HMG Review Project – Comment, Project No. P092900

This comment pertains to question 10.c (i.e., "Unilateral effects in markets with auctions or negotiations") in "Horizontal Merger Guidelines: Questions for Public Comment," FTC and DOJ, September 22, 2009. It suggests that revisions in that area could lead to a more accurate merger review process.

Bidding Competition and the UPP Test

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Introduction and summary

Farrell and Shapiro (2008) have proposed a test – called the Upward Pricing Pressure ("UPP") test – to evaluate potential unilateral effects of horizontal mergers.[2] The UPP test is based on the Bertrand model of price competition with differentiated products.[3] Accordingly, the UPP test can be applied to mergers in industries where suppliers post prices and customers choose which supplier(s) to buy from based on the posted prices.[4]

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[1] Charles River Associates, smoresi@crai.com. I benefitted from discussions with Gopal Das Varma, Steve Salop and Yianis Sarafidis. The analysis and conclusions herein represent my own views and do not represent the views of Charles River Associates. I am submitting this comment on my own and not on behalf of any client. I was not commissioned by anyone for preparing this comment.

[2] J. Farrell and C. Shapiro, "Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition," working paper, 2008. http://faculty.haas.berkeley.edu/shapiro/alternative.pdf. *See* also G. Werden, "A Robust Test for Consumer Welfare Enhancing Mergers Among Sellers of Differentiated Products," *Journal of Industrial Economics*, 44 (1996), 409-413; D. O'Brien and S. Salop, "Competitive Effects of Partial Ownership: Financial Interest and Corporate Control," *Antitrust Law Journal*, 67 (2000), 559-614.

[3] For a formal treatment of Bertrand competition, *see*, e.g., M.R. Baye and D. Kovenock, "Bertrand Competition," in *The New Palgrave Dictionary of Economics*, 2nd Edition, Eds. S.N. Durlauf and L.E. Blume (Palgrave Macmillan), 2008. http://www.nash-equilibrium.com/baye/Bertrand_Palgrave2e.pdf.

[4] For example, many retail industries fit this description relatively well.

This comment shows that the UPP test – suitably reinterpreted and properly implemented – can be applied usefully *also* in industries where suppliers set prices through bidding competition.[5]

When bidding competition resembles a "sealed-bid auction," the UPP test can be implemented using the formula of Farrell and Shapiro (2008) *provided* that one uses a definition of "diversion ratio" that is different from that used in the context of Bertrand industries.[6] Specifically, the Farrell-Shapiro formula still applies if one uses the "winning probability diversion ratio" instead of the "quantity diversion ratio."[7] In practice, however, this might not be a significant difference. In many cases, the winning probability diversion ratio is estimated across a number of bidding competitions by comparing total gains and losses in terms of customers or accounts, not in terms of the bidders' probabilities of winning a given single account.

When bidding competition resembles an "open-bid auction," the UPP test can be *approximated* using the formula of Farrell and Shapiro (2008) and a "diversion ratio" based on market shares. Specifically, that "diversion ratio" is the market share of the merging partner divided by the total market share of the non-merging firms.

The general conclusion that seems to emerge from this comment is that the UPP test proposed by Farrell and Shapiro (suitably interpreted and properly implemented) could

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[5] For a non-technical introduction to bidding competition models, *see*, e.g., P. Klemperer, *Auctions: Theory and Practice*, Princeton University Press, 2004.

[6] In bidding markets, the definition of "variable cost" is slightly different than in Bertrand markets. In particular, customer-specific "fixed costs" can be relatively large and are entirely variable since the firm incurs those costs only if it wins the customer's account.

[7] In the Bertrand model, when a firm contemplates a unilateral price increase, it assumes that all the other firms will maintain their prices constant and expand output. Following a unilateral price increase by Firm 1, the quantity diversion ratio to Firm 2 is equal to the quantity of output gained by Firm 2 (given Firm 2's price) divided by the quantity of output lost by Firm 1.

In the first-price sealed-bid auction model, when a firm contemplates a unilateral increase in its bid, it assumes that all the other firms will maintain their bidding strategies constant and thus win the auction with greater probability. Following a unilateral increase in Firm 1's bid, the winning probability diversion ratio to Firm 2 is equal to the increase in Firm 2's winning probability (given Firm 2's bidding strategy) divided by the decrease in Firm 1's winning probability.

be useful for gauging potential unilateral effects in a variety of industries.[8] In particular, the UPP test – or other "price pressure indices" – could be used, possibly together with other considerations, to establish a "safe harbor" for unilateral effects and/or a presumption of potentially adverse unilateral effects.[9]

Bidding Markets

In bidding markets, customers generally seek competitive bids from several suppliers.[10] In some cases, customers use a single round of bidding – i.e., they ask suppliers to submit "sealed bids" containing their contract offers – and then select a supplier based on the best contract offered. This type of bidding mechanism is referred to as the (first-price) *sealed-bid auction*. In other cases, customers use two or more rounds of bidding to "negotiate" price, and inform bidders about the current best offer to reduce the prices that are bid in the next round. This type of bidding mechanism is referred to as the *open-bid auction*.

Sealed-Bid Auctions

Consider a sealed-bid auction for the business of a given customer, and assume that the contract involves a fixed quantity of products and services to be delivered to the customer by the winner of the auction. The expected profit of a bidder – say, Firm 1 – takes the following form:

$$\pi_1 = (P_1 - C_1)d_1(P_1) \qquad (1)$$

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8 A companion comment shows that the UPP test (suitably reinterpreted and properly implemented) can be applied usefully also in industries with Cournot competition. *See* S. Moresi, "Cournot Competition and The UPP Test," comment to HMG review process, 2009.

9 This point is explained in more detail in S. Salop and S. Moresi, "Updating the Merger Guidelines: Comments," comment to HMG review process, 2009.

10 In bidding markets, each procurement may involve competition that is entirely distinct from that in other procurements, and thus each procurement may be considered a separate and distinct relevant market under certain conditions. These conditions include situations where products are customized according to the specifications of the particular buyer, and where such customization makes arbitrage infeasible. See, e.g., *United States v. Ingersoll-Dresser Pump Co. and Flowserve Corp*.

where P_1 is the total price for the contract offered by Firm 1, C_1 is the Firm 1's cost of fulfilling the contract, and $d_1(P_1)$ is the probability that Firm 1 will win the bidding competition. The winning probability decreases as the bid increases, i.e., $d_1(P_1)$ is a decreasing function of P_1.[11]

Note that (1) is very similar to the profit function of a firm in the Bertrand model; the firm's winning probability function in the auction model plays a very similar role as the firm's residual demand function in the Bertrand model. In addition, Firm 1's bid P_1 also affects the winning probability of each of the other bidders. For example, the winning probability of Firm 2 is higher if Firm 1 submits a higher bid. This is similar to the assumption in the Bertrand model that Firm 2's demand increases if Firm 1 raises its price. Thus, from the perspective of Firm 1, the winning probability of Firm 2 is an increasing function of P_1, denoted by $d_2(P_1)$.[12]

The first-order condition of Firm 1's profit-maximization problem is:

$$(P_1 - C_1)\frac{\partial d_1}{\partial P_1} + d_1 = 0 \tag{2}$$

If Firms 1 and 2 merge, the post-merger first-order condition for P_1 is:

$$(P_1 - (1-E)C_1)\frac{\partial d_1}{\partial P_1} + d_1 + (P_2 - C_2)\frac{\partial d_2}{\partial P_1} = 0 \tag{3}$$

[11] The winning probability function depends on the equilibrium bidding strategies of the other firms, and several other factors, including information about the costs of the other firms and the preferences of the customer.

[12] Of course, the winning probability of Firm 2 is also a function of Firm 2's bid, P_2.

where $(P_2 - C_2)$ is Firm 2's margin and E denotes the "efficiencies credit" that the Agencies would be giving to the merging parties.[13] Note that I follow Farrell and Shapiro's approach in their Equation (1) and evaluate the merger effect on Firm 1's bidding incentive assuming no efficiencies at Firm 2. I also will follow their notation and denote the pre-merger equilibrium values with an "upper bar" – e.g., $\bar{P}_i$ is the pre-merger value of P_i.

Proposition 1 In the first-price sealed-bid auction model, a merger of Firm 1 and Firm 2 creates *upward pricing pressure* on Firm 1's bid *if and only if* the following condition is satisfied:

$$\tilde{D}_{12}(\bar{P}_2 - \bar{C}_2) > E\bar{C}_1 \tag{4}$$

where $\tilde{D}_{12} = -\dfrac{\partial d_2 / \partial P_1}{\partial d_1 / \partial P_1}$ is the *winning probability diversion ratio* from Firm 1 to Firm 2.

Proof Using (2), the left-hand side of (3) evaluated at the pre-merger point is positive if and only if (4) is satisfied. ■

The above result and proof are basically the same as in Farrell and Shapiro (2008). That is, the UPP test for sealed-bid auctions (i.e., Equation (4)) involves the "same" formula as the UPP test for the Bertrand markets (i.e., Equation (1) in Farrell and Shapiro (2008)). Both tests compare the product of the diversion ratio and the margin (which gauges the anticompetitive effect from reduced competition) and the presumed reduction in variable costs (which gauges the procompetitive effect from presumed efficiencies). The margin of the merging partner (i.e., $\bar{P}_2 - \bar{C}_2$) and the presumed reduction in variable costs (i.e.,

[13] "The strength of the presumption established by the test can be adjusted—in the case of concentration measures, by choosing thresholds at which concentration evokes concern; in our case, by choosing how much credit to give for efficiencies." (Farrell & Shapiro, p. 3)

$E\overline{C}_1$) are defined in a similar way in both tests. The main difference is that each test uses a different definition of "diversion ratio."

In the sealed-bid auction model, following a unilateral increase in the bid submitted by one of the merging firms, the relevant diversion ratio is the increase in the probability that its merging partner will win the customer's account divided by the reduction in its own probability of winning that account. In practice, however, this winning probability diversion ratio is often estimated in the same way as the standard quantity diversion ratio. That is, in many cases, the winning probability diversion ratio is estimated across a number of bidding competitions by comparing total gains and losses in terms of customers or accounts, not in terms of the bidders' probabilities of winning a particular account.

Open-Bid Auctions

In an open-bid auction, the winner is the firm with the lowest cost and the equilibrium price is the second-lowest cost.[14] Consider a customer of Firm 2, i.e., Firm 2 has the lowest cost of serving that customer. Suppose that Firm 2 is constrained by Firm 1, i.e., Firm 1 has the second-lowest cost of serving that customer. Post-merger, Firm 1 will refrain from competing for that customer, and thus the equilibrium price will be determined by the third-lowest cost. Absent any information on the cost distribution across firms, one can assume that the difference between the third-lowest cost and the second-lowest cost is equal (on average) to the difference between the second-lowest cost and the lowest cost. That is, one can assume that Firm 2's margin on that customer will double post-merger as a result of the reduced competition from Firm 1. This leads to a first price effect that can be approximated to be equal to $\overline{S}_1\overline{S}_2(\overline{P}_2 - \overline{C}_2)$, where $\overline{S}_i$ is the pre-merger market share of Firm *i*. The term $\overline{S}_1\overline{S}_2$ is an approximate measure of the number of customers for whom Firm 2 and Firm 1 have the lowest cost and the second-lowest cost, respectively.

[14] I am assuming that each firm is offering products and services of comparable quality.

There also is a price effect from Firm 1's variable cost reduction induced by the merger. Consider a customer of a rival of the merged firm, i.e., the rival has the lowest cost of serving that customer. Suppose that the rival is constrained by Firm 1, i.e., Firm 1 has the second-lowest cost of serving that customer. Post-merger, Firm 1 will compete "longer" for that customer and the equilibrium price paid by the customer to the rival will decrease by the amount $E\overline{C}_1$.[15] This leads to a second price effect that can be approximated to be equal to $-\overline{S}_1(1-\overline{S}_1-\overline{S}_2)E\overline{C}_1$. The term $\overline{S}_1(1-\overline{S}_1-\overline{S}_2)$ is an approximate measure of the number of customers for whom a rival of the merging firms and Firm 1 have the lowest cost and the second-lowest cost, respectively.

It follows that the total price effect is (approximately):

$$\overline{S}_1\overline{S}_2(\overline{P}_2-\overline{C}_2) \; - \; \overline{S}_1(1-\overline{S}_1-\overline{S}_2)E\overline{C}_1 \tag{5}$$

This leads to the following result:

Proposition 2 In the open-bid auction model, a merger of Firm 1 and Firm 2 is likely to create *upward pricing pressure* through a change in Firm 1's bidding incentives if the following condition is satisfied:

$$\hat{D}_{12}(\overline{P}_2-\overline{C}_2) \; > \; E\overline{C}_1 \tag{6}$$

where $\hat{D}_{12} = \dfrac{S_2}{1-S_1-S_2}$ is the "diversion ratio" from Firm 1 to Firm 2.

Proof (5) is positive if (6) is satisfied. ■

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[15] I am ignoring the possibility that Firm 1 might become the lowest-cost firm as a result of the cost savings.