

Cartel versus Merger*

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Abstract

Prior to federal antitrust and merger law when firms were largely unconstrained in their decision to either form a cartel or merge, many firms organized as cartels rather than merging, even though it might appear that a merged entity could accomplish everything a cartel could accomplish, and more. We show that the payoff to a cartel exceeds that of a merged entity in a procurement setting where a buyer who is dissatisfied with the bids of incumbent bidders can resolicit bids after qualifying a new entrant. This provides a rationale for a decision by firms to form a cartel rather than merge.

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1 Introduction

As described by Bittlingmayer (1985),

“Perhaps as much as one-half of U.S. manufacturing capacity took part in mergers during the years 1898 to 1902. These mergers frequently included most of the firms in an industry and often involved firms that had been fixing prices or that had been operated jointly through the legal mechanism of an industrial trust. ... The Sherman Antitrust Act was passed in 1890, and the first crucial decisions making price fixing illegal – Trans-Missouri (1897), Joint Traffic (1898), and Addyston (1899) – occurred just before or during the first stages of the merger wave. Merger of competing firms remained unchallenged until 1904.”
Bittlingmayer (1985, p.77)

This suggests that many firms in the late 1800s, when facing a relatively unconstrained choice between forming a cartel or merging into a single corporate entity, chose to form cartels rather than merge.

However, one might expect a merged entity to be more profitable than a cartel. As described by Stigler (1964), a cartel must overcome the difficulties associated with surmounting the incentives for members of a cartel to secretly deviate from the terms of a collusive agreement. In addition, must cartels devote effort to disguising their existence from their customers. A merged entity, on the other hand, does not incur these costs. Thus, in the absence of agency problems and transaction costs inherent in large firms as in Williamson (1985) or Coase (1937), a merged entity should not only be able to duplicate any actions that a cartel can undertake, but also take additional actions that a cartel may not be able to undertake.

We show that in an environment where buyers are strategic, with the ability to take incremental actions such as voiding initial bids and reconducting the procurement after inviting new and additional bidders to participate when bids appear to be “too high,”¹ the expected payoff to firms can be greater if they form a cartel rather than a merge.

We consider a setting with two incumbent sellers and one potential new seller. All sellers operate in either a low-cost environment or a high-cost environment, which is known to them but not known to the buyer. We consider two communication regimes, one in which sellers must compete non-cooperatively and another in which sellers may form a cartel or merge. If the sellers merge, this is observed by all players. If the sellers do not merge, the sellers

¹In Section 2, we discuss the details of one such episode that received attention in the landmark Addyston Pipe conspiracy. For additional examples, see Appendix B.

observe whether a cartel has been formed, but the buyer does not and so is uncertain about the existence of a cartel. The buyer purchases inputs through a competitive procurement, but the buyer retains the right to suspend the procurement and invite the new seller as a bidder.² It is costly to the buyer to extend this invitation, but if the new seller enters, the buyer can re-conduct the procurement. The new seller only enters if the environment is one with low costs.

We show that in this model, the two incumbent sellers are able to obtain higher profits if they form a cartel than if they merge. Relative to the case of merged firms, when non-merged firms submit high bids, the buyer, who is uncertain about the existence of the cartel, attaches a greater probability to high bids being the result of high costs. Thus, given that the new seller only enters in a low-cost environment, the buyer is less likely to invite the new seller when a cartel (whose existence is not fully observable to the buyer) submits a high bid compared to when a merged entity submits a high bid. As a result, a cartel is more profitable than a merged entity.

While cartels and horizontal mergers have been widely studied in the past,³ there is not much work that addresses these two forms of industrial organization as potential alternatives for incumbent firms.⁴ An exception is Bittlingmayer (1985), which directly addresses why many firms preferred colluding over merging in the past. Building on Sharkey (1973), Bittlingmayer (1985) emphasizes the role of fixed costs in industries with a small number of firms and uncertain demand. Akin to the natural monopoly case, when demand is low, the operation of, say, two small plants is more expensive than the operation of a single large plant, and coordinating production (by perhaps operating one plant below its capacity) is necessary to recover costs.⁵ Bittlingmayer argues that a cartel may be a cheaper form of organization than a merger in cyclical industries, where costs can be recovered during periods of high demand and cooperation between firms is required only occasionally when demand is low.⁶

²For other approaches to modeling buyer resistance, see Harrington and Chen (2006) and Marshall, Marx, and Raiff (2008).

³On cartels, see the survey article by Levenstein and Suslow (2006) and the references therein. On mergers, see the survey article by Mookherjee (2006) and the references therein.

⁴One could offer a Coasian (1937) explanation for the choice between a cartel and a merged entity. The trade-off between the costs of maintaining and operating a cartel versus the cost of running a large merged entity due to, say, diseconomies of scale or agency problems, is likely to influence the “merge or cartelize” decision for firms. See Nocke and White (2007) for the effects of vertical mergers on incentives to collude and Kovacic et al. (2004) for effects of horizontal mergers.

⁵For a more detailed discussion and illustrative examples, see Bittlingmayer (1982, 1985).

⁶Bittlingmayer (1985) also argues that early antitrust decisions against cartels raised the cost of maintaining cartels, which left firms with merger as the next best option and resulted in first large-scale merger wave in the U.S. between 1898 and 1904. Stigler (1950) suggests that firms in the past might have preferred to cartelize rather than merge due to the obstacles posed by large capital requirements for mergers. Stigler argues that mergers became feasible because of the development of a sound market for securities by the New

There are also strategic considerations *external* to incumbent firms that influence their merger decisions. One such consideration is the threat of post-merger entry, which directly affects the incumbent firms' profitability. Gelman and Salop (1983) show that when an entrant can commit to serving a small enough portion of the demand, an incumbent monopolist (merged entity) may find it optimal to accommodate the entrant rather than fight it. For the monopolist to accommodate the entrant, the monopolist must expect a payoff at least equal to what it would obtain by matching the entrant's price. In the model of Gelman and Salop (1983), the entrant ensures this by committing to serve a small enough portion of the market, leaving the residual demand for the monopolist.⁷

In a durable goods environment, Ausubel and Deneckere (1987) show that a cartel has the commitment power to maintain static monopoly prices while a monopolist lacks this ability. Thus, industry profits are higher when incumbent firms collude rather than merge.⁸

The remainder of this paper is organized as follows. Section 2 provides a historical overview of the Addyston cartel and other cartels/mergers of the same period. Section 3 reviews the salient features of procurement practices. Section 4 presents our model. Section 5 provides our results. Section 6 concludes.

2 Background

The *U.S. v. Addyston Pipe and Steel Co. et al.*⁹ case of 1898 is considered to be a landmark event in antitrust history.¹⁰ In 1894, six southern manufacturers of cast iron pipes,¹¹ which are used to transport water and gas by cities and municipalities, entered into a conspiracy involving territorial market division. The cartel divided the U.S. into two territories, Pay Territory and Free Territory. For every ton of pipe shipped into the Pay Territory by a member, the member made a payment into a pool, referred to as a bonus payment. For shipments into the Free Territory, no bonus payments were necessary. The cartel "reserved" certain cities for particular cartel members, which meant that other cartel members would

York Stock Exchange at the end of the 19th century and the removal of restrictions on the formation of large corporations after 1880.

⁷As an example, after the International Paper Company was created in 1898, several small firms entered the business. Instead of attempting to fight these smaller firms, the company let them fill their order books and charged monopoly prices on future orders. (Lamoreaux, 1985, p.129)

⁸In the same paper, Ausubel and Deneckere (1987) also show that the monopolist gains the ability to commit to maintaining future prices at the static monopoly level if there is a potential entrant at each time period.

⁹*U.S. v. Addyston Pipe and Steel Co. et al.*, 85 Fed. 271.

¹⁰See Bittlingmayer (1982).

¹¹The firms involved were: Addyston Pipe and Steel Company, Dennis Long & Co., Howard-Harrison Iron Company, Anniston Pipe and Foundry Company, South Pittsburgh Pipe Works, and Chattanooga Foundry and Pipe Works.

not compete for any contract with the designated cartel members in those cities. At the end of every month, the bonus payments made by the members were tallied and divided among the members based on their capacities.

The amounts of the per-ton bonus payments made by the cartel members were decided by an auction before every procurement. Before a procurement, the cartel center would fix the price that would be quoted by the member representing the cartel at the procurement. The right to bid at the procurement was decided by holding a pre-auction knockout. Cartel members would submit bids on the bonuses they would pay into the pool in exchange for the right to be the cartel's representative at the procurement. The winner of the knockout would quote the price set by the cartel center at the procurement, while other cartel members "protected" that bid.

After about two years of operation, suspicion about the existence of the cartel was raised when at a procurement in Atlanta, cartel members who were within a hundred miles of the city bid one to two dollars higher than a non-cartel company (R.D. Wood & Co.) that was a thousand miles away. All bids were rejected as being too high and a new procurement was held. Anniston (for whom Atlanta was reserved) then bid considerably lower than its previous bid, suggesting that bids were not competitive in the first instance.¹²

An initial civil suit against the defendants in 1896 was decided in favor of the cartel, but in a landmark 1898 verdict, Howard Taft declared the cartel illegal.¹³ The Addyston case, along with the railroad cartel cases involving the Trans-Missouri Freight Association and the Joint Traffic Association,¹⁴ were instrumental in making collusion illegal under Section 1 of the Sherman Act. (Bittlingmayer, 1985)

While the above verdicts set precedents for *collusion* being a criminal offense under the Sherman Act, in 1904 the Northern Securities verdict set a precedent for *merging* to form a monopoly a criminal offense under the Act.¹⁵ Thus, collusion was deemed illegal under the Sherman Act *before* merging to monopolize was. In fact in 1895, in *U.S. v. E.C. Knight* the Supreme Court decided in favor of the American Sugar Refining Company, which was a virtual monopoly formed through the consolidation of sugar refineries.¹⁶ Thus, there was a period between 1898 and 1904 when a large consolidation was not deemed illegal by the

¹²Addyston, Transcript of Record, p 299.

¹³The Supreme Court upheld the decision in 1899 in the first unanimous decision in a Sherman Act case. (Whitney, 1958)

¹⁴*U.S. v. Trans-Missouri Freight Association*, 166 U.S. 290 (1897), *U.S. v. Joint Freight Association*, 171 U.S. 505 (1898).

¹⁵*Northern Securities v. U.S.*, 197 U.S. 400, was an historic Supreme Court case under the Sherman Act involving the merger of major railroad companies, which led to the creation of Northern Securities. In 1904, the merged entity was dissolved.

¹⁶*U.S. v. E. C. Knight*, 156 U.S. 1.

Supreme Court, but a cartel was.

Operating in the legal environment before 1904, it is noteworthy that the pipe manufacturers formed a cartel rather than merging. But even more interesting is the fact that in a little more than a year after the Associated Pipe Works cartel was declared illegal in 1898, its members consolidated in 1899 to form the United States Cast Iron Pipe and Foundry Company (USCIP&F). (Whitney, 1958, p.7) The firms therefore seemed to have preferred colluding over merging and only upon being prosecuted for collusion did they decide to merge. In fact, prior to the first wave of industrial mergers, which happened between 1898 and 1904, the chosen form of cooperation among firms in a wide range of industries seems to have been collusion rather than merger (Jones, 1921, p.6).

Table 1 lists the cases filed between 1890 and 1904 by the Government against firms in the manufacturing sector under Section 1 of the Sherman Act.¹⁷ Some of these cases were decided by the Supreme Court and others by lower courts. The particular time interval is chosen because the Sherman Act was passed in 1890 and the Northern Securities case was decided in 1904. Thus, the time period is one after the Sherman Act was passed, but during which there was no precedent for ruling mergers that resulted in a monopoly as illegal. Curiously, all the cases involved firms that had formed cartels at some point in the past, and in at least three of the six cases, it appears the firms later merged.¹⁸

Table 1: Antitrust case filings between 1890 and 1904 under Sections 1 of the Sherman Act in manufacturing sector

Year	Case	Industry	Prior Cartel	Merged
1892	Nelson et al.	Lumber	Yes	Likely
1902	Swift & Co. et al.	Meat Packing	Yes	1903
1893	Patterson et al.	Cash Register	Yes	No info
1896	Kansas City Exchange	Livestock	Yes	No info
1903	Federal Salt Co.	Salt	Yes	No info
1896	Addyston et al.	Cast Iron Pipe	Yes	1899

Source: Thorelli (1954, Chapter 8)

Table 2 lists additional industries in which firms that had initially colluded later merged. These cartels were operating prior 1904.¹⁹

¹⁷Some of the cases also involved Section 2 of the Sherman Act.

¹⁸In addition, two cases filed under Section 2 of the Sherman Act, *U.S. v. E. C. Knight*, 156 U.S. 1, and *U.S. v. Greenhut et al.*, 50 Fed. 469, involved the merger of firms that had initially formed a cartel.

¹⁹In each case the existence of the cartel was revealed at a later date.

Table 2: Evidence of the pattern of collusion followed by merger

Industry	Consolidation Year
Gun Powder ^a	1902
Wire Nails ^a , Tin Cans ^b , Tin Plates ^c	1898, 1901, 1898
Newsprint ^b , Strawboard ^d , Wallpaper ^a	1898, 1889, 1898
Petroleum Refining ^e	1899
Agricultural Machinery ^a	1902
Cotton Oil ^e	1889
Cordage ^f	1887

Source: a-Stevens (1912), b-Whitney (1958), c- Lamoreaux (1985), d-Weeks (1916), e-Bittlingmayer (1985), f-Thorelli (1954)

Interestingly, there were two combinations (United Shoe Machinery and Du Pont Co.) in which the entities that merged did so despite wanting to suppress interfirm rivalry through collusion because they were given legal advice against forming a cartel. In particular, one of Du Pont’s lawyers cited Addyston as an example of collusion being perceived as illegal and the E.C. Knight case, in which a consolidation resulting in a virtual monopoly was allowed, as an example in which a merger was less likely to be prosecuted. (Bittlingmayer, 1985)

3 Buyer procurement practices

In order to seek the best value when acquiring products or services, firms typically use competitive procurements. Governments, whether local, state or federal, are typically required by law to use competitive procurements as well. In order to participate in a procurement, a seller must either be directly invited by the buyer or satisfy a qualification process to be included the bidding. For example, a seller with inadequate financial resources to ensure completion of a contract, or one that has performed poorly in the past, may be excluded from participation in a current procurement. In addition, a potential bidder that does not expend resources to qualify and that is unknown to the buyer may be excluded. For any typical competitive procurement, it is common for there to exist potential suppliers who are either not invited to bid or who do not seek qualification as a bidder.

Almost all procurement rules allow for the buyer, after receipt of all bids, to make no award and void the procurement.²⁰ During the course of a procurement a buyer may observe

²⁰See Federal Acquisition Regulations (<https://www.acquisition.gov/Far/reissue/FARvoll1ForPaperOnly.pdf>): “Section 14.404 Rejection of bids. (c) Invitations may be cancelled and all bids rejected before award but after opening when ... (6) All otherwise acceptable bids received are at unreasonable prices, or only one bid is received and the contracting officer cannot determine the reasonableness of the bid price; (7) The bids were not independently arrived at in open competition, were collusive, or were submitted in bad faith.”

actions by the bidders, including their actual bids, that cause the buyer to believe that they are not obtaining the best value from the initial bids. In that case, a buyer may undertake some incremental action to invigorate the policing action of the competitive process and reconduct the procurement with this new competitive pressure in place. One such action is to invite and seek qualification of sellers that did not participate in the initial round of bidding. If one or more new sellers can be identified, then the procurement may be reopened and new bids solicited.

Overall, a common sequence with regard to procurements in private industry and the public sector is as follows. (See Appendix B for examples.)

1. **Initial bidding.** Invite qualified sellers to participate and obtain initial bids.
2. **Seek additional competitive pressure.** If the initial bids are “reasonable,” then make an award. If the bids provide the buyer with less surplus than expected, then void the initial procurement, seek additional competitive pressure perhaps by investing resources to encourage qualification of sellers who did not participate initially, and conduct a new procurement.
3. **Bidding with additional competitive pressure.** Make an award based on the new bidding.

These common procurement practices guide our modeling framework.

4 Model

There is one buyer that wishes to procure a single item by means of a first-price procurement. There are three potential sellers: two incumbent sellers that we label S_1 and S_2 , and one new potential seller that we label S_3 . We assume that with probability $\rho \in (0, 1)$, costs are “low” and each seller S_i draws its cost x_i independently from the uniform distribution on zero to one, and that with probability $1 - \rho$, costs are “high” and all sellers’ costs are equal to 1. All sellers and the buyer know the distributional source of costs conditional on the low or high-cost state. Sellers observe whether they are in the low-cost or high-cost state, but the buyer does not. Because the buyer knows that costs are bounded above by one, the buyer does not accept bids greater than 1.

We assume that with probability $\xi \in (0, 1)$, sellers 1 and 2 are able to form a cartel or merge if they so choose. However, with probability $1 - \xi$, communication costs or other organizational impediments prevent sellers 1 and 2 from being able to form a cartel or merge.

The sellers observe whether the environment permits them to form a cartel or merge, but the buyer does not, although if the sellers choose to merge, that is observed by the buyer.

We model both a merged entity and a cartel as a bidder that draws two costs and then bids to maximize its payoff based on the minimum of those two costs.

We assume that the buyer can invite seller S_3 to participate as a bidder at cost k to the buyer.²¹ We assume that S_3 must pay a small positive cost to become an eligible bidder.²² We assume that this cost is sufficiently small that S_3 enters when invited as long as the environment is one with low costs.

The timing and information in the model is as follows:

Nature: The state of sellers' costs is realized: low with probability ρ and high with probability $1 - \rho$. The ability of the sellers to form a cartel or merge is realized: cartel or merger is possible with probability ξ and not possible with probability $1 - \xi$. These states are observed by the sellers but not by the buyer.

Stage 0 (merge, collude, or compete): If the formation of a cartel or merger is possible, then S_1 and S_2 choose between (i) merging to form S_M , (ii) acting as a cartel, or (iii) remaining as non-cooperative bidders. A decision to merge is observed by all players. A decision to form a cartel is observed by all sellers, but not by the buyer.

Stage 1 (initial bidding by incumbent sellers): If the sellers merged, S_M draws two independent costs and bids based on the minimum of these two costs. If the sellers did not merge, sellers S_1 and S_2 each draw independent costs. The sellers submit bids.

Stage 2 (potential entry by new seller): After observing the bids, the buyer decides whether or not to incur cost k and invite S_3 to bid in stage 3. If S_3 is invited to bid in stage 3, S_3 decides whether or not to enter before drawing its cost (from either the low-cost or high-cost distribution according to the state of sellers' costs). To enter, S_3 must pay a small positive cost. If S_3 does not enter, then the buyer pays the lowest stage-one bid to the corresponding bidder.²³ If S_3 chooses to enter, then stage 3 is reached.

Stage 3 (post-entry bidding): If S_3 enters, then the procurement is re-conducted. The buyer voids the initial bids. The incumbent sellers, S_M or S_1 and S_2 , draw new costs

²¹In many industries potential suppliers have to be pre-qualified before they are allowed to participate in the procurement. Supplier qualification process is usually costly for the procurer as it typically involves verification of quality and reliability requirements, on-site visits, and verification of insurance coverages and credit-worthiness.

²²This may reflect the cost of quality certifications or of making changes to the production process to ensure compatibility with the buyer's requirements.

²³Ties are resolved by a fair randomization device.

(from either the low-cost or high-cost distribution according to the state of sellers' costs). The bidder with the lowest bid wins the procurement and receives a payment from the buyer equal to its bid.

We use perfect Bayesian Nash equilibrium as our solution concept.

5 Results

5.1 Stage 3

We only reach stage 3 if S_3 has entered. Seller S_3 knows if it is competing against a merged entity, cartel, or two other non-cooperative bidders.

In the low-cost state, bidding is as in a standard IPV first-price auction (with asymmetric bidders if S_1 and S_2 have merged or formed a cartel). In our setting, this equilibrium exists and is unique.²⁴ Let P_{nc} be the expected winning bid in the low-cost state when bidders are non-cooperative and P_M be the expected winning bid in the low-cost state when bidders 1 and 2 have merged or formed a cartel. Let π_{nc} be the expected surplus to a non-cooperative bidder in the low-cost state, and let π_M be the expected surplus to the merged entity or cartel in the low-cost state.

In the high-cost state, each bidder has a cost of 1 and bids 1 in any equilibrium in non-weakly-dominated strategies. The buyer pays 1 and all sellers have zero surplus.

5.2 Stage 2

By assumption, S_3 's fixed cost of entry is sufficiently small that S_3 enters in the low-cost state, regardless of whether it faces non-cooperative bidders, a cartel, or a merged entity.

Seller S_3 does not enter in the high-cost state because doing so yields a negative expected payoff of due to the positive entry cost.

Let γ be the buyer's belief that they are in the low-cost state, conditional on observing the Stage-1 bids. If bidders 1 and 2 are merged, then the buyer invites S_3 if the merged entity's bid is greater than

$$\gamma P_M + (1 - \gamma) + k, \tag{1}$$

which is the buyer's expected cost from the Stage-3 auction plus the cost of inviting the new bidder. If bidders 1 and 2 are not merged, let $\Pr(\text{cartel} \mid b_1, b_2)$ be the buyer's belief that the bidders are colluding, conditional on observing the Stage-1 bids. Then the buyer invites

²⁴See, e.g., Athey (2001) and Lebrun (1996, 1999).

S_3 if the low bid in Stage 1 is greater than

$$\gamma \Pr(\text{cartel} \mid b_1, b_2) P_M + \gamma(1 - \Pr(\text{cartel} \mid b_1, b_2))P_{nc} + (1 - \gamma) + k,$$

which is the buyer's expected cost from the Stage-3 auction plus the cost of inviting the new bidder.

5.3 Stage 1

5.3.1 Preliminaries

It will be useful to let G be the cdf for the minimum of two random variables drawn from the uniform distribution on zero to one. Note that $G(x) = 2x - x^2$.

As a preliminary result, we consider four possible thresholds for the buyer's cost to invite S_3 to bid and prove Lemma 1 characterizing these thresholds. Define the invitation cost threshold k^M implicitly by

$$k^M = \frac{(1 - G(P_M + k^M - \pi_M))\rho}{(1 - G(P_M + k^M - \pi_M))\rho + (1 - \rho)}(1 - P_M), \quad (2)$$

define threshold k^C implicitly by

$$k^C = \frac{(1 - G(P_M + k^C - \pi_M))\rho\xi}{(1 - G(P_M + k^C - \pi_M))\rho\xi + (1 - \rho)}(1 - P_M), \quad (3)$$

define threshold \bar{k}^M by

$$\bar{k}^M \equiv \frac{G(1 - \pi_M)\rho}{G(1 - \pi_M)\rho + 1 - \rho}(1 - P_M), \quad (4)$$

and define threshold \bar{k}^C by

$$\bar{k}^C \equiv \frac{G(1 - \pi_M)\rho\xi}{G(1 - \pi_M)\rho\xi + 1 - \rho}(1 - P_M). \quad (5)$$

Lemma 1 $k^M, \bar{k}^M, \bar{k}^C, k^C \in (0, 1 - P_M)$, $k^C < k^M < \bar{k}^M$, $k^C < \bar{k}^C < \bar{k}^M$, and for ξ sufficiently close to zero, $\bar{k}^C < k^M$.

Proof. See the Appendix.

Lemma 1 shows that for ξ sufficiently close to zero, the invitation cost thresholds are ordered as $k^C < \bar{k}^C < k^M < \bar{k}^M$. The range of ξ for which this ordering holds depends on

the parameter ρ . For example, for $\rho = 0.5$, the ordering holds for $\xi \in (0, 0.208)$.

In what follows, to avoid uninteresting cases, we assume that $k \leq 1 - P_M$.²⁵

5.3.2 Stage-1 equilibria

We begin by showing that when invitation costs for the buyer are less than \bar{k}^M , there is no equilibrium in which the buyer accepts a bid of 1 with probability 1, and so there is no equilibrium in which a merged entity can obtain the maximum price of 1 with certainty. As intuition for this result, note that the merged entity prefers to obtain a price of 1 rather than submit a lower bid, which might be accepted or might lead the buyer to invite S_3 , as long as $1 - \min\{x_1, x_2\} > \pi_M$, the merged entity's surplus from a bid of 1 is greater than its expected payoff from moving to Stage 3. Thus, if the buyer accepts a bid of 1, the merged entity will respond by bidding 1 when its minimum cost draw is less than $1 - \pi_M$. But this means that buyer's posterior belief on the low-cost state following the observation of a bid of 1 will be sufficiently high that for invitation costs below \bar{k}^M , the buyer prefers to invite S_3 to bid. One can see this by noting that the buyer's posterior belief on the low-cost state after observing a bid of 1 would be at least $\gamma = \frac{G(1-\pi_M)\rho}{G(1-\pi_M)\rho+1-\rho}$, so using (1), the buyer's expected purchase price from inviting S_3 would be less than or equal to

$$\gamma P_M + 1 - \gamma + k = 1 + k - \bar{k}^M,$$

which for $k < \bar{k}^M$ is less than the buyer's purchase price of 1 if it does not invite S_3 .

Proposition 1 *Assume $k < \bar{k}^M$. In Stage 1, if S_1 and S_2 have formed a merged entity S_M , in any equilibrium involving non-weakly-dominated strategies, the buyer does not accept a bid of 1 with probability 1.*

Proof. In any equilibrium involving non-weakly-dominated strategies, S_M bids 1 in the high-cost state. In the low-cost state, if S_M wins at a price of 1 with probability 1, then S_M bids 1 for all $x < 1 - \pi_M$. Thus, the buyer's posterior belief on the low-cost state after observing a bid of 1 is bounded below by $\gamma = \frac{G(1-\pi_M)\rho}{G(1-\pi_M)\rho+1-\rho}$. Because the buyer accepts a bid of 1, it must be that $1 \leq \gamma P_M + 1 - \gamma + k$, which we can write as $k \geq \bar{k}^M$, which contradicts the assumption that $k < \bar{k}^M$. Q.E.D.

In the low-cost state, the merged entity can potentially bid in such a way that induces the buyer to invite S_3 to enter, which would give the merged entity an expected payoff of

²⁵If $k > 1 - P_M$, then B never qualifies Seller 3.

π_M . Thus, we can use Proposition 1 to construct an upper bound on the merged entity's expected payoff in Stage 1 as follows:

Corollary 1 *For $k < \bar{k}^M$, in any equilibrium involving non-weakly-dominated strategies, in Stage 1 a merged entity with cost draws x_1 and x_2 has expected payoff less than $\max\{1 - \min\{x_1, x_2\}, \pi_M\}$.*

Despite the fact that, as shown in Proposition 1, in the low-cost state the merged entity does not win at a price of 1 when $k < \bar{k}^M$, there is an overlapping range of invitation costs for the buyer such that the cartel does win at a price of 1.

Proposition 2 *Assume $k \geq \bar{k}^C$. In Stage 1, if S_1 and S_2 have not formed a merged entity, then there exists an equilibrium involving non-weakly-dominated strategies in which in the low-cost state a cartel with cost draws x_1 and x_2 has expected payoff equal to $\max\{1 - \min\{x_1, x_2\}, \pi_M\}$.*

Proof. The proof is by construction. We show that there exists an equilibrium in which in the low-cost state cartel firms submit identical bids according to the bid function

$$\beta^C(\min\{x_1, x_2\}) \equiv \begin{cases} 1, & \text{if } x \leq 1 - \pi_M \\ \frac{P_M + k + 1}{2}, & \text{otherwise,} \end{cases}$$

and the buyer accepts the lowest bid if it is less than or equal to the maximum non-cooperative bid and accepts one of the bids at random if both bids are equal to 1, but otherwise, the buyer invites S_3 to bid. See the Appendix for a complete statement and verification of the equilibrium.

In the low-cost state, given cost draws x_1 and x_2 in Stage 1, an expected payoff of $\max\{1 - \min\{x_1, x_2\}, \pi_M\}$ is the most that a cartel or merged entity can obtain. To obtain such a payoff requires that the cartel or merged entity wins at the maximum price of 1, except when the cartel or merged entity prefers not to win in Stage 1, but rather to have the buyer invite S_3 so that the firms can compete in the Stage-3 procurement with expected payoff π_M . Thus, the payoff obtained by the cartel in Proposition 2 is the maximum possible.

We can now state our main results. Proposition 3 states that firms at least weakly prefer to form a cartel when the buyer's invitation costs are above threshold \bar{k}^C . The result obtains because in this range, as established in Proposition 2, there exists an equilibrium in which the cartel obtains the maximum payoff of $\max\{1 - \min\{x_1, x_2\}, \pi_M\}$, but for a subset of the range of invitation costs, namely $k \in (\bar{k}^C, \bar{k}^M)$, a merged entity has strictly lower payoff in

every equilibrium. In this range, the buyer rejects a bid of 1 by the merged entity but the buyer accepts bids of 1 from non-merged bidders.

Proposition 3 *For all $k \geq \bar{k}^C$, there exists equilibrium cartel behavior that gives the firms weakly higher expected payoff if they form a cartel than in any equilibrium as a merged entity, with strictly higher expected payoff for $k \in (\bar{k}^C, \bar{k}^M)$.*

Proof. The proof follows from Corollary 1 and Proposition 2. Q.E.D.

The result of Proposition 3 is illustrated in Figure 1. It shows that the cartel can obtain the maximum payoff of $\max\{1 - \min\{x_1, x_2\}, \pi_M\}$ for all $k \geq \bar{k}^C$, while a merged entity is always held strictly below that level for $k \in (\bar{k}^C, \bar{k}^M)$.

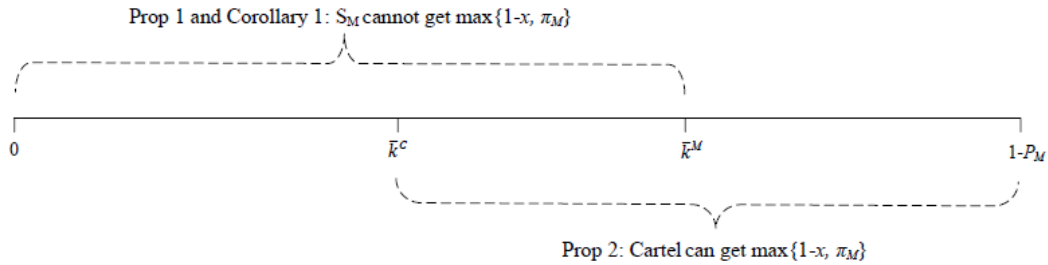


Figure 1: Illustration of Proposition 3

We have shown that there exists an equilibrium for the non-merged game such that the firms' expected joint payoff is weakly greater if they form a cartel than in any equilibrium of the merged game. We have not shown that for *all* equilibria for the non-merged game, the firms' expected joint payoff is weakly greater if they form a cartel than in *any* equilibrium of the merged game. However, focusing on threshold equilibria, we can show that the cartel's expected payoff is always weakly greater than the merged entity's expected payoff. Specifically, we focus on equilibria in which a merged entity or cartel bids either bids so as to induce the buyer to invite S_3 , or the merged entity or cartel bids either 1 or $P_M + k$, which is the maximum bid less than 1 such that it is a best reply for the buyer to accept the bid given beliefs that they are in the low-cost state. The equilibrium outcomes can be characterized by what the buyer does when it receives two bids equal to 1: accepts one of the bids, invites S_3 , or randomizes between accepting one of the bids and inviting S_3 .

Proposition 4 completes the argument that for this class of equilibria for our model, forming a cartel weakly dominates merging.

Proposition 4 *For all k , there exist equilibria for the merged and non-merged games such that a cartel with cost draws x_1 and x_2 has expected payoff greater than or equal to a merged entity with the same cost draws.*

Proof. The proof is by construction. The equilibria we construct have the feature that for low k , the buyer invites S_3 when it receives a bid of 1; for high k , the buyer accepts bids of 1; and for intermediate k , the buyer mixes between accepting a bid of 1 and inviting S_3 when it receives a bid of 1. When the buyer accepts a bid of 1, the cartel or merged entity has expected payoff $\max\{1 - \min\{x_1, x_2\}, \pi_M\}$. When the buyer invites S_3 when it receives a bid of 1, the cartel or merged entity has expected payoff $\max\{P_M + k - \min\{x_1, x_2\}, \pi_M\}$. When the buyer mixes, the cartel or merged entity has a payoff that is intermediate between the two. As depicted in Figure 2, when ξ is sufficiently small that the invitation cost thresholds are ordered as $k^C < \bar{k}^C < k^M < \bar{k}^M$, then the cartel's expected payoff is always weakly greater, and is strictly greater for $k \in (k^C, \bar{k}^M)$.

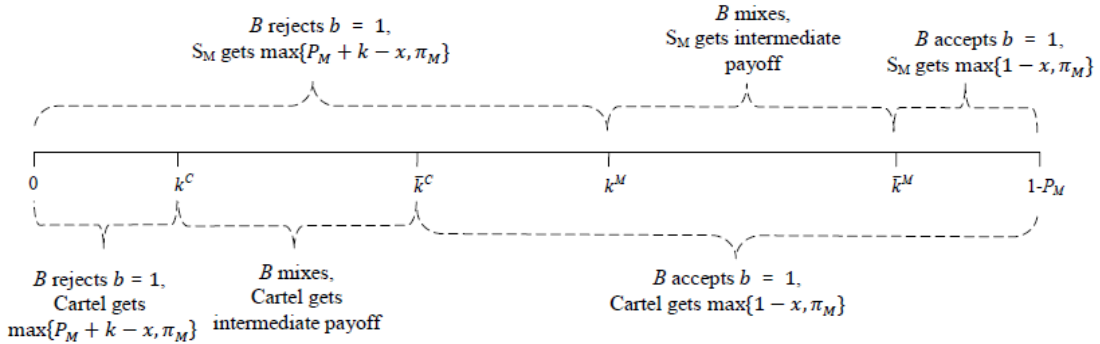


Figure 2: Illustration of equilibria for sufficiently low ξ

The result is the same when the invitation cost thresholds are ordered as $k^C < k^M < \bar{k}^C < \bar{k}^M$, depicted in Figure 3, but in that case the intervals of mixing by the buyer overlap and the result follows from the fact where the mixing intervals overlap, the probability with which the buyer accepts a bid of 1 is greater for a cartel than for a merger, intuitively because a buyer facing non-merged firms places some probability weight on their being non-cooperative, in which case bids of 1 signal the high-cost state, and in the high-cost state the buyer prefers not to invite S_3 .

For the complete proof, see the Appendix.

As we have demonstrated above, a cartel is better able to exploit the buyer's uncertainty about the state to successfully submit high bids when in the low-cost state. Additional uncertainty about the existence of a cartel leads the buyer to be more lenient in terms of accepting higher prices relative to when it faces a merged entity. Stated differently, a merged entity faces greater buyer resistance than firms operating as a cartel when the buyer is uncertain as to whether the firms are in a cartel or acting non-cooperatively.

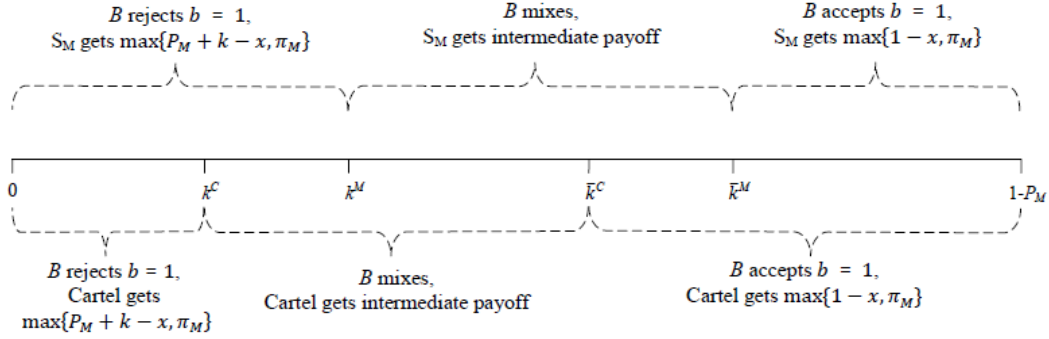


Figure 3: Illustration of equilibria for sufficiently high ξ

6 Conclusion

It seems intuitively clear that a merged entity should be able to do anything that a cartel can do, plus more, and so should be earning higher profits than a cartel. But in the late 1800s, when firms were relatively unencumbered in the choice between merging or forming a cartel, many chose to function as a cartel. For a more recent example, a steel cartel involving 17 prestressing steel producers operated a global price-fixing and market-sharing cartel between January 1984 and September 2002.²⁶ In 2002, DWK Saarstahl revealed the existence of the cartel under the EU Leniency Programme introduced that year. The cartel included Mittal Steel and Arcelor, the first and second-largest steel producers in the world, but in 2006, Mittal and Arcelor merged. Thus, it appears Mittal and Arcelor chose collusion when a merger was possible.

Whereas a merger is a publicly observed event, a cartel is a clandestine operation (even back in the late 1800s). Other non-cartel firms in an industry may know of the existence of a cartel, but the buyers who procure from colluding firms are usually uncertain of the existence of the cartel. In a model that parallels buyer procurement practices as well as the informational environment that confronts procurement participants, we show that a cartel can hide behind the possibility that they might be non-cooperative bidders to enhance their profits relative to a merged entity.

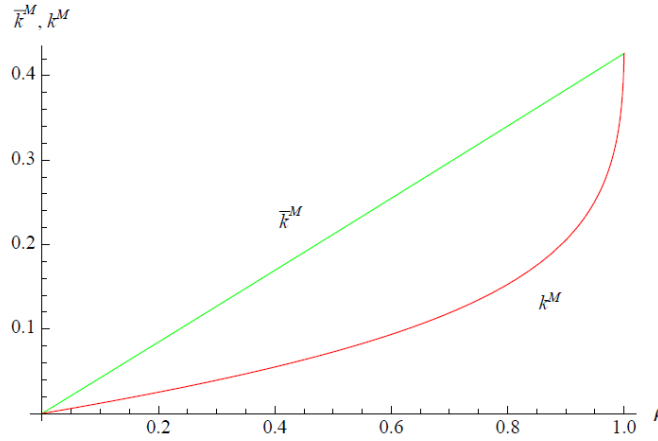
In our model, the buyer can invoke additional competitive pressure by inviting a new firm to bid in a reconducted procurement. In practice, reserving the right to void a procurement and resolicit bids is commonplace (see Appendix B).

²⁶Statements in this paragraph rely on: Case No COMP/M.4137 - MITTAL / ARCELOR, Article 6(2) NON-OPPOSITION, Date: 02/06/2006, http://ec.europa.eu/competition/mergers/cases/decisions/m4137_20060602_20212_en.pdf; and “Corrected Antitrust: Commission fines prestressing steel producers € 458 million for two-decades long price-fixing and market-sharing cartel,” Reference: IP/10/1297, Date: 06/10/2010, <http://europa.eu/rapid/pressReleasesAction.do?reference=IP/10/1297&format=HTML&aged=0&language=EN&guiLanguage=en..>

Overall, our analysis highlights the importance of accounting for strategic action by buyers during the procurement process. In practice, buyers are not passive but, rather, actively evaluate the competitive process during a procurement and make profit-enhancing adjustments to increase the policing function of competition as deemed appropriate.

A Appendix: Omitted proofs

Proof of Lemma 1. It is clear that $0 < \bar{k}^C, \bar{k}^M < 1 - P_M$. To see that $0 < k^M < 1 - P_M$, note that the left side in (2) is continuously increasing in k^M as k^M ranges from zero to $1 - P_M$ and the right side in (2) is continuously decreasing in k^M as k^M ranges from zero to $1 - P_M$. At k^M equal to zero, the right side is positive. At k^M equal to $1 - P_M$, the right side is equal to $\frac{(1-G(1-\pi_M))\rho}{(1-G(1-\pi_M))\rho+(1-\rho)}(1 - P_M)$, which is less than $1 - P_M$. Thus, k^M is well defined and $k^M \in (0, 1 - P_M)$. A similar argument holds for k^C . The result that for ξ sufficiently close to zero, $\bar{k}^C < k^M$, follows from $\lim_{\xi \rightarrow 0} \bar{k}^C = 0$ and $k^M > 0$. The result that $k^M < \bar{k}^M$ for $\rho \in (0, 1)$ follows from a numerical evaluation of the expressions as shown in the figure below.



Similar evaluation shows $k^C < \bar{k}^C$. The inequalities $k^C < k^M$ and $\bar{k}^C < \bar{k}^M$ follow from $\xi \in (0, 1)$. Q.E.D.

Proof of Proposition 2. We construct an equilibrium characterized by supplier cost thresholds $x^C \equiv 1 - \pi_M$ and $x^{nc}(k) \equiv P_{nc} + k - \pi_{nc}$ as follows: In the high-cost state, both cartel and non-cooperative sellers bid 1. In the low-cost state, cartel firms submit identical bids according to the bid function

$$\beta^C(\min\{x_1, x_2\}) \equiv \begin{cases} 1, & \text{if } x \leq x^C \\ \frac{P_M + k + 1}{2}, & \text{otherwise.} \end{cases}$$

In the low-cost state, non-cooperative firms bid according to the bid function

$$\beta^{nc}(x) = \begin{cases} \tilde{\beta}(x), & \text{if } x \leq x^{nc}(k) \\ \frac{P_M + k + 1}{2}, & \text{otherwise,} \end{cases}$$

where $\tilde{\beta}(x) \equiv \frac{1}{2(1-x)}(2(P_{nc} + k)(1 - x^{nc}(k)) + (x^{nc}(k)^2 - x^2))$, which satisfies $\tilde{\beta}(x^{nc}(k)) = P_{nc} + k$. The buyer accepts the lowest bid if it is less than or equal to $P_{nc} + k$ and accepts one

of the bids at random if both bids are equal to 1, but otherwise, the buyer invites S_3 to bid. If the buyer observes at least one bid less than 1, the buyer believes that they are in the low-cost state with probability one. If the buyer observes both bids equal to 1, the buyer believes the firms are in a cartel and that they are in the low-cost state with probability $\frac{G(x^C)\rho\xi}{G(x^C)\rho\xi+1-\rho}$. If the buyer observes at least one bid less than or equal to $P_{nc} + k$, the buyer believes that firms are non-cooperative with probability 1. If the buyer observes that both bids are equal to $\frac{P_M+k+1}{2}$, then the buyer believes firms are in a cartel with probability $\frac{(1-G(x^C))\xi}{(1-G(x^C))\xi+(1-G(x^{nc}))(1-\xi)}$ and non-cooperative with complimentary probability. For other bid combinations, which are off the equilibrium path, the buyer believes firms are non-cooperative with probability 1.

We now show that this is an equilibrium. The buyer's beliefs are consistent with Bayes' rule given the bid strategies. Given the buyer's beliefs, it is a best reply for the buyer to accept bids less than or equal to $P_{nc} + k$ and reject bids between $P_{nc} + k$ and 1. To see that it is a best reply for the buyer to accept a bid of 1, note that the buyer's expected cost if it rejects a bid of 1 is

$$\frac{G(x^C)\rho\xi}{G(x^C)\rho\xi+1-\rho}P_M+1-\frac{G(x^C)\rho\xi}{G(x^C)\rho\xi+1-\rho}+k=1+k-\bar{k}^C,$$

which is greater than or equal to 1 by the assumption that $k \geq \bar{k}^C$. To see that it is a best reply for the cartel to bid according to β^C , note that when the cartel's cost (the lowest of the two firms' costs) is x , the cartel's payoff from a bid of $P_M + k$ is $P_M + k - x$, and the cartel's payoff from a bid greater than $P_M + k$ but less than 1 is π_M , and the cartel's payoff from a bid of 1 is $1 - x$. For $x \leq x^C$, by the assumption that $k \leq 1 - P_M$, the cartel weakly prefers to bid 1 rather than $P_M + k$, and by the definition of x^C , the cartel weakly prefers to bid 1 rather than an amount between $P_M + k$ and 1. Similarly, for $x > x^C$, the cartel prefers to bid an amount such as $\frac{P_M+k+1}{2}$ that leads to S_3 being invited rather than a bid of 1, which would be accepted. To see that it is a best reply for non-cooperative firms to bid according to β^{nc} , note that $\tilde{\beta}(x)$ is the equilibrium bid function for two bidders when there is a reserve price of $P_{nc} + k$ and expected payoff of π_{nc} to each if both bids are above the reserve price.²⁷ To see that non-cooperative firm i with cost $x_i \leq x^{nc}(k)$ cannot profitably deviate by bidding 1, note that given equilibrium behavior by the other non-cooperative firm, bidding 1 results in the object either being awarded to the other bidder (if the other bidder has $x \leq x^{nc}(k)$) or S_3 being invited to bid (if the other bidder has $x > x^{nc}(k)$), which weakly decreases the

²⁷In a standard IPV procurement with a reserve price R , a bidder with cost draw $x_i = R$ bids R and therefore if $x_i \leq R$ the optimal bid $\beta(x_i) = R \frac{1-F(R)}{1-F(x_i)} - \frac{1}{1-F(x_i)} \int_{x_i}^R s d(1-F(s))$. However in the present case, a noncooperative bidder with cost draw $x_i > x^{nc}(k)$ will bid the "reserve price" $P_{nc} + k$, and therefore for $x_i \leq x^{nc}(k)$, $\tilde{\beta}(x_i) = (P_{nc} + k) \frac{1-F(P_{nc}+k)}{1-F(x_i)} - \frac{1}{1-F(x_i)} \int_{x_i}^{x^{nc}(k)} s d(1-F(s))$. Now using our distributional assumption $F(s) = s$, we obtain the desired expression.

firm's expected payoff relative to following the equilibrium strategy. Q.E.D.

Proof of Proposition 4. First consider the case of a cartel. We first prove two lemmas.

Lemma A.1 *Assume $k \leq k^C$. In Stage 1, if S_1 and S_2 have formed a cartel, then an equilibrium is as follows: In the high-cost state the firms bid 1, and in the low-cost state the firms submit identical bids according to the bid function*

$$\beta^*(\min\{x_1, x_2\}) \equiv \begin{cases} P_M + k, & \text{if } \min\{x_1, x_2\} \leq x^M(k) \\ 1, & \text{otherwise,} \end{cases}$$

where $x^M(k) \equiv P_M + k - \pi_M$. Non-cooperative bidders bid according to β^{nc} defined in the proof of Proposition 2. The buyer accepts one of the bids if both bids are equal to $P_M + k$ and accepts the low bid if at least one bid is less than or equal to $P_{nc} + k$, but otherwise, the buyer invites S_3 to bid. If the buyer observes a bid less than 1, the buyer believes that they are in the low-cost state with probability one. If the buyer observes a bid less than or equal to $P_{nc} + k$, the buyer believes it is facing non-cooperative bidders with probability one. If the buyer observes both bids equal to 1, the buyer believes they are in the low-cost state with probability $\frac{(1-G(x^M(k)))\rho\xi}{(1-G(x^M(k)))\rho\xi+(1-\rho)}$.

Proof of Lemma A.1. The buyer's beliefs are consistent with Bayes' rule given the bid strategy. Given the buyer's beliefs, it is a best reply for the buyer to accept one of the bids if both are equal to $P_M + k$ and reject bids between $P_M + k$ and 1. It is a best reply for the buyer to accept the lowest bid if it is less than or equal to $P_{nc} + k$. To see that it is a best reply for the buyer to reject a bid of 1, note that the buyer's expected cost if it rejects a bid of 1 is

$$\frac{(1-G(x^M(k)))\rho\xi}{(1-G(x^M(k)))\rho\xi+(1-\rho)}P_M + 1 - \frac{(1-G(x^M(k)))\rho\xi}{(1-G(x^M(k)))\rho\xi+(1-\rho)} + k = 1 + k - k^C,$$

which is less than 1 by the assumption that $k < k^C$. To see that it is a best reply for the cartel firms to bid according to β^* , note that when the cartel's cost is x , the cartel's payoff from a bid of $P_M + k$ is $P_M + k - x$, and the cartel's payoff from a bid greater than $P_M + k$ is π_M . By the definition of $x^M(k)$, for costs less than or equal to $x^M(k)$, it is a best reply for the cartel to bid $P_M + k$ and for costs greater than $x^M(k)$, it is a best reply for the cartel firms to bid 1. Q.E.D.

Lemma A.2 *Assume $k^C < k < \bar{k}^C$. In Stage 1, if S_1 and S_2 have formed a cartel, then an equilibrium is as follows: In the high-cost state the firms bid 1, and in the low-cost state the*

firms submit identical bids according to the bid function

$$\beta^{**}(\min\{x_1, x_2\}) \equiv \begin{cases} P_M + k, & \text{if } x \leq x^C(k) \\ 1, & \text{if } x^C(k) < x \leq 1 - \pi_M \\ \frac{P_M + k + 1}{2}, & \text{otherwise,} \end{cases}$$

where $x^C(k) \equiv \frac{P_M + k - \alpha(k)}{1 - \alpha(k)} - \pi_M$, where $\alpha(k)$ is implicitly defined by

$$k = \frac{\left(G(1 - \pi_M) - G\left(\frac{P_M + k - \alpha(k)}{1 - \alpha(k)} - \pi_M\right)\right) \rho \xi}{\left(G(1 - \pi_M) - G\left(\frac{P_M + k - \alpha(k)}{1 - \alpha(k)} - \pi_M\right)\right) \rho \xi + (1 - \rho)} (1 - P_M). \quad (\text{A.1})$$

Non-cooperative bidders bid according to β^{nc} defined in the proof of Proposition 2. The buyer accepts one of the bids if both bids are equal to $P_M + k$, or, the low bid if at least one bid is less than or equal to $P_{nc} + k$. The buyer rejects the bids and invites S_3 if the bids are greater than $P_M + k$ but less than 1. If the bids are equal to 1, the buyer accepts the bid with probability $\alpha(k)$ and invites S_3 to bid otherwise. If the buyer observes a bid less than 1, the buyer believes that they are in the low-cost state with probability one. If the buyer observes a bid less than or equal to $P_{nc} + k$, the buyer believes it is facing non-cooperative bidders to with probability one. If the buyer observes both bids equal to 1, the buyer believes they are in the low-cost state with probability $\frac{(G(1 - \pi_M) - G(x^C(k))) \rho \xi}{(G(1 - \pi_M) - G(x^C(k))) \rho \xi + (1 - \rho)}$.

Proof of Lemma A.2. First note that given $k \in (k^C, \bar{k}^C)$, $\alpha(k) \in (0, 1)$ and $x^C(k) < 1 - \pi_M$. The buyer's beliefs are derived from Bayes' rule given the bid strategy. Given the buyer's beliefs, it is a best reply for the buyer to accept one of the bids if both are equal to $P_M + k$, accept the lowest bid if it is less than or equal to $P_{nc} + k$, and reject bids between $P_M + k$ and 1. To see that it is a best reply for the buyer to randomize when it receives a bid of 1, note that the buyer's expected cost if it rejects a bid of 1 is

$$\frac{(G(1 - \pi_M) - G(x^C(k))) \rho \xi}{(G(1 - \pi_M) - G(x^C(k))) \rho \xi + (1 - \rho)} P_M + 1 - \frac{(G(1 - \pi_M) - G(x^C(k))) \rho \xi}{(G(1 - \pi_M) - G(x^C(k))) \rho \xi + (1 - \rho)} + k$$

which is equal to 1 by the definition of $\alpha(k)$. To see that it is a best reply for the cartel to bid according to β^{**} , note that when the cartel's cost is x , the cartel's payoff from a bid of $P_M + k$ is $P_M + k - x$, and the cartel's payoff from a bid greater than $P_M + k$ but less than 1 is π_M , and the cartel's payoff from a bid of 1 is $\alpha(k)(1 - x) + (1 - \alpha(k))\pi_M$. For costs less than or equal to $x^C(k)$, it is a best reply for the cartel to bid $P_M + k$. For costs less than or equal to $1 - \pi_M$ but greater than $x^C(k)$, it is a best reply for the cartel to bid 1, and for costs greater than $1 - \pi_M$, it is a best reply for the cartel to bid $\frac{P_M + k + 1}{2}$. Q.E.D.

Continuation of the Proof of Proposition 4. Combining Lemmas A.1 and A.2, there exist equilibria in which a cartel with cost draws x_1 and x_2 has expected payoff $\max\{P_M + k - \min\{x_1, x_2\}, \pi_M\}$ when $k \leq k^C$ and greater than or equal to $\max\{P_M + k - \min\{x_1, x_2\}, \pi_M\}$ when $k \in (k^C, \bar{k}^C)$. From Proposition 2, we have the result that for $k \geq \bar{k}^C$, the cartel's expected payoff is $\max\{1 - \min\{x_1, x_2\}, \pi_M\}$.

The characterization of equilibria for the merged entity is analogous, with the merged entity having expected payoff of $\max\{P_M + k - \min\{x_1, x_2\}, \pi_M\}$ when $k \leq k^M$, payoff greater than or equal to $\max\{P_M + k - \min\{x_1, x_2\}, \pi_M\}$ when $k \in (k^M, \bar{k}^M)$, and payoff $\max\{1 - \min\{x_1, x_2\}, \pi_M\}$ when $k \geq \bar{k}^M$. Note that for $k \in (k^M, \bar{k}^M)$ the mixing probability in the merger equilibrium is implicitly defined as in (A.1), but with $\xi = 1$, which implies that for a given k , in the merger equilibrium, the buyer accepts a bid of 1 with lower probability than in the no-merger equilibrium. Thus, for parameters such that there is mixing for both a cartel and merged entity, the cartel's expected payoff is greater. Q.E.D.

B Appendix: Bid rejections and reprocurments in practice

In this appendix, we review various public procurements conducted by U.S. cities and towns. As background, in these procurements the bid specifications always indicate that the city council has the right to award the contract to the lowest responsive bidder, or to reject any and all bids.²⁸ The right to reject all bids can be exercised if any of the following reasons is justified.

- All bids are found to be substantially non-responsive to the requirements of the bid documents.
- Bid documents are defective and/or incomplete.
- There is evidence of inadequate competition.
- Bid prices are unacceptably high.

In the table below, we summarize fifty recent examples of procurements that we have reviewed and in which rejection of all initial bids was officially approved by the City Council.²⁹ In some of these cases, bids were rejected because one or more bidders were deemed nonresponsive, the received bid applications were incomplete and/or contained errors. These cases are not of interest for us. We focus on the procurements in which all bids were rejected because the lowest responsive bid was unacceptably high for the buyer.

²⁸For example, see *RCW 35.23.352* (available at <http://www.mrsc.org/askmrsc/featuredinq.aspx?inq=222>), which applies to cities other than first class cities and to towns. Rejection of all bids would also be an option for first class cities.

²⁹We refer to the procurements by the name of the city. The full citations are provided in the references.

City	Project	Industry	Number of Bidders	Date	Reason for Rejection
Bellflower	Landscape Improvement	Landscaping	6	06.14.10	Bid documents may be considered defective under governing program regulations
Belmont	Overhaul and upgrade Sewer and Pump Station pumps, holding tanks, and consultants	Construction / Renovation	4	01.09.07	Not sufficient funding in project budget to award to low bidder
Belmont - 2	Sanitary Sewer Rehabilitation Ralston Avenue Pipe Bursting and Pipelining	Construction / Renovation	2	09.14.04	Two received bids exceed the anticipates costs. The City will redesign and re-advertise the project
Boise	Installation of a new digital storage and management system that will interface with Airport's existing CCTV video surveillance system to enhance security at Airport	Digital Storage and Management	3	10.19.06	Several communications, corrections, protests and appeals regarding award
City of Bainbridge Island	Winslow Wastewater Treatment Plant Project - improve the physical status of this plant	Construction	2	08.29.07	Both bids contain material errors, irregularities
Clinton	Install water and sewer infrastructure for Sampson Square Apartments	Construction	3	02.16.10	Lowest bid greater than grant funding
Concord	Off-Site Records Storage and Retrieval Services	Storage of records and city materials	5	10.26.09	Inaccuracies and misinformation reported in prepared Staff Report
Concord -2	Obtain a professional charter bus service for young campers	Transportation	5	03.23.09	Four of the bids were rejected as incomplete and the fifth bid was formally withdrawn by the vendor
Costa Mesa	Install fence around bike trail to protect property of residents	Construction	1	11.15.04	Bidder no longer could honor bid proposal prices as submitted for project; proposal is over one year old and no longer indicative of market prices
Costa Mesa -2	Roof replacement of city building	Roofing	18	02.02.10	Discrepancies with bidders in terms of contractor certification, more clarification is required in bidding documents
Des Moines	Golf Course Repairs – damaged from erosion and slope failure	Construction	2	10.11.10	Lowest bid was 53% over project estimate and exceeded project budget
Elk Grove	Street Sweeping Services	Street Sweeping	5	05.12.10	Subcontractors were not specified by the bidders
Elk Grove -2	Street widening, landscaping, lighting and traffic signal improvements	Construction	N/A	01.05.05	City decided to redesign the project: combine Segments 1,2, and 3 of project and bid as a single construction contract

City	Project	Industry	Number of Bidders	Date	Reason for Rejection
Folsom	Revitalization Project	Construction	2	07.20.09	Low bid exceeded engineer's estimate
Fort Walton Beach	Fleet Fuel Management System and Vendor-managed Replenishment Systems	Fueling	3	09.28.10	One vendor did not meet minimum requirements and was deemed non-responsive
Fresno	Delivery of Ortho Poly Phosphate Blend to the Surface Water Treatment Facility	Ortho Poly Phosphate Blend Delivery	1	05.01.07	Want to obtain greater bidder participation and lower pricing
Fresno - 2	Landscaping around City Hall and Santa Fe Depot	Landscaping	4	10.02.07	There is a reasonable expectation that additional bids will be received through a future rebid, thereby, reducing the cost of this item
Imperial Beach	Renovation of fire station	Construction	3	06.06.07	2 companies were non-responsive in their bid proposals
Inglewood	Alley reconstruction - replacement of pavement and improvement of sidewalks and curbs	Construction	10	07.28.09	Bid documents possessed irregularities and inconsistencies
Inglewood -2	Design and Construct Earth Support System; Excavation and securing of site Senior Center and Senior Residences project	Construction	6	07.14.09	Irregularities in bidding process
Lacey	Construct a treatment facility and booster station at reservoir site	Construction	5	05.24.07	Low bidder withdrew because of data errors and next apparent low bidder's value higher than engineer's estimate
Mercer Island	Island Crest Way Corridor Construction	Construction	3	06.21.10	Low bidder's bid is non-responsive because low bidder did not list electrical subcontractor
Missoula	Stripping and stockpiling topsoil, and large rocks, rough grading, earth moving, landscape contouring and removal of excess granular materials	Construction	2	6.3.09	Both bids were above the anticipated budget for this project
Monterey	Preventive and routine maintenance as well as emergency response service for elevators, escalators, wheelchair lifts, and dumbwaiters in city	Maintenance	2	08.18.09	one bid non-responsive under bidding guidelines and other bid failed to comply with a clear and stated requirement
Murrieta	Citywide Rubberized Emulsion Aggregate Slurry Seal Project	Asphalt / Paving	5	05.18.10	Low bid was non-responsive and protest filed by other company
Muskego	Renovate local pavilion	Construction	2	5.8.01	Funds budgeted are insufficient to complete the project as planned
Muskego - 2	Sewer Project	Sewage	8	01.24.84	The lowest bidder requested increasing the bid

City	Project	Industry	Number of Bidders	Date	Reason for Rejection
Naples	Sale of City's \$3,000,000.00 Redevelopment Refunding Revenue Bond	Banking. Financial Services	2	02.17.99	Staff wants to monitor interest rate environment and wait until it becomes more favorable to city
Norwalk	Rehabilitation of old senior center owned by city	Construction	16	3.4.08	City Council received protest from one of bidders that apparent lowest bidder didn't comply with bid requirement
Oakland	On-call sidewalk and curb ramp work at various city locations	Construction	2	6.30.05	Two bids received were non-responsive and did not meet the City's L/SLBE and local trucking program requirements
Pasadena	Purchase of LED Tube Lights for Various City Facilities	Lighting Supply	11	04.19.10	None of bidders deemed responsive
Piedmont	Build children's play area	Construction	3	07.19.04	Large discrepancy between architect's estimate for the base bid work versus the low bid
Pinole	Crosswalk Improvements	Construction	4	08.18.09	lowest bid was below the engineer's cost estimate, but irresponsible
Pinole -2	Information Network Technology Support Services	IT Support	2	06.15.10	Both responses were for more than double the budgeted amount
Pittsburg	Build a fire station	Construction	13	07.02.08	Low bidder's submitted bid proposal not in compliance with bid documents
Plant City	Furnishing and Installing a 12,000 Gallon Diesel Tank	Fueling	13	8.24.09	Lowest bid was above City's budget for project
Redmond	Construction of Water Conservation Demonstration Garden	Construction/Landscaping	-	8.19.03	All bids received exceed engineer's estimate
San Rafael	Tennis and Basketball Court Renovation	Construction	4	08.02.10	Lowest bid exceeded Engineer's Estimate
Santa Clarita	Build public library	Construction	26	10.12.10	Low bidder and others did not submit certain documents required
Shasta Lake	Build Native American Cultural Resource Center	Construction	7	09.08.10	Low bid exceeds available funding
Silver City	Re-roof library and replace HVAC units in library	Construction/Roofing	4	11.10.09	Town issued bid up to \$185,000 from fund but all bids exceeded this amount

City	Project	Industry	Number of Bidders	Date	Reason for Rejection
St. Helena	Remodel library	Architecture / Construction	3	01.12.10	Bid specifications were not amended, so none of the bids received could be considered complete
Suisun City	Landscaping along Bikeway	Landscaping	7	09.07.10	Lowest bid exceeded engineer's estimate
Sunnyvale	Purchase three rotary mowers for General Services. Fleet Maintenance Division	Mowers	4	10.26.10	The lowest bid was deemed non-responsive; others also contained some errors and miscalculations.
Thousand Oaks	Residential Water Service Polybutylene Replacement	Engineering/Construction	9	05.13.08	Apparent low bidder withdrew and second lowest bid exceeded estimate
Tracy	Fire Department wants to purchase Triple Combination Fire Pumper	Fire Apparatus Manufacturers	6	08.05.08	The low bid with tax was \$469,574.63, which is higher than the authorized budgeted amount of \$460,000
Tracy	Replace Dr. Powers Park Restroom	Construction	8	06.16.09	Protests by two bidders
Tracy - 2	Removal of existing flooring and installation of new flooring and related covers at Community Center	Flooring	2	06.16.09	All bids were non-responsive
Villa Park	Mesa Drive Widening & Guard Rail Project	Construction	9	12.16.08	The lowest qualified bid was approximately 44% higher than the engineer's estimate of the project.
Woodinville	Build bridge	Construction	2	06.13.05	The lowest bid exceeded engineer's estimate by approximately 30%
Woodinville- 2	Install Fire Detection and Alarm System at City Hall Annex Building	Maintenance	2	07.02.01	The lowest bid was higher than the project funding.

In our sample, it is common for the buyer (the city) to have comprehensive cost estimates of the project before soliciting bids. However, usually no formal reserve price is announced prior to bidding. It is often the case that all received bids are beyond the cost limits established by the purchasing authorities. When the lowest received bid substantially exceeds the cost estimates, the city councils typically void all initial bids and announce re-bidding.

For example, in September 2006, the City Council of Belmont procured a contract for Haskins and Hastings Pump Stations Rehabilitation. The contract was to be awarded to the lowest responsible bidder for an amount up to the engineer's estimate of \$520,000. Twelve general contractors requested bid packages, but only four submitted bids as follows: \$695,000, \$724,000, \$787,000 and \$859,000. In response to the high bids received, the city council "evaluated the bid results to determine why the majority declined to bid and why the engineer's estimate was substantially lower than the lowest bid. The contractors said that small rehabilitation jobs on old pump stations are difficult and risky. It is hard to keep the station in service throughout reconstruction and there are often unknowns that complicate the work."³⁰ The bids were thoroughly assessed by the purchasing authorities of the city. "Staff ran statistical analyses on the range and variability of the 30 separate bid items in the four bids.... In most cases, the engineer's estimate for each bid item was within the range of prices submitted by the four bidders. Staff did identify two items where the engineer's estimate was significantly lower than the bid prices.... Staff believes that these two items can be either respectively and/or redesigned to reduce their cost."³¹ On January 9, 2007, the city council approved to reject all bids and re-advertised the project in Spring 2007.

In March 2007 the City Council of Fresno publicly advertised a contract for Ortho Poly Phosphate Blend delivery. A procurement notice inviting bids was distributed to fifteen prospective bidders. Only one sealed-bid proposal was received. As described in the staff report to the city council, "Shannon Chemical of Malvern, Pennsylvania, submitted the one bid. However, Shannon Chemical's bid pricing is fifty-five percent (55%) above the current contract pricing. Other potential bidders were surveyed as to why they did not bid, and it was discovered that most of them did not stock the product.... Council may reject the one bid received, because the pricing is fifty-five percent (55%) over current pricing. The contract will be then re-bid, and Staff will take measures to assure that a greater number of bids are received. Staff is confident that lower pricing can be achieved."³²

In October 2003, the City Council of Piedmont approved the Dracena Children's Play Area project and authorized the solicitation of bids. Nine contractors picked-up the bidding

³⁰ *The City of Belmont*, p.1.

³¹ *The City of Belmont*, pp.1-2.

³² *The City of Fresno*, p.2.

documents and plans, but only three bids were received. There was a large discrepancy between the architect's cost estimate for the project and the lowest bid. According to the staff report, "the difference between the base bid architect's estimate and base bids actually received is obviously disappointing and troubling."³³ Eventually the city council decided to reject all bids, re-work the project design and specifications to lower the costs, and re-conduct the procurement in 2004.

There are a number of other cases in our sample in which all bids were rejected because they were substantially above what buyer believed to be a reasonable level. Examples include the following. The City of Folsom rejected all bids because "the lowest responsive bid was received from McGuire and Hester for \$3,737,259.80 and was \$1.55 million over the engineers estimate."³⁴ The City of Pinole rejected all bids as "both responses were more than double the budgeted amount."³⁵ The City of Clinton rejected all bids for "exceeding the funding that was allowed for the project."³⁶ The City of Piedmont rejected all bids due to "the large discrepancy between the architects estimate for the base bid work versus the low bid."³⁷ The City of Plant City rejected all bids because "the lowest bid by Fueling Components Inc. was above the City budget."³⁸ The City of San Rafael rejected all bids because "the lowest bid of \$161,232.50 is \$36,232.50 more than the Engineer's Estimate."³⁹ The City of Shasta Lake rejected all bids because "the low bid exceeds the available funding for the project by approximately \$106,000."⁴⁰ The City of Suisun City rejected all bids because "the low bid came in approximately 95% above the engineer's estimate and approved budget for this project."⁴¹ The City of Villa Park rejected all bids due to the high cost of the lowest bid. "The lowest qualified bid, received from Elite Bobcat Service, is in the amount of \$269,494.00. This is \$81,937.70 (approximately 44%) over the Engineer's (estimate)."⁴² The City of Woodinville rejected all bids because "the low bid amount for this project exceeded the engineer's estimate by approximately 30%."⁴³ The City of Des Moines rejected all bids because "the lowest bid submitted by Synergy Contracting LLC, in the amount of \$474,108.70 was 53% over the project estimate of \$310,000, and exceeded the project

³³ *The City of Piedmont*, p.1.

³⁴ *The City of Folsom*, p.3.

³⁵ *The City of Pinole - 2*, p.3.

³⁶ *The City of Clinton*, p.2.

³⁷ *The City of Piedmont*, p.2.

³⁸ *The City of Plant City*, p.1.

³⁹ *The City of San Rafael*, p.1.

⁴⁰ *The City of Shasta Lake*, p.2.

⁴¹ *The City of Suisun City*, p.2.

⁴² *The City of Villa Park*, p.1.

⁴³ *The City of Woodinville*, p.1.

budget.”⁴⁴ The city of Missoula rejected all bids as “both bids were above the anticipated budget for this project.”⁴⁵ The City of Redmond rejected all bids due to the fact that “all bids received by the City substantially exceeded the engineer’s estimate for the work involved and the construction budget for the project.”⁴⁶

In many of these cases the city councils approved rejection of all bids when there was an expectation of lower future bids. For example, the official reason for rejecting all bids by the city of Fresno in March 2007 was that “while the sole bidder was responsive, the 55% increase over previous contract pricing is considered to be excessive. There is a reasonable expectation that additional bids will be received through a future rebid, thereby, reducing the cost of this item.”⁴⁷ Likewise, the city of Lecay approved rejection of all bids because the lowest bid was in excess of the anticipated costs. The main reason for re-bidding was to “modify design changes, seek more competitive bids, and incorporate value engineering.”⁴⁸

There are cases where rejection of all bids was approved even though there was no expectation of lower future bids. In these cases, there is a large discrepancy between the expected costs of the project (from the buyer’s perspective) and the bids submitted by the sellers. However, after evaluating the received bids (sometimes via direct communication with the bidders), buyers seem to be convinced that cost are indeed higher than expected prior to bidding. For example, the City Council of the City of Belmont “evaluated the bid results to determine why there was not more competition for the contract and why the unit prices were significantly higher than anticipated. The primary reason for the lack of competition was that the project was located on very steep terrain with the depth of manholes varying from 10 feet to 30 feet.... The limited bidding response demonstrated the difficulty of the project.”⁴⁹ It was approved to redesign and re-advertise the project to save the City money. The bids received by the City of Piedmont for the Dracena Children’s Play Area project were also significantly higher than expected. According to the staff report, “the difference between the base bid architects estimate and base bids actually received is obviously disappointing and troubling. After speaking with the bidders and reviewing the bids, Phil Singer (the project consultant) has concluded that this discrepancy is based on several factors.”⁵⁰ It was decided to “re-work the project design and specifications to lower the cost of the project through value engineering and modifications.”⁵¹

⁴⁴ *The City of Des Moines*, p.1.

⁴⁵ *The city of Missoula*, p.1.

⁴⁶ *The City of Redmond*, p.1.

⁴⁷ *The City of Fresno*, p.4.

⁴⁸ *The City of Lecay*, City Manager’s Report, paragraph 5.

⁴⁹ *The City of Belmont - 2*, p.1.

⁵⁰ *The City of Piedmont*, p.1.

⁵¹ *The City of Piedmont*, p.1.

To summarize, review of the above procurement examples reveals the following phenomena: 1. When the buyer is uncertain about the cost environment, it can infer valuable information from the observed bids. 2. If the initial bids are “reasonable” then the buyer makes an award to the lowest bidder. 3. If the initial bids are providing the buyer with less surplus than expected, then the buyer voids the initial procurement and seeks additional competitive pressure. 4. If the buyer is budget-constrained, it might void all initial bids even if there is no expectation of obtaining more favorable bids.

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