

PRICE SIGNALING AND “CHEAP TALK” IN LABORATORY POSTED OFFER MARKETS

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Adam Smith’s observation that “sellers of the same trade seldom meet together ... but the conversation ends in a conspiracy against the public ...” has enjoyed widespread support among economists and has strongly influenced antitrust policy in the U.S. and many other nations.¹ More controversial, however, is the appropriate definition of a “meeting,” in terms of the type of communication that could have an adverse impact on market performance. Due to “folk theorem” considerations, theoretical predictions are imprecise when oligopolists interact repeatedly. Moreover, non-binding “cheap talk” between firms may facilitate price coordination, but this communication does not eliminate any theoretical equilibria present in the game without communication. Consequently, the impact of communication is an empirical question.

Several recent laboratory studies have assessed the impact of various forms on non-binding price signaling on market performance in posted offer markets with a small number of sellers. Unlike some earlier research featuring explicit conspiracies implemented through face-to-face verbal communication (e.g., [Isaac and Plott, 1981](#); [Isaac, Ramey, and Williams, 1984](#)), these studies of price signaling implement communication that is legal or possibly legal under U.S. antitrust law. In some cases, the type of communication implemented in the laboratory was under investigation in specific antitrust cases.²

Certain types of non-binding price communications increase transaction prices modestly in some environments. This price increase is more likely to be sustained across transaction periods when sellers compete in multiple markets simultaneously ([Cason and Davis, 1995](#)), or when the price signaling language is structured to permit repeated price change proposals and “consensus-building” agreement or disagreement signals by rival sellers ([Harstad, Martin, and Normann, 1997](#)). In many other settings, however, the positive price impact due to price signaling is transitory and declines across periods

¹ [Smith \(1937, p. 128\)](#).

² This review focuses on market games with preplay communication, rather than bimatrix games such as those studied in [Cooper et al. \(1989, 1992\)](#). In a battle of the sexes game, [Cooper et al. \(1989\)](#) find that one-way communication significantly increases the frequency of equilibrium play. [Cooper et al. \(1992\)](#) demonstrate that this one-way communication increases play of the Pareto-dominant equilibrium in a cooperative coordination game, but that two-way communication is more effective in a simple coordination game when greater risk is associated with the Pareto-dominant equilibrium.

– especially with free-form price signaling or with a very restricted signaling language (Cason, 1995; Holt and Davis, 1990).

The first laboratory study to examine a specific form of price signaling was motivated by a U.S. Federal Trade Commission (FTC) complaint against the producers of certain gasoline additives (Grether and Plott, 1984). The FTC was concerned that the advance price notification practiced by sellers in this industry, along with some other practices, had an anticompetitive impact on prices. In the field, these announcements were usually made several days prior to their required 30-day advance notice, which permitted sellers to rescind proposed price increases that were not followed by others. In this sense, the advance price notices could be interpreted as non-binding price signals.

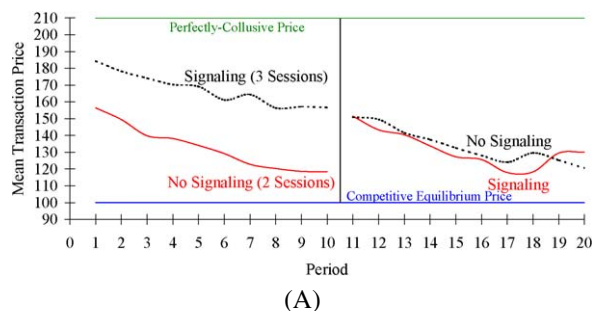
Unlike the experiments summarized below, Grether and Plott’s experiment employed human buyers, and trading did not occur using the standard posted offer institution.³ In the price announcement treatment each seller posts prices publicly, and then actual trades are executed following verbal negotiation over the telephone. All sessions employed four sellers. The results suggest that in this trading institution, the price signaling operationalized through this advance price notification increased prices. However, Grether and Plott did not attempt to isolate the impact of advance price notification, because their interest concerned how this practice interacted with other practices cited in the FTC complaint (e.g., most favored nation clauses). More recent studies have focused on identifying the marginal impact of price signaling, holding all other environmental and institutional factors constant.

1. Multi-Market versus Single-Market Competition

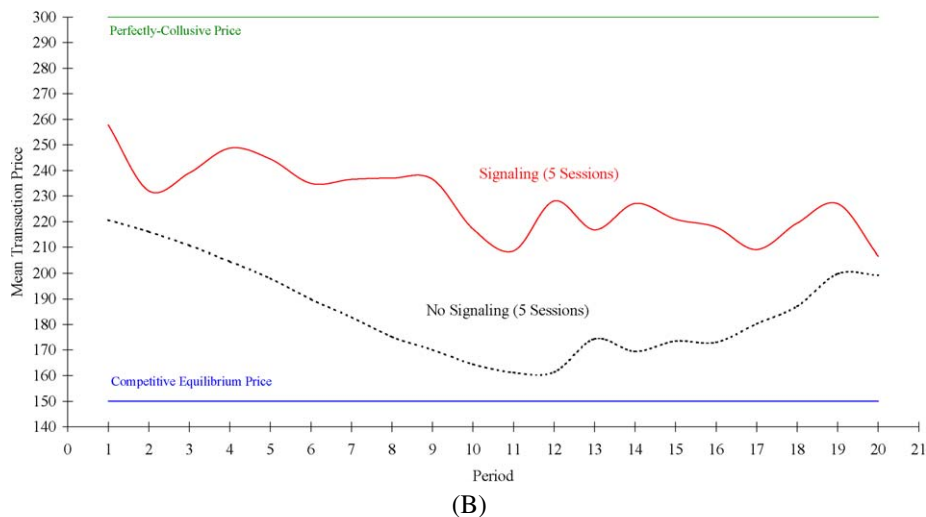
Researchers have recognized for several years that multi-market contact can facilitate collusion, because it allows sellers to exploit slack incentive constraints arising in the single-market setting (Edwards, 1955; Bernheim, and Whinston, 1990). Airlines compete in dozens (and in some cases hundreds) of city-pair markets simultaneously, and a recent antitrust case against the major U.S. airlines focused on non-binding price communications that the airlines routinely posted on their shared electronic tariff publishing system (*United States v. Airline Tariff Publishing Company et al.*, 1993). This case inspired two laboratory experiments that determine the impact of similar free-form price communications on market prices in single-market and multi-market environments.

In Cason (1995) four sellers compete in a single market, and in Cason and Davis (1995) three sellers compete simultaneously in three markets. In both studies, the baseline treatment was the standard posted offer trading institution. In the price signaling treatment, sellers were free to post public, non-binding price proposals for one or two

³ All the studies cited below employ simulated, non-strategic buyers in order to allow the seller subjects to focus on their strategic interaction with the other sellers.



Source: Cason (1995).



Source: Cason and Davis (1995).

Figure 1. (A) Single-market competition in the price signaling treatment sellers could continuously change multiple non-binding prices prior to their final posted prices; the impact of signaling is temporary when sellers compete in a single market. (B) Multi-market competition with the same continuous, non-binding price signaling rules, signaling has a more persistent impact when 3 sellers compete in 3 markets simultaneously. Prices are similar in both treatments in the final period.

minutes before submitting binding price offers.⁴ Figure 1 illustrates that in the single-market setting (Panel A), mean prices are higher with signaling only in the first ten periods. Prices decline in both treatments, and *do not* decline more slowly when signaling is permitted. Therefore, the higher prices with price signaling in the early periods

⁴ Cason (1995) employs a within-session treatment switchover design, while Cason and Davis (1995) fixes the treatment for each session and evaluates the treatment effect across sessions.

is due to the higher initial prices in this treatment. By contrast, in the multi-market setting (Panel B), mean prices are always higher in the signaling treatment. Nevertheless, the impact of price signaling appears temporary even in the multi-market setting, as the prices in the two treatments are very similar toward the end of the sessions. Unlike the field application of the airline market, in both of these laboratory studies the sellers did not develop an obvious “language of conspiracy.” Rather, conspiracies were more successful when a subset of sellers support the others with supercompetitive prices.

2. The Importance of the Signaling Language

In contrast to the free form price signaling implemented in Cason (1995) and Cason and Davis (1995), other studies have imposed more structure on the permissible price signals. Holt and Davis (1990) reports posted offer triopolies with very restrictive price signaling. Each period before sellers submitted binding price offers, one seller (chosen in sequence) made a “price announcement.” This announcement was displayed to the other two sellers, who then publicly indicated one of three possible responses: (1) *agreement* with the announcement; (2) prices should be *lower* than the announcement; and (3) prices should be *higher* than the announcement. Neither the announcements nor responses were binding. The signaling treatment was always introduced following 15 periods of trading without price signaling.

Holt and Davis find that prices increase substantially after signaling opportunities are introduced, but that this impact is temporary. Prices in the two treatments are nearly identical after about 10 periods. Similar to the single-market, free-form price communication in Cason (1995), after several periods the price signaling becomes irrelevant cheap talk. Subjects propose high, collusive prices, but submit much lower binding offer prices. Within a few periods the proposals lose credibility and are ignored.

Harstad, Martin, and Normann (1997) manipulate the price signaling language as a treatment variable. Their experiment employs four sellers in each session. In one treatment sellers publicly post free form price proposals for 30 to 120 seconds before they submit binding price offers, similar to Cason (1995) and Cason and Davis (1995). In another treatment sellers propose specific price changes, which are followed by agreement or disagreement responses by the remaining sellers. This signaling structure is similar to the Holt and Davis (1990) language, except that in Harstad, Martin, and Normann (1997) any seller can propose price changes at any time, and multiple proposals are permitted per period. This structured price signaling is intended to give the conscious parallelism theory of MacLeod (1985) the best chance of describing behavior. Sellers in these latter structured signaling sessions are then brought back for another session with free form price signaling.

Relative to their no signaling benchmark treatment, Harstad, Martin, and Normann (1997) find that free form price signaling has a small but usually temporary impact on prices. This is consistent with the earlier results summarized above. But in contrast to the one-shot structured signaling of Holt and Davis (1990), prices are higher in their

structured signaling treatment for 17 periods or longer. Prices decline slowly for 2 out of the 3 sessions in this treatment (and rise substantially beginning in period 13 in the other session), but prices typically remain above the static Nash equilibrium until the ending periods. When these subjects who have gained experience in the structured signaling treatment return for a session with free form price signaling, they tend to set prices significantly higher than the free form signaling sessions with inexperienced subjects. This suggests that they have learned some “collusive language” in their structured signaling session that translates in some way to the free form signaling environment.

3. Summary

Three main conclusions can be drawn from this experimental literature on non-binding price signaling.

1. Although price signaling often increases transaction prices, this increase is very often temporary. *Equilibrium* behavior may be unaffected by non-binding price signaling in many environments.
2. Price increases due to price signaling are more likely when sellers compete in multiple markets. Conspiracies are more successful when a subset of sellers forego short term gains by repeatedly offering supercompetitive prices.
3. The market impact of price signaling depends on the signaling language available to sellers. Very restrictive language (e.g., one price proposal by one seller per period) does not have a lasting impact on prices. By contrast, multiple-round structured signaling – in which many sellers per period can propose price changes with specific responses required of other sellers – can generate persistently higher prices compared to free form price signaling.

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