higher bidding rebates. In Columns (2)-(5), we focus on TPs and find that the coefficient on the TPs dummy is insignificant in Columns (2) and (3), i.e. in the full sample as well as in the sub-sample of *Optional* firms, where the insignificant negative coefficient signals comparatively lower rebates. However, the coefficient on TP turns positive and significant, when the comparison is with Large Optional, i.e. large firms in an optional subcontracting position. This finding seems to indicate that TPs choose optimal size in entry the auction more efficiently than large firms. Finally, when we focus on firms in a mandatory subcontracting position (Column (5)), the results show that TPs' bidding rebates are significantly larger.

Considering firms' bids as *proxy* for self-estimated cost in executing the contract (i.e. perceived production efficiency), these results suggest that TPs' bids do not statistically differ from firms in a position of optional subcontracting, i.e. firms that can opt for ex-post subcontracting, but do significantly better than both firms that have to subcontract ex-post (Mandatory subcontracting) and large fully qualified firms that have the choice to it (Large optional). Turning to control variables, we find that only the *Number of participants* and the *Type of auction* dummy enter significantly in all columns. The former highlights the interesting results that the higher the number of participants, hence the tougher the expected competition in the bidding process, the higher is the bidding rebate, and the lower the final price, with a benefit for public procurement. The latter indicates that Average Bid Auctions allow the higher rebates as compared to the alternative Average Bid Auction+Lottery format (see Moretti, Galavotti and Valbonesi, 2015 for a discussion about).

<div align="center">

**Table 4 – Firms' outsourcing status and their bidding rebates**

</div>

| Dep. Var.: Bidding Rebate | Full sample | Full Sample | Only Optional | Only Large Optional | TPs vs. Mandatory |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Temporary Partnerships | | 0.019 | -0.205 | 0.409* | 0.495* |
| | | (0.164) | (0.163) | (0.228) | (0.304) |
| Optional Subcontracting | 0.216** | | | | |
| | (0.098) | | | | |
| Log(1+Backlog) | -0.067 | -0.061 | -0.098 | -0.073 | 0.152 |
| | (0.063) | (0.063) | (0.072) | (0.120) | (0.138) |
| Log(Distance) | 0.006 | 0.005 | -0.010 | 0.026 | 0.071* |
| | (0.029) | (0.029) | (0.030) | (0.070) | (0.041) |
| Log(Reserve price) | 0.061 | 0.062 | 0.092* | 0.171** | -0.025 |
| | (0.050) | (0.050) | (0.049) | (0.081) | (0.101) |
| Log(No. Participants) | 1.267*** | 1.265*** | 1.270*** | 1.388*** | 1.397*** |
| | (0.139) | (0.139) | (0.151) | (0.284) | (0.217) |
| ABA Auction | 7.176*** | 7.114*** | 5.354*** | 5.293*** | 7.628*** |
| | (0.294) | (0.283) | (0.585) | (0.701) | (0.316) |
| Constant | 4.337** | 4.525** | 8.755*** | 2.600 | 6.641*** |
| | (2.041) | (2.015) | (1.322) | (3.332) | (1.558) |
| | | | | | |
| Firm size Dummies | Yes | Yes | Yes | Yes | Yes |
| Winning firm Dummy | Yes | Yes | Yes | Yes | Yes |
| Categ. of work Dummies | Yes | Yes | Yes | Yes | Yes |
| Year Dummies | Yes | Yes | Yes | Yes | Yes |
| | | | | | |
| R-squared | 0.521 | 0.520 | 0.517 | 0.502 | 0.534 |
| Observations | 13,331 | 13,331 | 11,616 | 4,412 | 3,492 |

OLS regressions. ABA denotes Average Bid Auctions. Robust standard errors in parentheses are clustered by firm. *** $p<0.01$, ** $p<0.05$, * $p<0.10$

We then consider the performance of the contract investigating cost- and time-overrun by winners. Our empirical findings - presented in Table 5 and 6 – show that on the one hand the probability that TPs complete the contract with cost-overrun is always lower with respect to firms in other outsourcing status, although it is significantly so only with respect to firms in a position of mandatory subcontracting. On the other hand, the probability that TPs complete the contract with time-overrun is always significantly larger with respect to other firms in voluntary outsourcing status (while does not differ to firms in a mandatory position). To sum up, TPs do not differ from mandatory subcontracting firms in their probability to delay contract delivery, but are significantly less likely to exceed the expected project cost. Altogether, these findings seem to indicate that TPs succeed in planning and performing production at efficient costs, while they suffer inefficiency in the contract's timely execution as compared to firms in other outsourcing status. Indeed, note that the TPs' inefficiency in the contract's completion time could belong to transaction costs arising

from the coordination of the firms in the temporary partnership.[13]

**Table 5 - Probability of Cost Overrun in contracts execution (winning firms)**

| Dep. Variable: pr_delay | Full Sample | Full Sample | Optiona | Only Large Opt | TPs vs Mandatory |
|---|---|---|---|---|---|
| VARIABLES | (1) | (2) | (5) | (3) | (4) |
| | | | | | |
| Temporary Partnerships | | -0.240 | -0.276 | -0.312 | -2.277*** |
| | | (0.379) | (0.326) | (0.490) | (0.651) |
| Optional Subcontracting | -0.884* | | | | |
| | (0.530) | | | | |
| Log(1+Backlog) | -0.125 | -0.118 | -0.061 | -0.146 | -1.150** |
| | (0.137) | (0.137) | (0.118) | (0.130) | (0.521) |
| Log(Distance) | -0.096 | -0.101 | -0.089 | 0.107 | 0.156 |
| | (0.083) | (0.084) | (0.089) | (0.143) | (0.117) |
| Log(Reserve price) | 0.438** | 0.411** | 0.471** | 0.362 | 0.239 |
| | (0.200) | (0.205) | (0.202) | (0.334) | (0.381) |
| Log(No. Participants) | -0.322* | -0.271 | -0.344* | -0.733* | -0.492 |
| | (0.181) | (0.174) | (0.194) | (0.431) | (0.377) |
| ABA Auction | 0.033 | 0.048 | 0.067 | 0.337 | -0.371 |
| | (0.356) | (0.350) | (0.391) | (0.596) | (0.620) |
| Log(Expected Duration) | -0.000 | -0.000 | 0.000 | 0.001 | -0.001 |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.002) |
| Constant | -2.744 | -3.280 | -3.871 | -1.829 | 2.132 |
| | (2.664) | (2.594) | (2.528) | (4.259) | (4.749) |
| Firm size Dummies | Yes | Yes | Yes | Yes | Yes |
| Categ. of work Dummies | Yes | Yes | Yes | Yes | Yes |
| | | | | | |
| Wald (p-value) | 0.096 | 0.060 | 0.166 | 0.521 | 0.043 |
| Pseudo R2 | 0.12 | 0.09 | 0.10 | 0.10 | 0.17 |
| Observations | 227 | 227 | 195 | 77 | 70 |

Probit regressions. ABA denotes Average Bid Auctions. Robust standard errors are in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.10$

The above results on contracts' performance should be considered along with our results on bidding rebates. TPs offer higher rebates (i.e. lower bidding price to execute the contract) as compared to firms in a position of mandatory subcontracting. Moreover, TPs execute the contract with lower probability of cost-overruns than firms in a position of mandatory subcontracting. These findings would suggest that - in the aim to design regulation for cost efficient public procurement - incentives should be to firms to enter the auction as qualified in the form of *ex-ante*

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[13] Again the control variables provide some interesting information. First of all, the negative sign on the number of participants in both tables, indicates that competitive pressure disciplines both time and cost overruns, leading to a more efficient delivery of the project. Second, Reserve Price, indicating the "size" of the project, is positively related with both the probability of delay and the probability of cost overrun. And finally, the expected duration is found to be negatively associated to time-overrun, as expected.

temporary partnerships as opposed to enter the auction as partially qualified and proceed to *ex-post* mandatory subcontracting. However, our results also suggest that coordination among firms in the temporary partnerships may lead to time-overruns: in this perspective, the inclusion in the awarded contract of explicit (i.e. bonus and penalty) and implicit (i.e. relational contracts) incentives for timely execution should be carefully addressed by the regulator.

**Table 6 - Probability of Time Overruns in the delivery of the contract (winning firms)**

| Dep. Variable: pr_delay | Full Sample | Full Sample | Only Optional | Only Large Optional | TPs vs Mandatory |
|---|---|---|---|---|---|
| VARIABLES | (1) | (2) | (3) | (4) | (5) |
| | | | | | |
| Temporary Partnerships | | 1.047** | 0.990** | 1.945** | 0.380 |
| | | (0.518) | (0.480) | (0.831) | (0.947) |
| Optional Subcontracting | -0.379 | | | | |
| | (0.357) | | | | |
| Log(1+Backlog) | 0.163 | 0.176 | 0.219 | 0.714 | -2.125** |
| | (0.238) | (0.238) | (0.220) | (0.488) | (0.860) |
| Log(Distance) | -0.078 | -0.090 | -0.052 | -0.098 | -0.637 |
| | (0.116) | (0.116) | (0.121) | (0.267) | (0.537) |
| Log(Reserve price) | 0.666** | 0.634** | 0.633** | 1.580** | 5.447*** |
| | (0.302) | (0.310) | (0.301) | (0.614) | (1.879) |
| Log(No. Participants) | -0.772** | -0.720** | -0.753** | 0.136 | -1.117 |
| | (0.347) | (0.347) | (0.332) | (0.551) | (0.691) |
| ABA Auction | 0.287 | 0.318 | 0.291 | 0.121 | 0.856 |
| | (0.335) | (0.329) | (0.383) | (0.619) | (0.732) |
| Log(Expected Duration) | -0.002** | -0.002** | -0.002* | -0.005*** | -0.016*** |
| | (0.001) | (0.001) | (0.001) | (0.002) | (0.005) |
| Constant | -2.338 | -3.577 | -3.505 | -19.412*** | -57.489*** |
| | (3.545) | (3.345) | (3.347) | (6.366) | (20.512) |
| Firm size Dummies | Yes | Yes | Yes | Yes | Yes |
| Categ. of work Dummies | Yes | Yes | Yes | Yes | Yes |
| | | | | | |
| Wald (p-value) | 0.000 | 0.002 | 0.002 | 0.000 | 0.000 |
| Pseudo R2 | 0.17 | 0.17 | 0.17 | 0.31 | 0.65 |
| Observations | 234 | 234 | 202 | 81 | 73 |

Probit regressions. ABA denotes Average Bid Auctions. Robust standard errors are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.10$

## 5. Conclusion

In the aim to disentangle effects from different types of outsourcing in procurement, we empirically investigate an Italian dataset on auctions for the awarding of public works, exploiting the regulation on firms' qualification, which allows firms to bid individually (thus choosing or being obliged to *ex-post* subcontracting) or in Temporary Partnership with other firms (thus proceeding in this way for an ex-ante outsourcing).

We find that Temporary Partnerships offer similar prices to fully qualified firms in a position to choose whether *ex-post* subcontracting, and lower prices than partially qualified firms which must proceed with *ex-post* mandatory subcontracts. We also find that the similarity between TPs and firms in a position of optional subcontracting does not survive once we compare TPs only with the subsample of large firms having the option to subcontract: this means that size matters in planning procurement supply-chain, and TPs can derive positive efficiency effects from their discretion in deciding their size auction by auction.

Considering contracts' performance we found that: i) TPs execute contracts with lower probability of cost-overruns than firms in a position of mandatory subcontracting, and ii) with higher probability of time-overruns. Our findings suggest that procurement regulations should permit firms entering the auction as qualified in the form of *ex-ante* temporary partnerships, carefully designing - explicit and/or implicit - incentives for the timely execution of contracts.

# References

Albano, G., Bianchi, M, Spagnolo, G, 2006, "Bid Average Methods in procurement," *Rivista di Politica Economica*, **1-2** 41-62.

Albano GL, Spagnolo G, Zanza, M, 2009,"Regulating joint bidding in public procurement", *Journal of Competition Law Econom.* **5(2)** 335–360.

Athey, S, Coey, D, Levin, J, 2013, "Set-Asides and Subsidies in Auctions" *American Economic Journal: Microeconomics* **5** 1-27

Arya, A, Mittendorf, B, Sappington, DEM, 2008, "The make-or-buy decision in the presence of a rival: Strategic outsourcing to a common supplier", *Management Science,* **54**(10) 1747–175

Chen,Y . 2005, "Vertical disintegration",. J.Econom. Management Strategy **14** 209-229

Coase, R. (1937): "The Nature of the Firm" Economica **4** (16) 386–405

Decarolis, F, 2009, "When the Highest Bidder Loses the Auction: Theory and Evidence from Public Procurement," *Economic working papers 717, Bank of Italy, Economic Research Department.*

De Silva, D G, Dunne, T, Kosmopoulou, G, Lamarche, C, 2012, "Disadvantaged Business Enterprise Goals in Government Procurement Contracting: An Analysis of Bidding Behavior and Costs" *International Journal of Industrial Organization* **4** 377-388

Flynn R, Davis P, 2015, "The policy–practice divide and SME-friendly public procurement", *Environment and Planning C: Government and Policy* **20** 1–20

Galavotti, S, Moretti, L, and Valbonesi, P, 2014, "Sophisticated Bidders in Beauty Contest Auctions" *Marco Fanno Working Paper 187, Department of Economics and Management, University of Padova.*

Grossman, S, Hart, O, 1986, "The Costs and Benefits of Ownership: a Theory of Vertical and Lateral Integration," *Journal of Political Economy* **94** 691-719.

Holmstrom, B, Roberts, J, 1998, "The boundaries of the firm revisited", *Journal of Economic Perspective,* **12** 73–94

Joskow, P.L. 1988. "Asset Specificity and the Structure of Vertical Relationships: Empirical Evidence" *Journal of Law, Economics and Organization* **4** 95-117.

Krasnokutskaya, E, Seim, K, 2011, "Bid Preference Programs and Participation in Highway Procurement Auctions", *American Economic Review* **101** 2653-2686

Kamien, M, Li. L, 1990, "Subcontracting, Coordination, Flexibility and Production Smoothing in Aggregate Planning," *Management Science,* **36** 1352-1363.

Kogut, B, Zander, U, 1992, "Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology" *Organization Science* **3** 383-397.

Kogut, B, Zander, U, 1996, "What Firms Do? Coordination, Identity, and Learning", *Organization Science* **7** 502-518.

Lafontaine, F, Slade, M, 2007, Vertical Integration and Firm Boundaries: The Evidence" *Journal of Economic Literature* **45** 629-685

Lafontaine, F, Slade, M, 2008. "Exclusive Contracts and Vertical Restraints: Empirical Evidence and Public Policy," in P. Buccirossi, ed., *Hanbook of Antistrust Economics,* Cambridge MA: MIT Press, 391-414

Lewis, TR, Sappington, DEM, 1991, "Technological Change and the Boundaries of the Firm," *American Economic Review* **81** 887-900.

Lewis, G, P, Bajari, 2011, "Procurement Contracting with Time Incentives: Theory and Evidence", *Quarterly Journal of Economics* **126** 1173-1211.

Loader K, 2013, "Is public procurement a successful small business policy support? A review of the evidence" *Environment and Planning C: Government and Policy* **31** 39–55

Macher, J T, 2006, "Technological Development and the Boundaries of the Firm: A Knowledge-Based Examination in Semiconductor Manufacturing," *ManagementScience* **52** 826-843.

Marechal F, Morand P-H, 2003, Pre vs. post-award subcontracting plans in procurement bidding. *Econom. Lett.* **81**(1) 23–30.

Marion, J, 2007, "Are Bid Preferences Benign? The e_ect of Small Business Subsidies in Highway Procurement Auctions" *Journal of Public Economics* **91** 1591-1624.

Marion, J, 2009. "How Costly is Affirmative Auction? Government Contracting and California's Proposition 209," *Review of Economics and Statistics* 91 503-522.

Miller, D. 2014. "Subcontracting and Competitive Bidding on Incomplete Procurement Contracts," *The Rand Journal of Economics* **45** 705-746.

Moretti, L, Valbonesi, P, 2015, "Firms' Qualifications and Subcontracting in Public Procurement: An Empirical Investigation" *Journal of Law Economics and Organization* **31** 568-598

Novak, S, Stern, S, 2008, "How Does Outsourcing Affect Performance Dynamics? Evidence from the Automobile Industry", *Management Science* **54** 1963-1979

OECD. 2007. Integrity in Public Procurement, available at:
www.oecd.org/development/aide_ectiveness/38588964.pdf

Quinn, J B, Hilmer, F G, 1994, "Strategic Outsourcing" *Summer Sloan Management Review* 43-55.

Rey, P, Tirole, P, 2007, "A primer on vertical foreclosure" in M, Armstrong, Porter, R, eds. *Handbookof Industrial Organization*, Vol.3, Elsevier S cience, Amsterdam, 21 45-2220.

Saussier, S, Tirole, J, 2015. "Renforcer l'efficacité de la commande publique", *Les notes du conseil d'analyse économique*, n° 22, download from:
http://www.cae-eco.fr/IMG/pdf/cae-note022v2.pdf

Spagnolo, G. 2012. "Reputation, Competition, and Entry in Procurement" *International Journal of Industrial Organization* **30** 291-296.

Spiegel, Y, 1993, "Horizontal Subcontracting" Rand Journal of Economics **24** 570-590.

Van Mieghem, J.A. 1999. "Coordinating Investment, Production and Subcontracting", 45 Management Science 954-971.

Van Long, N, 2005, "Outsourcing and technology spillovers", *International Review of Economic Finance*, **14** 297-3

Williamson, O. 1971. "The Vertical Integration of Production: Market Failure Considerations" *American Economic Review* **63** 316-325.

Williamson, O. 1985. *The Economic Institutions of Capitalism*, New York: The New Press.