Horizontal Mergers in Spatially Differentiated NonCooperative Markets: a Comment

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We show that a merger of Cournot-Nash firms who produce spatially differentiated products and apply spatial price discrimination is unlikely to increase the profits of the merging firms. Even though the merged firm is in some sense larger than its rivals, it is unlikely to be able to translate this larger size into profit-increasing behavior unless the difference in the costs of the merging firms at the affected consumer locations is "sufficiently great". A simulation experiment indicates that the joint profits of the merging firms is positively related to the difference in their pre-merger marginal costs and to transport costs and is negatively related to the number of firms that are active at the affected consumer location prior to the merger. While such mergers always increase consumer prices, our experiments indicate that profitable mergers (which might occur) can be expected to increase prices by less than unprofitable mergers (which will not).

I. INTRODUCTION

Policy-makers' current interest in the unilateral competitive effects of horizontal mergers[1] has no doubt been motivated by the growing theoretical literature on the subject, which began with an important paper by Salant, Switzer and Reynolds (1983). One striking result of their paper was, however, that the majority of horizontal mergers among firms in the standard Cournot model are not profitable.[2] The logic behind this paradox is quite straightforward. A merger among *m* firms converts an *n*-firm market game into an n-m+1-firm market game. In the Cournot model with constant unit costs, the merged firm has no means of exploiting its potentially greater size in the post-merger game. This is problematic because a two-firm merger, by combining the assets of two firms, should in some sense be "bigger" than either the two firms were pre-merger. It was this intuition that motivated researchers to develop alternative models in which horizontal mergers among firms were profitable. For example, Perry and Porter [1985], Farrell and Shapiro [1990] and McAfee and Williams [1992] resolve the profitability paradox in the standard Cournot model by assuming that firms have increasing rather than constant marginal costs of production.

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[1] The 1992 Horizontal Merger Guidelines make an important distinction between anticompetitive mergers that facilitate collusion among firms in the industry and anticompetitive mergers that make it more profitable for merging firms to reduce output and cause market price to increase unilaterally. Baker (1996) makes a case for the growing significance of unilateral theories for policy makers.

[2] By the standard Cournot model we mean one in which firms produce a homogeneous product and have constant unit costs of production. The profitability paradox of horizontal mergers in this model is most often associated with Salant, Switzer and Reynolds (1983). However, the paradox was also shown to hold in a more general Cournot model in Szidarovzky and Yakowitz (1982).

McAfee, Simons and Williams (MSW) [1992] adopt a somewhat different approach. They argue that there is an important drawback to using a Cournot model with non-differentiated products to evaluate the unilateral effects of horizontal mergers. The drawback is that a model in which products are non-differentiated assumes away the problem of identifying what is the relevant market affected by a horizontal merger. When each firm produces the same good and the market clears at a single place, the question of "who is in the market and who is not" has little meaning. As a result the model has limited relevance to policy makers who are concerned about defining what is the relevant product and geographic market affected by a proposed merger. MSW advocate instead a *spatial* model of Cournot competition in which firms engage in price discrimination. The main contribution of their paper is to provide a simple way for policy-makers to define the relevant market affected by a merger between two firms.

The purpose of our Comment is to point out some potentially misleading aspects of using the approach proposed in MSW to evaluate the unilateral effects of horizontal mergers. First, MSW claim that a merger in the spatial Cournot model with price discrimination results in a "bigger firm" because the merged firm combines the plants of two firms. To quote: "Unlike Salant, Switzer and Reynolds [1983] a merged firm does not shut down any plants, unless a plant has strictly higher delivered cost at every location than one of the merged firm's other plants." (MSW, p. 353) This statement seems to suggest that the merger paradox characteristic of the standard Cournot model, is no longer a problem when the Cournot firms serve multiple spatially separated markets. We show, on the contrary, that the merger paradox is alive and well in the spatial Cournot model proposed by MSW. Specifically we show that, at each local market in the spatial model affected by a merger, the merging firms *lose* market share, whereas the non-merged firms, on the other hand, enjoy an increase in market share and profits in exactly the same manner as arises in the spaceless version of the model.

This prompts the question "What makes a two-firm merger profitable in the spatial Cournot model with price discrimination?" We show that for a two-firm merger to be profitable in this model it must be either a merger to monopoly, or a merger between firms with sufficiently different costs. It is cost heterogeneity alone that has any chance of generating merger profitability in the model proposed by MSW. Indeed the sole contribution of the spatial aspect of the Cournot model is that it gives a natural reason for there being cost differences between firms at local markets. More importantly, two firms competing in this version of the Cournot spatial model do not become "bigger" by merging in any important sense. The suggestion that the merged firm is "bigger" is misleading, and we believe that such a claim has the potential to create confusion about the profit incentives to merge. The point is that a majority of mergers in the MSW model, just as in the standard Cournot model, are simply not profitable.

The profitability of a two-firm merger is not an issue raised in MSW. Nevertheless it is relevant to the way they suggest policy-makers identify which local markets are affected by a merger. Specifically, MSW show how the predicted post-merger price increase in a local market depends upon the extent of competition prevailing before and after the merger. However their derivation applies to *any* two-firm merger irrespective of whether or not the merger is profitable. This is important if the price effect of profitable mergers (that we might expect to observe) differ significantly from the price effects of unprofitable mergers (that we ought not to observe). We show by means of a simulation exercise that profitable mergers do, indeed, have different predicted price changes than unprofitable ones. Without understanding what makes a two-firm merger profitable in the spatial markets it is not clear how policy-makers can "choose an acceptable price change" and apply the MSW result to define the relevant market.

The remainder of our Comment is structured as follows. In the next section we show formally that any two-firm merger in the spatial Cournot model proposed by MSW does not resolve the Cournot paradox in any local market. We also show that the profitability of a merger between two firms in a local market depends upon there being substantially different marginal costs in supplying that market. In Section III we then present the results of a simulation exercise which identifies the conditions that will typically have to be satisfied for a two-firm merger to be profitable within the MSW framework. On the basis of this simulation exercise we show that a two-firm merger which satisfies the profitability condition can be expected to have a smaller impact on price than a two-firm merger which is not profitable. This arises very simply because the profitability of a two-firm merger requires that there be a significant difference in the price-cost margins of the merging firms.

II. ANALYSIS

We begin with a brief description of the MSW model. Consumers are distributed over some two-dimensional space *S*, with demand for a homogeneous product at some location $s \in S$ given by the inverse demand function $p^s(Q^s)$. There are *n* firms who market the product. They compete at each location *s* by playing a Cournot game in quantities. The (constant) marginal costs for firm *i* in supplying consumers at *s* are c_i^s ($i = 1...n$) and may vary across firms. Firms are able to price discriminate across consumer locations without fear of consumer arbitrage, with the result that competition will be Cournot-at-every-point *s*. It follows that if a subset $n(s)$ of the *n* firms is active at location *s* then these will be the firms with the lowest marginal costs of supplying *s*, defined by the condition:

(1) $$i \in n(s) \Leftrightarrow c_i^s \leq p^s.$$

The following regularity condition, which ensures downward sloping reaction functions, is assumed to hold:

(2) $$q_i p''(Q) + p'(q) < 0.$$

Now consider a merger between two firms *i* and *j*. The firms are assumed to play a Cournot game before and after the merger. Since there are no capacity constraints in the model and firms' marginal costs at each location are constant, we can apply the analysis of Farrell and Shapiro (1990) to identify the impact of the merger at each local market *s*. Obviously, for the merger to have any impact at *s* at all both firms *i* and *j* must be active at *s* prior to the merger. Thus, for a consumer location *s* such that $i, j \in n(s)$:

Proposition 1: The merger of firms *i* and *j* will increase price at *s*.

Proof: Since the merger of firms *i* and *j* does not produce any cost synergies, Proposition 2 of Farrell and Shapiro (1990) applies. Q.E.D.

Proposition 2: The merger leads to increased output and greater profit for each firm outside the merger and active at location *s*.

Proof: Consider some firm $k \in n(s)$, which is active at *s* but is not part of the merger. The first-order condition for firm *k* pre-merger is:

$$q_k^s p'(Q^s) + p(Q^s) - c_k^s = 0 .$$

From this we can derive that:

(3) $$\frac{dq_k^s}{dQ^s} = -\frac{q_k^s p''(Q^s) + p'(Q^s)}{2p'(Q^s) + q_k^s p''(Q^s)} < 0 ,$$

given condition (2) and second-order conditions for profit maximization.

The merger will result in a decrease in the output of one of the merging firms and so, from Farrell and Shapiro (1990) Lemma, it follows that the merger decreases aggregate output Q^s. From (3) it follows that q_k^s is increased by the merger. The merger therefore results in each non-merged firm that is active at *s* prior to the merger selling more output at a higher price and so increases the profits of these firms. Q.E.D.

In the spatial Cournot model with price discrimination a merger between firms *i* and *j* will result in the complete closure of the high-cost supplier at each local market *s* that both firms serve prior to the merger. This will lead to an increase in output and profit of the remaining supplier at location *s* (Proposition 2 applies to the surviving supplier).

The closing down of the high-cost supplier at a local market in the post-merger game will of course have an impact on prices, and it is precisely the effect of profitable mergers on prices that is important to policy makers. Indeed, the question of profitability, although not raised in MSW, is crucial to how their result is used by policy-makers to define the relevant market affected by the proposed merger. MSW show that a reasonable approximation of the price increase caused by a merger of firm *i* and firm *j* at a local market *s* is: $\frac{\Delta p}{p} = \frac{S_i}{\varepsilon n(s)}$, where S_i is the market share of the higher cost firm *i*, ε is the elasticity of demand and *n(s)* is the number of firms active at the location *s* before the merger.[3] This result, however, is derived for any two-firm merger irrespective of whether it is profitable or not. Nevertheless MSW recommend that the relationship be used to identify the relevant local markets affected by a merger. To quote: "Choose an acceptable price change, which for concreteness we take to be 5%. Define the relevant market to be that area where the merger will probably cause prices to increase by at least 5%. Thus, using the heuristic of Remark 1, the relevant area is the set of locations in which the lesser market share of the two merging firms exceeds $\frac{\varepsilon n(s)}{20}$." (MSW p. 354)

What is an *acceptable* percentage price increase for a two-firm merger in the spatial Cournot model proposed by MSW? Our analysis above suggests that for a merger between firms *i* and *j* to be profitable the low-cost supplier must generate sufficient gains to offset the losses in profit of the closed down supplier. This, in turn, suggests that there must be a rather large degree of cost heterogeneity between the two firms in supplying a location. But the greater the difference in costs between the firms in supplying a location, the smaller would be the expected increase in post-merger price at that location. The next step in our analysis is to investigate this point further and to determine what degree of cost difference between firms *i* and *j* will lead to their merger increasing their joint profit in local market *s*.

Unfortunately, it is not possible to derive any really clear-cut, general results with respect to the impact of a two-firm merger on the merged firms' joint profits.[4] However, some progress can be

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[3] The relationship proven in Theorem 1 is not based on a *spatial* model. Rather the result is derived from two equilibrium conditions, one for Cournot competition among *n* firms and one for Cournot competition among *n* -1 firms. The idea here is that when firm *i* and firm *j* merge, firm *i* will no longer compete at any location where $c_i > c_j$. Hence at such a location if there were *n* firms active before the merger then after the merger there will be *n* – 1 firms, with the high cost member of the merger pair being closed down.

[4] Kamien and Zhang (1990) show that if the merger decision is endogenous then a necessary, but not sufficient condition for a merger to occur is that it be privately profitable. Gaudet and Salant (1991, 1992) show that when all firms in the market have identical costs, a necessary condition for a merger of *s* firms in an *n*-firm industry to be profitable is that a marginal contraction in output by the merged firms is profitable, which will hold if and only if $s - \alpha(n-s) < 1$ where $\alpha = (p' + qp'')/(p' - c'')$. As they note, however, this is not a sufficient condition since the merger will lead to a *non-marginal* change in the outputs of both the merged and non-merged firms. Moreover, this condition depends upon the assumption that all firms have identical costs. Levin (1990) considers firms with different but constant marginal costs. It follows from his analysis that a necessary, but not sufficient condition for a merger to increase profits is that the merged firms have more than 50% of the market prior to the merger.

made if we linearize the model by assuming that the inverse demand at each local market *s* is linear; i.e. $p(s) = a(s) - b(s)Q(s)$. The number of firms active at location *s* is, as before, *n*(*s*). Now suppose that firms $i, j \in n(s)$ merge. Without loss of generality assume that $c_i^s < c_j^s$, so that the merged firm will have marginal costs of c_i^s at location *s* in the post-merger game. We can then state the following:

Proposition 3: Given linear demand and $c_i^s < c_j^s$, a necessary condition for the merger of firm *i* and firm *j* to increase the merged firm's profit at *s* is that:

(**) $$\frac{PCM_i(s)}{PCM_j(s)} > \frac{n(s)}{\sqrt{2n(s)+1}}$$

where $PCM_h(s)$ is the pre-merger price-cost margin of firm *h* at *s*, *h*=*j*,*i*.

Proof: Profits of firms *i* and *j* prior to the merger are:

$$\pi_i(s) = \frac{\left(a(s) - (n(s)+1)c_i^s + C(s)\right)^2}{(n(s)+1)^2};\ \pi_j(s) = \frac{\left(a(s) - (n(s)+1)c_j^s + C(s)\right)^2}{(n(s)+1)^2}$$

where $C(s) = \sum_{k \in \kappa(s)} c_k^s$.

Profits post-merger, provided that no new firm enters at *s*, are:

$$\pi_i^m(s) = \frac{\left(a(s) - n(s)c_i^s - c_j^i + C(s)\right)^2}{n(s)^2}.$$

The merger increases profit if :

$$p_i^m(s) > p_i(s) + p_j(s)$$

$$\Rightarrow \frac{\left(a(s) - n(s)c_i^s - c_j^i + C(s)\right)^2}{n(s)^2} > \frac{\left(a(s) - (n(s)+1)c_i^s + C(s)\right)^2}{(n(s)+1)^2} + \frac{\left(a(s) - (n(s)+1)c_j^s + C(s)\right)^2}{(n(s)+1)^2}$$

$$\Rightarrow \frac{\left(a(s) - (n(s)+1)c_i^s + C(s)\right)^2}{n(s)^2} > \frac{\left(a(s) - (n(s)+1)c_i^s + C(s)\right)^2}{(n(s)+1)^2} + \frac{\left(a(s) - (n(s)+1)c_j^s + C(s)\right)^2}{(n(s)+1)^2}$$

$$\Rightarrow \frac{\left(a(s) - (n(s)+1)c_i^s + C(s)\right)^2}{\left(a(s) - (n(s)+1)c_j^s + C(s)\right)^2} > . \frac{n(s)^2}{2n(s)+1}$$

The price-cost margin for firm *k* prior to the merger is:

$$PCM_k(s) = \frac{a(s) - (n(s)+1)c_k^s + C(s)}{p(s)},$$

and so the result follows. Q.E.D.

Observe that $n(s)/\sqrt{2n(s)+1} > 1$ for all $n(s) \geq 3$. It follows then that a two-firm merger, which is not a merger to monopoly, will be profitable at local market *s* only if the difference in marginal costs of the merging firms is "sufficiently great" as defined by Proposition 3. Further, since $n(s)/\sqrt{2n(s)+1}$ is increasing in $n(s)$, the required difference in costs will be *greater* the *more* firms there are active at *s* prior to the merger. For example, if $n(s) = 3$ there will need to be at least a 13.3% difference in the pre-merger price-cost margins of the two firms while if $n(s) = 5$ this increases to a 51% difference in price-cost margins.

Of course, for the two-firm merger to be profitable in the aggregate, it is not necessary that the merger increase profit at *every* local market *s*. Overall losses at some locations may be offset by overall gains at others. To order to investigate the aggregate profitability of a two-firm merger in the spatial Cournot model with price discrimination we undertake a simulation experiment, the results of which are presented in the next section.

III. A Simulation Experiment

For our experiment we assume that consumers are uniformly distributed over the nodes of a 10x10 grid. Consumer demand at each node *s* in the grid is linear and given by the inverse demand function $p(s) = 1 - Q(s)$. Suppose that prior to any merger five firms are located on the consumer grid. Each firm has constant marginal costs c_i ($i = 1,..,5$) and incurs the same transport cost *t*, which we assume is linear in quantity and distance in supplying the consumer locations. For simplicity we assume a rectangular distance metric, so that the transport cost per unit incurred by a firm located at grid reference (k,l) in supplying consumers located at grid reference (m,n) is $t(|k-m|+|l-n|)$. In each simulation the location of firm *i* is a pair $[i_1,i_2]$ where i_1 and i_2 are each drawn from the uniform discrete distribution [1,...,10].[5] Marginal costs for each firm and transport costs for all firms are drawn from the continuous uniform distributions $[0,\bar{c}]$ and $[0,\bar{t}]$.

[5] As in MSW we make no assumptions about the equilibrium nature of the firms' locations pre- and post-merger. Our model is a slight variant on MSW in that MSW assume that each firm has n_i plants, each of which has its own

This specification of the model is used to calculate the Cournot-Nash prices, quantities and profits for each firm at each location. We then assume that firms 1 and 2 merge (since the firms are randomly located, this imposes no constraints on the results) and calculate the post-merger Cournot-Nash prices, quantities and profits. In doing so, we consider two cases as in MSW. For the first case, we assume that there is no post-merger entry at any consumer location affected by the merger. In the second case we allow for the possibility that the merger could induce one of the non-merged firms to supply a particular location that it was not able to supply prior to the merger. Since there is very little difference between these two cases, we confine our comments below to the second "with entry" case because this seems to be a more reasonable description of the post-merger market equilibrium. Each experiment consists of 500 simulations.[6]

Table 1 describes the "data" we generated from each experiment. These data were used to examine the relationship between the profitability of a two-firm merger and various market characteristics. The results of the simulations are summarized in Tables 2-4. Table 2 indicates, as we would expect from our analysis of the previous section, that the likelihood that a two-firm merger is profitable increases with both $\bar{c}$ and $\bar{t}$. When $\bar{c}$ is "high" there is a greater chance that the difference in the marginal costs of the merging firms will be sufficient to satisfy condition (**) of Proposition 3. In addition, high marginal production costs reduce the number of consumer locations that a firm can profitably supply and so reduce the average value of $n(s)$, again increasing the chance that condition (**) will hold at a sufficiently great number of consumer locations for the merger to be profitable. When $\bar{t}$ is "high" similar effects hold. Even if the merging firms have the same marginal production costs, high transport costs increase the cost advantage and so the price-cost margin of firm 1, for example, relative to firm 2 in the consumer locations nearer to firm 1. Furthermore, a high transport cost reduces the number of consumer locations that a firm can profitably serve, that is, reduces $n(s)$.

(Tables 1 and 2 near here)

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costs, whereas we assume that each firm has a given location and serves an endogenously determined number of consumer locations.

[6] The calculations were performed using MATLAB®. The program and full details of these and the other results reported below are available from the authors on request.

We use regression analysis to investigate further the market conditions that are likely to lead to a two-firm merger being profitable. The dependent variable is denoted RATME, the ratio of aggregate joint post-merger to pre-merger profits of the merging firms where the aggregation is over the consumer locations they both serve prior to the merger. Recall that the merger affects only those consumer locations at which both firms are active prior to the merger. We would expect this ratio to be positively related to the difference in marginal production costs of the merging firms (DMC), negatively related to the number of firms that are active at the affected locations (TNCOMP) and negatively related to transport costs (TRV). The results summarized in Table 3 support these hypotheses.[7]

(Table 3 near here)

The distance between the plants of the merging firms (DISTM) also affects the profitability of a merger but as can be seen, the nature of this relationship change with the transport cost variable. There is a simple intuition for this change in sign. At low transport costs there is likely to be extensive market overlap between the merging firms, no matter where they are located. For the merger to be profitable it is necessary that there be a significant cost difference between these firms over a reasonable proportion of their joint consumer locations. This is more likely to be the case when the firms are some distance from each other. By contrast, when transport costs are high we have already noted that this will, of itself, generate a difference in price-cost margins. However, the firms are less likely to share markets and so be able to benefit from the merger unless they are located close to each other.

A two-firm merger always increases the profits of the non-merged firms, as we would expect from Proposition 2. However, our experiments suggest, as illustrated in Figure 1, that the non-merged firms gain less relative to the merged firms, the more profitable is the merger. Indeed, there are cases where the percentage increase in profits of the two merged firms exceeds that of the non-merged firms. This should not be surprising given our discussion of the regression results, since a merger is more likely to be profitable when the merged firms face very few competitors in the affected local markets.

(Figure 1 near here)

We now turn to the impact of a two-firm merger on consumer prices. In each simulation we calculated the average price increase caused by the merger at the consumer locations affected by the merger. Figure 2 presents a typical scattergram of the relationship between a merger's impact on joint profits of the merging firms and its effect on average prices. The mean price increase for each experiment is given in Table 4: the top entry in each cell is the mean price increase induced by unprofitable mergers while the bottom entry is the mean price increase induced by profitable mergers.

(Figure 2 and Table 4 near here)

We can see from this experiment that profitable mergers can be expected to have a *smaller* impact on prices than unprofitable mergers. The latter result, in particular, should not be surprising from our analysis of section II, given that profitable mergers require a significant difference in the price-cost margins of the merging firms.

Our investigation of what underlies profitability of horizontal mergers in the spatial framework proposed by MSW casts some doubt about whether this model is in fact a suitable one for evaluating the unilateral effects of horizontal mergers. The only factor that will lead a two-firm merger in this model to be profitable is if there is significant degree of cost heterogeneity between the merging firms. Moreover, the greater is the number of firms that are active prior to the merger, the larger this difference in costs must be. More specifically, in a local market s, the difference in cost between the high cost supplier, who will no longer supply s in the post merger game, and the low cost supplier, who does, must be greater the greater is $n(s)$, the number of the firms active in the pre-merger game. This in turn means that for a profitable merger the expected

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[7] In the interests of brevity we report only two of the sets of regression analyses. The number of "observations" is less than 500 since we omit simulations in which firms 1 and 2 do not interact in any markets prior to the merger, in which case, of course, the merger would have no effect.

price increase is smaller the larger the number of active firms. This relationship undermines the applicability of MSW's result to the question of market identification.

IV. Conclusions

The market impact of horizontal mergers continues to be a central issue in antitrust policy and enforcement. How the relevant market is defined and the estimated effect of the merger on market price critically affects the court's ruling in such cases. It is hard to find an area of public policy where the theory of industrial organization is more needed. Unfortunately, our theory of horizontal mergers is not yet quite up to the task. The standard Cournot model of quantity competition is beset by the paradoxical result that the majority of horizontal mergers are unprofitable. Moreover, horizontal mergers in a Cournot model generally have stronger beneficial effects on those firms that stay outside the merger than on those who merge. The drawback to the Cournot model is that the merged firm is unable to take advantage of its potentially greater size: since there are no capacity constraints in the model.

McAfee, Simons and Williams (1992) suggest that one means by which Cournot firms might become "bigger" than their rivals is if the firms operate in spatially differentiated markets and employ spatial price discrimination. In this kind of setting, a two-firm merger is unlikely to result in the complete elimination of one of the merging firms. Rather, in the post-merger game the merging firms will rationalize their operations by allocating demand at each consumer location that they both served prior to the merger to the lower cost plant for that location. They propose this model to be a more useful one for policy-makers to evaluate the unilateral effects of horizontal mergers.

However, we have shown in this Comment that the McAfee/Simons/Williams version of the spatial Cournot model with price discrimination does not resolve the merger paradox in any fundamental manner. While the merged firm may, indeed, be larger than its rivals in aggregate, there is no increase in market power that comes with the increased size. Rather, at each consumer location affected by a merger the consumer price is increased, the merging firms lose market share and the non-merged firms enjoy an increase in market share and profits. By contrast, the merging firms see their profits increase at these consumer locations only if the difference in their costs prior to the merger is "sufficiently great", with the required difference in costs being greater the greater the number of firms that are active at these locations. Indeed, the *only* reason that a merger increases the profits of the merging firms is if their costs are different so that they can eliminate the higher cost supply source.

The simulation experiment that we performed to mimic the McAfee/Simons/Williams model produces results that are consistent with these arguments. We show that the profitability of a two-firm merger in a market containing five spatially differentiated firms is positively related to the difference in the merging firms' marginal costs and the transport costs that they incur in supplying consumers. It is negatively related to the number of firms that are active at the consumer locations affected by the merger. The simulations also indicate that because of the required degree of cost heterogeneity between the firms that merge the impact of a profitable merger on consumer price is likely to be relatively small. This indicates that the price equation derived in McAfee/Simons/Williams is likely to be biased upwards since it is *not* confined solely to profitable mergers.

The natural question that arises is where we go from here in our attempts to understand the unilateral effects of horizontal mergers. Daughety (1990) suggests one approach that has some promise. If a merger results in the behavior of the merging firms changing from Cournot to Stackelberg then *any* two-firm merger will be profitable and many such mergers will actually reduce the prices that consumers have to pay.[8] It would be a simple matter to incorporate such behavioral changes into the spatially differentiated model. What is missing, however, is a convincing story of how the merging firms might be able credibly to change their behavior in this way.

[8] Formally, Daughety considers a situation in which the market contains *N* firms with identical costs, of which some subset *M* are merged firms. The merged firms play Cournot against each other but as a group play Stackelberg against the remaining firms. Daughety thought that two-firm mergers would be profitable up to some limit on the size of the leadership group but it is easy to show that the joint profits of *any* two firms in the non-merged group of followers will be increased if they merge to join the group of leaders.

An alternative approach would be to maintain Cournot behavior and spatial differentiation but to relax an important assumption of the McAfee/Simons/Williams model: that the merger has no impact on the locations of the merging firms other than by these firms rationalizing output across the various operating units. What we might imagine instead is a two-stage location/quantity game in which the merged firms can exercise a leadership role in the post-merger first stage location game rather than in the second-stage quantity subgame. This requires, of course, that we develop a model of equilibrium location choice pre- and post-merger, a far from trivial matter. Nevertheless, it seems reasonable to suppose that the ability to exercise location leadership might be sufficient to result in two-firm mergers being profitable provided that there are not “too many” firms in the market.

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Table 1: "Data" from the Simulation Exercise

Variable Name	Description
profme	ratio of post- to pre-merger profits for the merged firms aggregated over the consumer locations affected by the merger
profnme	ratio of post- to pre-merger profits for the non-merged firms aggregated over the consumer locations affected by the merger
tprofm	profit of the merged firms prior to the merger aggregated over the consumer locations affected by the merger
tprofmp	total profit of the merged firms post-merger aggregated over the consumer locations affected by the merger
tprofnm	total profit of the non-merged firms prior to the merger aggregated over the consumer locations affected by the merger
tprofnmp	total profit of the non-merged firms post-merger aggregated over the consumer locations affected by the merger
trv	unit transport costs
MC	marginal costs of the five firms
dmc	difference in marginal costs of the merging firms
L	locations of the five firms
distm	distance between merging firms
tncomp	total number of pre-merger firms active at the consumer locations affected by the merger
act	total number of consumer locations at which the merged firms are active prior to the merger
int	number of consumer locations at which both merged firms are active prior to the merger
mktover	ratio of int to act
mshare1	number of consumer locations at which firm 1 is active after the merger
mshare2	number of consumer locations at which firm 2 is active after the merger
avpact	average pre-merger consumer price at consumer locations affected by the merger
avpactme	average post-merger consumer price at consumer locations affected by the merger
pratio	mean post- to pre-merger price ratio at consumer locations affected by the merger

Table 2: Proportion of Two-Firm Mergers that are Profitable

		$\bar{c}$					
		0.25	0.30	0.35	0.40	0.45	0.50
$\bar{t}$	0.025	.206	.365	.405	.476	.527	.607
	0.050	.310	.378	.501	.536	.610	.633
	0.075	.462	.573	.605	.663	.725	.773
	0.100	.579	.667	.702	.739	.743	.787
	0.125	.622	.672	.727	.799	.780	.844

Table 3(a): Regression Results: $\bar{c}$ = 0.30; $\bar{t}$ = 0.025

Regression Statistics	
Multiple R	0.718741525
R^2	0.51658938
Adjusted R^2	0.512667184
Standard Error	0.05025801
Observations	498

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	1.330720311	0.332680078	131.7092311	1.9602E-76
Residual	493	1.245252721	0.002525868		
Total	497	2.575973032			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.874322297	0.015649789	55.86799368	2.1028E-215	0.843573812	0.905070782
dmc	0.668704657	0.03533	18.92738903	1.86301E-60	0.599288769	0.738120545
distm	0.001861517	0.000654803	2.84286703	0.004656475	0.00057497	0.003148065
tncomp	-4.6371E-05	2.38889E-05	-1.941111014	0.052814342	-9.33076E-05	5.65569E-07
trv	1.355830867	0.352710028	3.84403833	0.000136867	0.662831159	2.048830574

Table 3(b): Regression Results: $\bar{c}$ = 0.40; $\bar{t}$ = 0.100

Regression Statistics	
Multiple R	0.509306115
R^2	0.259392719
Adjusted R^2	0.253035575
Standard Error	0.042123448
Observations	471

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	0.28960333	0.072400833	40.80334149	2.52603E-29
Residual	466	0.826863358	0.001774385		
Total	470	1.116466688			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	1.001091025	0.011159776	89.705294	4.0168E-296	0.979161307	1.023020744
dmc	0.086398108	0.021302555	4.055762709	5.85722E-05	0.044537141	0.128259074
distm	-0.002044877	0.000622332	-3.285831417	0.001093538	-0.003267802	-0.000821953
tncomp	-8.84038E-05	2.07991E-05	-4.250372996	2.57902E-05	-0.000129275	-4.75322E-05
trv	0.372987554	0.108078809	3.451070176	0.000609201	0.160605356	0.585369751

Table 4: Ratio of Mean Post-Merger to Pre-Merger Prices[a]

		$\bar{c}$					
		0.25	0.30	0.35	0.40	0.45	0.50
$\bar{t}$	0.025	1.0661	1.0589	1.0628	1.0562	1.0630	1.0720
		1.0307	1.0259	1.0259	1.0259	1.0272	1.0268
	0.050	1.0531	1.0490	1.0546	1.0498	1.0505	1.0521
		1.0337	1.0312	1.0300	1.0298	1.0285	1.0313
	0.075	1.0535	1.0490	1.0511	1.0500	1.0473	1.0490
		1.0383	1.0357	1.0336	1.0317	1.0301	1.0294
	0.100	1.0528	1.0453	1.0427	1.0456	1.0448	1.0449
		1.0389	1.0346	1.0325	1.0311	1.0305	1.0294
	0.125	1.0506	1.0440	1.0467	1.0416	1.0386	1.0415
		1.0400	1.0357	1.0334	1.0322	1.0306	1.0302

Notes: a - The top entry in each cell is the mean price increase for unprofitable mergers and the bottom entry is the mean price increase for profitable mergers.

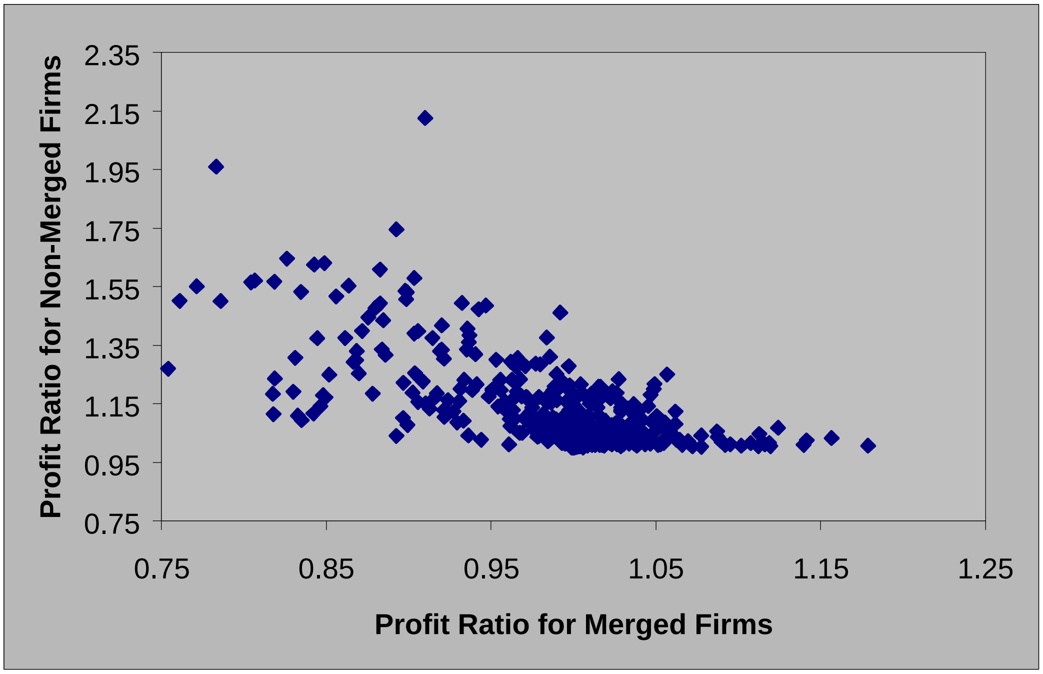

Figure 1: Impact of Merger on Merged and Non-Merged Firm Profitability

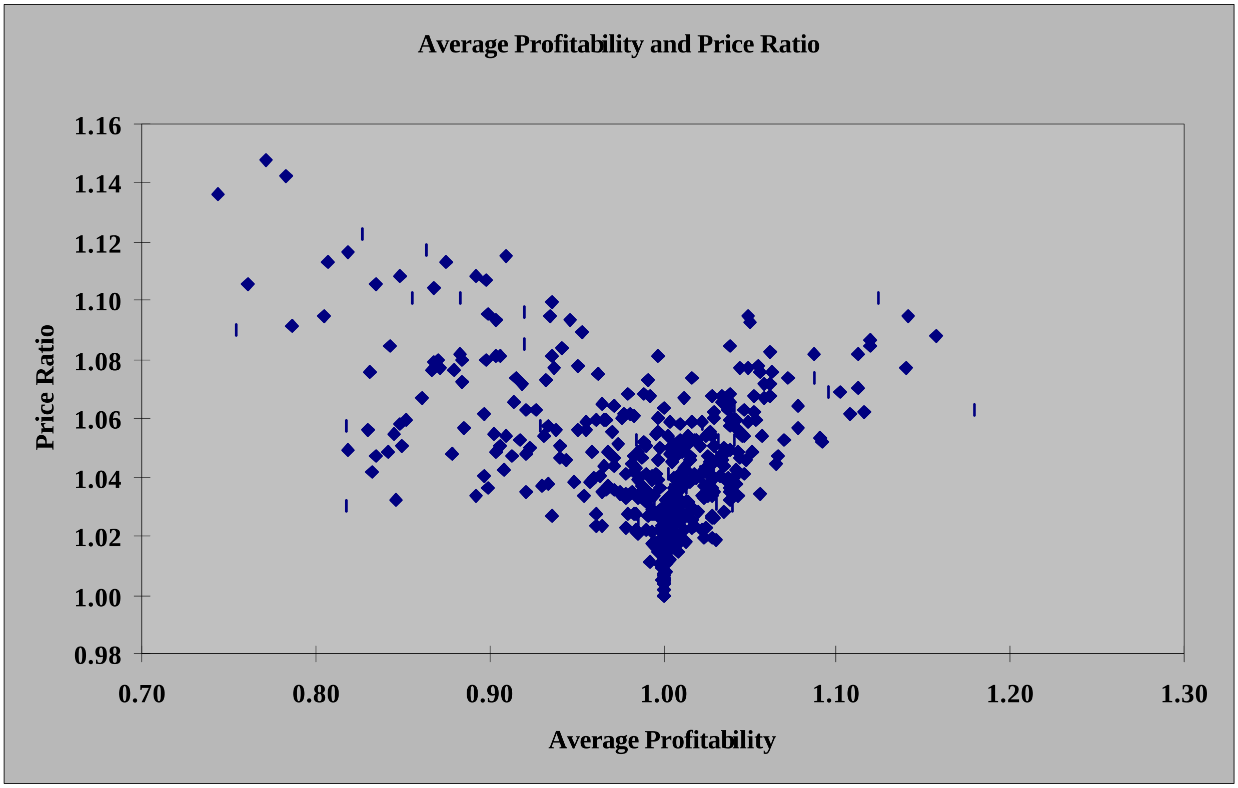

Figure 2: Price Impact of a Two-Firm Merger