

Non-Passive Buyers in Posted-Offer Markets

Amy Moore*

Abstract

We implement posted-offer markets inspired by the experimental economics tradition to study the impact of buying alliances on market outcomes. The paper is motivated by the recent formation of purchasing alliances, and by antitrust concerns about potential anti-competitive effects of such alliances. We find that ironic as it may seem, the formation of buying alliances paradoxically tilts the equation in favor of sellers.

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* Mailing address: BU321, Southern Utah University, Cedar City UT 84761.
Phone: (435) 586-7784
Email: moore@suu.edu

1. Introduction

Recent years have seen a phenomenal growth in the formation of purchasing alliances. Advances in computer technology have enabled firms to set up complex electronic exchange systems that promise to streamline purchasing transactions and transform the operation of markets (Kaplan and Sawhney 2000). Many such horizontal buying alliances have also been set up between companies that are rivals in the marketplace.

Although purchasing alliances can reduce administrative and search costs and result in overall efficiencies (FTC 2000), the potential for collusive collaboration amongst rivals and the possibility of monopsonistic conduct raises concerns with antitrust authorities. The possibility of horizontal price-fixing arrangements that could harm suppliers can attract legal scrutiny of such alliances under the Competitor Collaboration Guidelines (DeSanti 2000).

In this paper, we study the effect of buying alliances on market outcomes using posted-offer markets inspired by the experimental economics tradition, specifically with a view to determining whether the formation of an alliance tips the balance in favor of the buyers at the expense of their suppliers. The questions we examine in this paper are: in what way does the performance of markets change when buyers are allowed to form a buying alliance? Does the formation of buying alliances adversely impact sellers' profits? Specifically, we compare key parameters such as prices, profits and efficiencies, in markets implemented the conventional way with markets where buyers are afforded the opportunity to "form an alliance."

2. Method

In our experimental setup, two sellers and two buyers interacted with each other in laboratory posted-offer markets in which sellers had market power, i.e. the Nash equilibrium prices were designed to be higher than competitive equilibrium prices. Theoretically, it is a Nash equilibrium strategy in this design for sellers to set prices higher than competitive equilibrium prices. This market design was used in order to provide a sharper test of the effect of buyer alliances.

The market power design we used is shown in Figure 1. We chose the parameters r , p_c and c_2 such that both sellers have the ability to profitably raise prices above competitive equilibrium levels¹.

We used standard posted-offer procedures (Davis and Holt, 1993) with players interacting in a non-computerized face-to-face setting. In each of the 18 posted-offer markets, two buyers and two sellers transacted for 19 trading

¹ The Nash equilibrium can be computed using the algorithmic process outlined by Holt and Solis-Soberon (1992) and Davis and Holt (1993). We chose the design parameters to satisfy $r > 3p_c - 2c_2$, the condition that ensures market power.

periods, after which an uncertain stopping rule was employed. Sellers' costs and buyers' valuations were private information.

To study the effect of buyer alliances, we used two experimental conditions: in the "buyer-alliance" markets, buyers were given an opportunity to discuss buying strategies before the start of each trading period. In the "passive-buyer" markets, each buyer played independently of the other as in a conventional posted-offer market; there was no opportunity for any kind of discussion.

Note that the buyer-alliance markets did not have a formal contractual implementation of an alliance; buyers were given the option and an opportunity to discuss their buying strategies at the start of each period. They were also instructed that the discussions were not binding on them. The sellers could see the discussions taking place between the buyers, but could not hear them. This mirrors the information-sharing conditions the FTC is wary about in real-world buying alliances.

In all markets, we used standard posted-offer procedures which included trained and supervised research assistants, the reading of instructions at the beginning of each market, a short quiz to test subjects' comprehension of these instructions, and debriefing at the end of the game. Practice sessions were also conducted as trial periods to ensure that there was no confusion about the experimental procedure in subjects' minds.

3. Findings

We compared the pattern of play on a number of parameters, the most important being prices posted by the sellers, the profits they made, the surplus enjoyed by the buyers, and the overall efficiency in the market. Further, we assessed the extent to which observed play in the two conditions conformed to the theoretical pricing distribution² for the market-power design.

Posted prices higher in buyer-alliance condition

Sellers' posted prices were significantly *higher* in buyer-alliance markets compared to the passive-buyer markets (Figure 2: $p^{s_{alliance}}=12.90$, $p^{s_{passive}}=11.25$, $p<.05$). Exit interviews and observation of players revealed that sellers in the buyer-alliance markets became uneasy during the buyers' pre-trading discussions and priced their product more aggressively, often refusing to undercut the other seller's prices. In the passive-buyer condition, sellers did not perceive the buyers as adversaries, leading to lower posted prices in the passive condition. In fact, when the buyers were passive price-takers, the

² As outlined in Holt and Solis-Soberon (1992) and Davis and Holt (1993), this design does not have a pure-strategy Nash equilibrium. The mixed-strategy equilibrium involves price randomization over the range $[(r+2c_2)/3, r]$. This mixed-strategy distribution, which is symmetrical for the two sellers, is given by $\square(p) = \{3p-2c_2-r\} / \{2p-2c_2\}$ and is bounded between $p_{min}=(r+2c_2)/3$ and r .

posted prices were even below p_{min} , the lower bound theoretically predicted under the mixed-strategy Nash distribution.

Contract prices higher in buyer-alliance markets

Buying alliances were expected to result in deflated contract prices.³ However, mean contract prices, just like posted prices, were significantly higher in the buyer-alliance condition than when buyers were passive ($p^c_{alliance}=11.88$, $p^c_{passive}=9.58$, $p<.01$).

Buyer profits *not* higher, seller profits higher in buyer-alliance condition

When buyers have an opportunity to collude, buyer profits are expected to be higher. We found, however, that buyer profits in the two conditions were not significantly different. ($\pi^b_{passive}=49.12$, $\pi^b_{alliance}=49.29$, ns). What prevented buyers from making higher profits given opportunities to form alliances? Exit interviews revealed that buyers in the alliance condition became acutely conscious of the other buyer and started competing with fellow buyers rather than with sellers alone, which adversely affected their profits. Further, as seen in Figure 3, seller profits were in fact significantly higher in the buyer-alliance condition than in the passive-buyer condition ($\pi^s_{alliance}=29.11$, $\pi^s_{passive}=19.19$, $p<.01$).

Higher surplus extracted by sellers in buyer-alliance markets

In order to analyze equity effects and explore the distribution of surplus between buyers and sellers, we calculated seller profits as a percentage of the total accrued surplus. In buyer-alliance markets, sellers extracted an average surplus of 36.76%, significantly higher than the 27.99% surplus they extracted in the passive-buyer markets ($p<.05$). We find therefore that the formation of purchasing alliances actually tilts the equation in favor of sellers. Looking at it another way, buyers extracted significantly lower surplus ($p<.05$) in alliance markets (63.24%) than in passive markets (72.01%).

Market efficiency higher in buying-alliance condition

The above results suggest that the formation of buying alliances tilts the equation in favor of sellers. Are buyer-alliance markets more efficient than passive-buyer markets? To determine this, we computed efficiency as the percentage of maximum surplus extracted. Buyer-alliance markets were significantly more efficient than passive-buyer markets ($e_{alliance}=81.67$, $e_{passive}=72.30$, $p<.01$). More units were traded in buyer-alliance markets than in passive-buyer markets, although the difference was not statistically significant ($v_{passive}=3.65$, $v_{alliance}=3.95$, $p=0.09$).

Buyer-alliance pricing closer to theoretical mixed-strategy distribution

It is interesting to assess whether players in our experimental markets followed the theoretical mixed-strategy Nash pricing distribution. Figure 4 shows

³ We use the standard definition of contract price, namely the price at which the contract for a sold unit is struck in a market. It is computed as the total revenue generated in the market for any given period divided by the total number of units sold in that period. It is different from the posted selling price since it is meant to capture the average price of a *sold* unit.

theoretical predictions as well as observed densities for both experimental conditions. Interestingly, while the theoretical prediction is that players randomize between p_{min} and r as per the mixed-strategy distribution, in general, sellers in the passive condition posted prices well below those levels. Clearly, players in the buying-alliance condition did not randomize as per the theoretical predictions either, but their observed density weight was comparatively closer to theoretical predictions.

Comparison with theoretical distribution: long-run effect

To understand the long-term effects of buying alliances, we analyzed the pattern of play for the last two-thirds of each market. Recall that demand and supply parameters were not perfectly known to the players, and hence the initial periods of the game were likely used by the players to learn these market parameters. We therefore analyzed the pattern of play for periods 6 through 19, when we expect play to have stabilized after this initial learning. As seen in Figure 5, the observed density weight for the buyer-alliance markets is closer to the Nash equilibrium predictions even in the stabilized portion of the game; the passive markets are farther away from theoretical predictions.

4. Discussion and Concluding Comments

The experimental posted-offer markets we conducted aimed to study the effect of buyer alliances on market outcomes. We were motivated by the fact that antitrust authorities are concerned about the potential anti-competitive effects of such alliances. We found, however, that overall, buyer-alliance markets were more favorable for the sellers.

Prices posted by sellers were higher in buyer-alliance markets. It was as if the very fact that buyers could “gang up” against the sellers made the sellers want to post higher prices. Mean contract prices were also higher in buyer-alliance markets. This would seem natural, since the prices posted by the sellers were higher. However, we would have expected buyers in buyer-alliance markets to withhold purchases when faced with higher posted prices, resulting in lower contract prices; this did not happen. Even though the buyers did discuss withholding strategies, the need to maximize individual profits seems to have won over the need to punish sellers for setting high prices. Recall that as per standard posted-offer protocol, if the buyers withheld purchase during a trading period, they could not make any profit on the unbought units. Hence it appears that buyers only acted in a selfish, individually-rational manner even when afforded the opportunity to align with the other buyer.

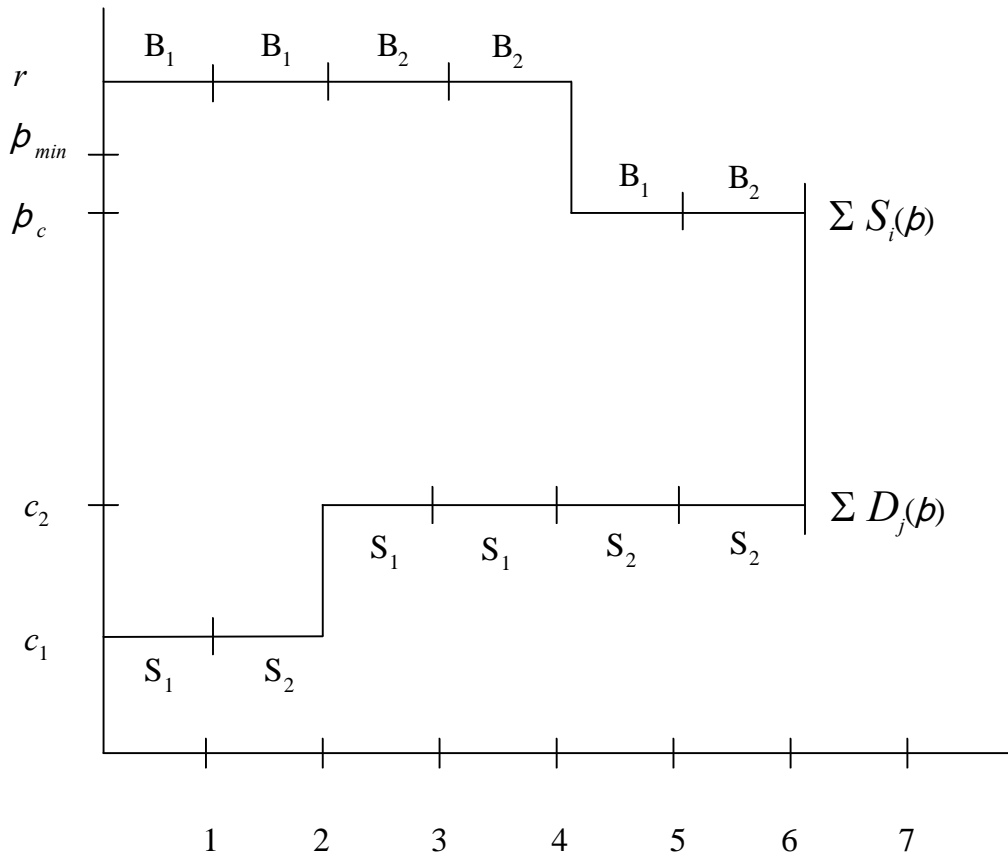
Consequently, buyer profits were lower in buyer-alliance markets compared to passive-buyer markets, although the difference was not statistically significant. Similarly, seller profits were significantly higher in buyer-alliance markets. Sellers also extracted a higher proportion of the total available surplus in buyer-alliance markets.

Finally, a comparison between the observed and theoretical pricing distributions showed that pricing frequencies in the buyer-alliance markets

followed the theoretical density function much more closely. The theoretical mixed-strategy distribution is derived under the assumption of individual rationality and per-period self-interested optimization by buyers. Thus, in the buyer-alliance markets, buyers appear to have put individual self-interest ahead of the welfare of the alliance, resulting in favorable outcomes for the sellers.

These results broadcast a consistent message that ironic as it may seem, the formation of buying alliances tilts the equation in favor of sellers, suggesting that the FTC need not be unduly concerned about the growth of buying alliances. We do acknowledge that these results are from an experimental study with all the accompanying caveats on generalizability that characterize experimental research. We see this paper as a first step in studying the paradoxical workings of buyer alliances in which market adversaries seek to forge collaborative relationships.

Figure 1



$$c_1 = 4, c_2 = 5, p_c = 10, r = 26$$

$$p_{min} = (r + 2c_2)/3 = 12$$

Figure 2
POSTED PRICES

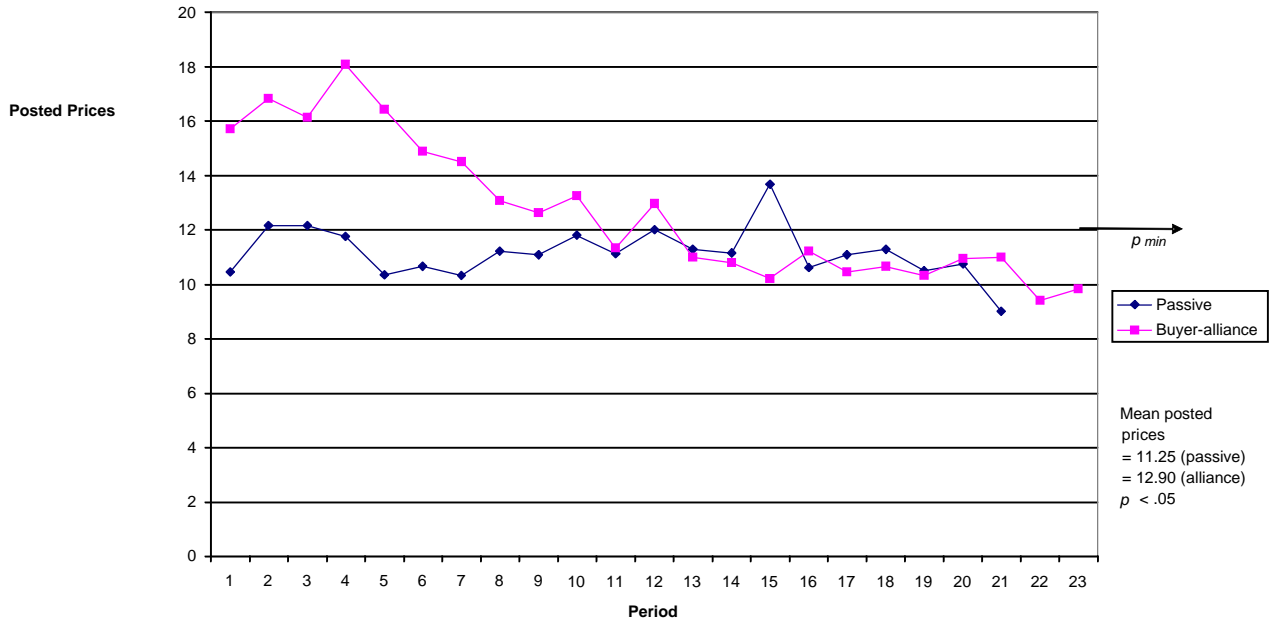


Figure 3
SELLER PROFITS

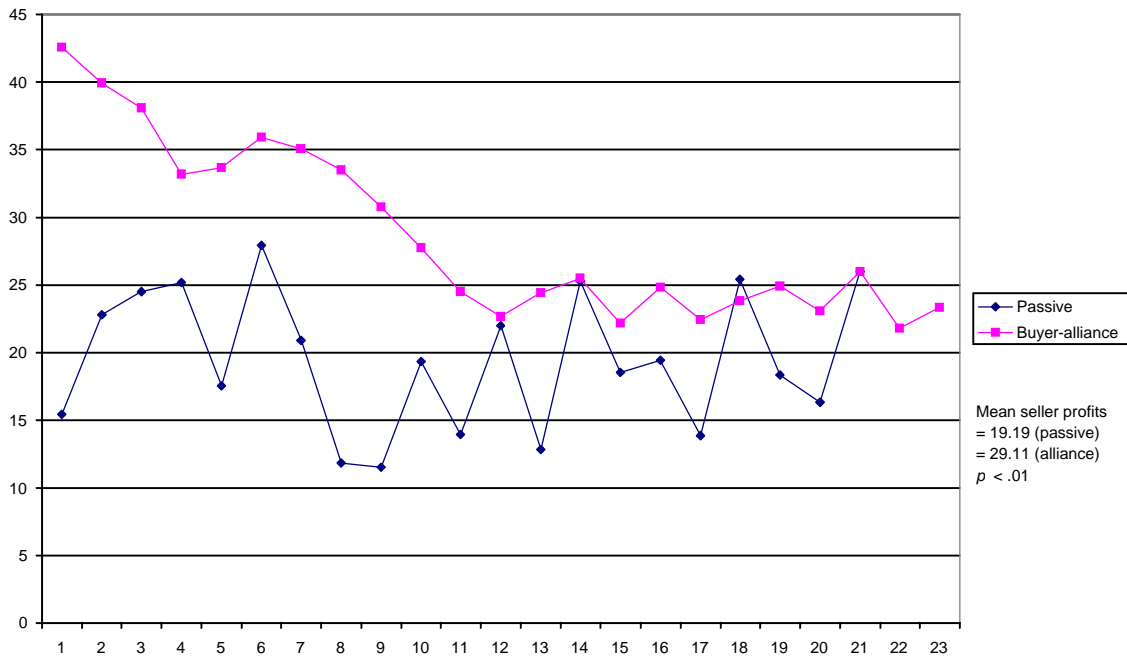


Figure 4
Density functions - theoretical predictions and observed densities

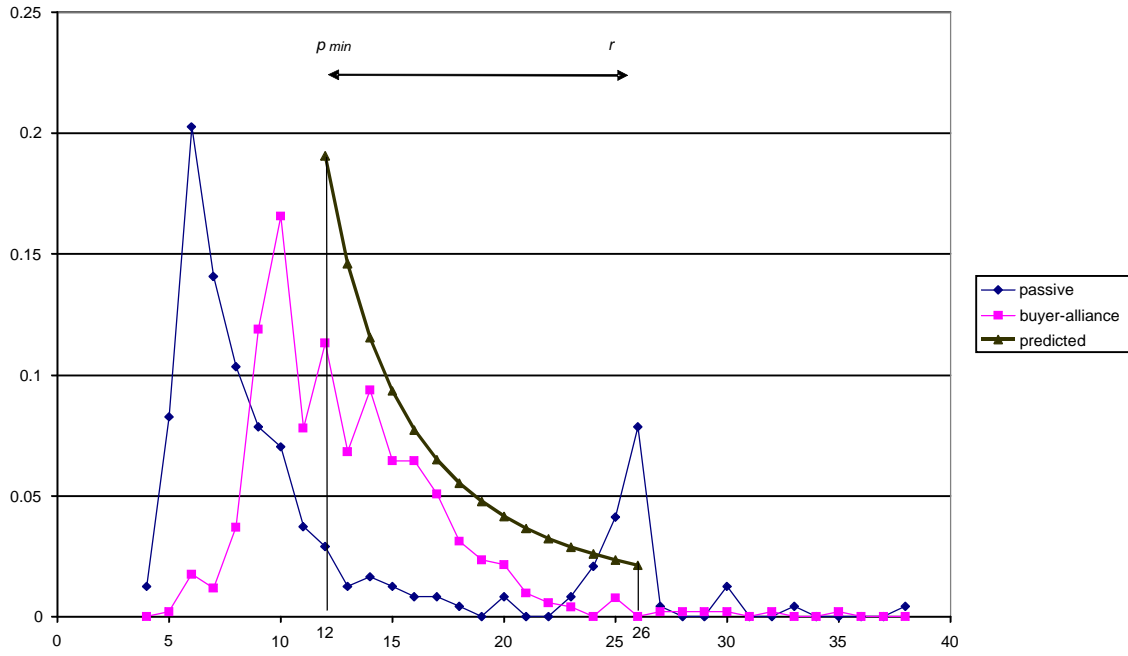
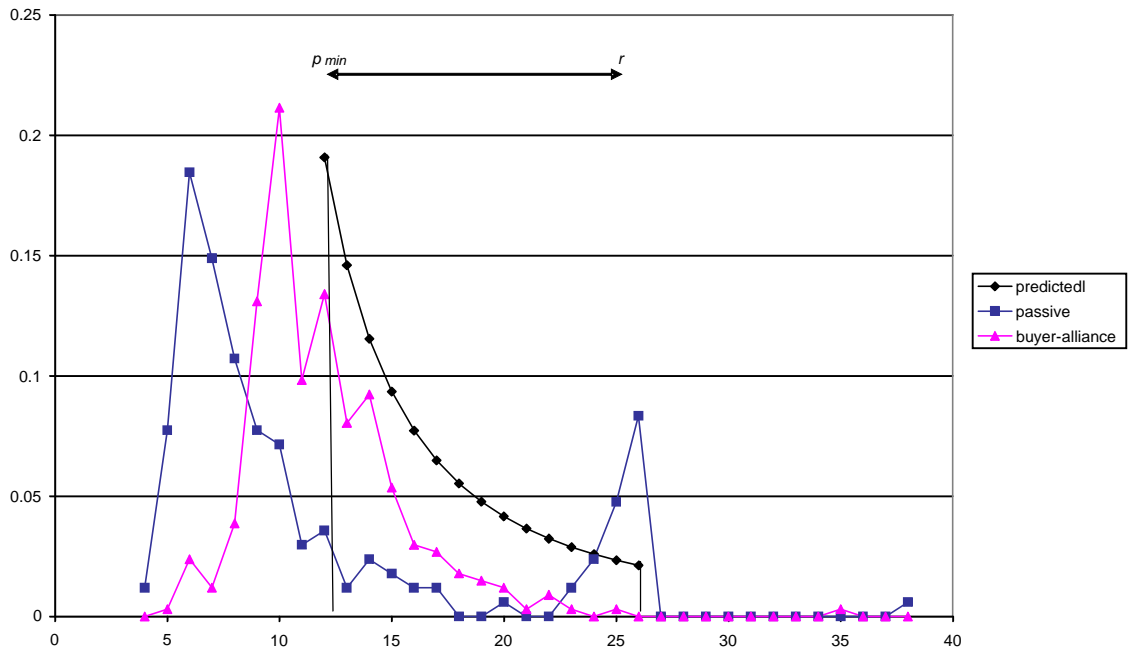


Figure 5
Density functions for long-run/stabilized play



References

- Davis Douglas D., Holt Charles A. (1993). *Experimental Economics*. Princeton University Press.
- DeSanti, Susan S. (2000). *The Evolution of Electronic B2B Marketplaces, Remarks before the Federal Trade Commission Public Workshop: Competition Policy in the World of B2B Electronic Marketplaces, June 29, 2000.*
- Federal Trade Commission (2000). "Entering the 21st Century: Competition Policy in the World of B2B Electronic Marketplaces." Federal Trade Commission Staff Report, October 2000.
- Holt Charles A., Fernando Solis-Soberon (1992). The calculation of equilibrium mixed strategies in posted-offer auctions. *Research in Experimental Economics*, Vol. 5, 189-228.
- Kaplan, Steven, and Mohanbir Sawhney (2000). "E-Hubs: The New B2B Marketplaces," *Harvard Business Review*, May-June, pp. 97-103.