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Equivalent tests for mergers in homogeneous goods industries

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Abstract

We show the equivalence of two tests that can be used to determine if a merger is not likely to cause a price increase in homogeneous goods industries. In addition, we discuss the advantages of one test over the other.

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1. Introduction

Mergers are motivated by two forces that have different effects on consumer welfare. On the one hand, mergers reduce the number of competitors and presumably tend to increase market concentration and price. On the other hand, merged firms have a chance to share good practices and technology. This process may lead them to innovate and, consequently, reduce production costs.

Several articles in the literature explain that mergers may increase welfare despite increasing market concentration or price. However, antitrust agencies are usually concerned about mergers that may lead to a price increase. In this sense, Froeb and Werden (1998) propose an ingenious test to detect whether a merger increases the price or not in the context of Cournot oligopoly for fairly general demand and cost functions. More precisely, they say that this test is valid for demand and cost functions that guarantee the existence of a unique equilibrium. Given that the test is relatively simple and robust, Goppelsroeder, Schinkel and Tuinstra (2008) further propose to complement the Herfindahl-Hirschman Index (HHI) analysis required in the merger guidelines with an extension of FW test to discriminate between mergers that should be approved and those that require further study.

In this communication, we show that FW test for mergers is actually equivalent to a test proposed earlier by Farrell and Shapiro (1990). However, we will argue that FS test is simpler to calculate and understand than FW test, as well as easier to extend to any number of merged firms.

2. Model

As in Froeb and Werden (1998), consider an industry with n firms that produce the same good. Suppose that firm i with cost function $C_i(q_i)$ produces q_i units of the good. Suppose also that firms sell their production at the market clearing price $p(Q)$, where $Q = \sum_{i=1}^{n} q_i$. It follows that the profit function of firm i is

$$p(Q)\cdot q_i - C_i(q_i). \tag{1}$$

Following the notation in Froeb and Werden (1998), define $c_i \equiv \frac{\partial C_i}{\partial q_i}$, $\varepsilon \equiv \left|\frac{\partial Q}{\partial p}\cdot\frac{p}{Q}\right|$ and $s_i \equiv \frac{q_i}{Q}$. The first order condition for profit maximization of firm i implies then that

$$p\left(1-\frac{s_i}{\varepsilon}\right) = c_i . \tag{2}$$

This condition should be satisfied by any firm both before and after the merger. Froeb and Werden (1998) point out that (2) remains intact for firms not involved in the merger as long as the price remains unchanged. The idea is simple. If the price is the same after the merger, then elasticity and total production are also the same (*i.e.*, ε and Q do not change after the merger). Similarly, given that the firms are not involved in the merger, then the marginal costs of these firms should not change. It follows that market shares should not change either.

Let *M* denote the subset of firms involved in the merger. Let s_F and c_F denote the post-merger market share and marginal cost, respectively, of the merged firm. Again, if the price remains unchanged, it is not difficult to see that $s_F = \sum_{i \in M} s_i$. That is, the market share of the merged firm equals the sum of the original market shares of the firms involved in the merger. Finally, given that equation (2) should be satisfied by the merged firm to keep the price unchanged, it follows that a merger will not cause a price increase as long as

$$p\left(1 - \frac{s_F}{\varepsilon}\right) \geq c_F . \tag{3}$$

This is FS test. It was proposed by Farrell and Shapiro (1990) in a slightly different form than it appears here.[1] However, if we write it this way, it is equivalent to FW test. As Farrell and Shapiro (1990) point out, the test applies for relatively general cost functions and the variables involved in it are easy to observe. The test requires information on the pre-merger market price, elasticity of demand and market shares of the firms involved in the merger, as well as an estimate of the marginal cost of the merged firm. The merger is likely to pass this test if the firms involved in the merger are relatively small, demand is elastic or the estimated marginal cost of the merged firm is low. Of course, there are some combinations of s_F and ε that make it impossible for a merger to pass the test.

In order to compare this test with FW test, define the pre-merger weighted average marginal cost of the merged firms as follows:

$$c_o \equiv \sum_{i \in M} c_i \frac{s_i}{s_F} = \frac{p}{\varepsilon \cdot s_F} \sum_{i \in M} s_i (\varepsilon - s_i) \tag{4}$$

As explained by Froeb and Werden (1998), in the case of a merger involving two firms (for example, firms j and k), the weighted average marginal cost savings required to avoid a price increase should be at least equal to

$$\frac{2 s_j s_k}{\varepsilon (s_j + s_k) - (s_j^2 + s_k^2)} . \tag{5}$$

This is FW test. However, we can be more precise and general saying that this condition is

$$1 - \frac{c_F}{c_o} \geq 1 - \frac{p\left(1 - \frac{s_F}{\varepsilon}\right)}{\frac{p}{\varepsilon \cdot s_F} \sum_{i \in M} s_i (\varepsilon - s_i)} = \frac{{s_F}^2 - \sum_{i \in M} s_i^2}{\varepsilon \cdot s_F - \sum_{i \in M} s_i^2} . \tag{6}$$

It is easy to see that (4) implies that (3) and (6) are equivalent. In other words, FW and FS tests are alternative ways of writing the same condition. In spite of the fact that the two tests are based

[1] Farrell and Shapiro (1990) arrive to condition (3) considering only two merged firms (1 and 2). Indeed, they say that $c_F < p\left(1 - \frac{s_1 + s_2}{\varepsilon}\right)$ is the condition required to make the price fall.

on the same principle, there is no previous work that shows their equivalence and compares them as far as we know.

3. Discussion

FW test is attractive because it focuses on expression (5) which is the RHS of (6) for two firms. The authority only requires an estimate of the price elasticity of demand and the market shares of the firms involved in the merger to calculate this expression. This calculation is then compared with an arbitrary number like 5 or 10% which represents the LHS of (6). That is, reasonable costs savings claimed by the merged firm. However, we will argue that FS test has some advantages over FW test.

First, FS test requires very simple calculations and applies directly to any number of merged firms. That is, equation (3) remains intact as we add more firms. Note that calculating s_F in the LHS of (3) is easy because it only requires adding the market shares of additional firms. In contrast, FW test becomes more complicated if we extend it to consider a merger involving more than two firms. For example, if we consider three firms (denote them j, k and l) then condition (6) becomes

$$1-\frac{c_F}{c_o} \geq \frac{2s_j s_k + 2s_j s_l + 2s_k s_l}{\varepsilon\left(s_j + s_k + s_l\right) - \left(s_j^2 + s_k^2 + s_l^2\right)}. \qquad (7)$$

Second, FS test requires essentially the same information that FW test but is easier to interpret. In comparison to FW test, this test relies explicitly on two additional pieces of information: the price and the post-merger marginal cost. The first piece of information is easy to obtain. The price is observed by the authority and actually required implicitly to calculate the elasticity which is also used in FW test. The second piece of information is more problematic. The post-merger marginal cost has to be estimated by the authority based on the pre-merger costs provided by the firms. As in FW test, this may require setting an arbitrary number for estimated costs savings. However, the notion of post-merger marginal cost, c_F, has a straightforward interpretation in comparison to the notion of cost savings, $1-\frac{c_F}{c_o}$, that is used implicitly in FW test.

FW test compares a weighted average of pre-merger marginal costs with the estimated post-merger marginal cost to calculate cost savings. This idea is misleading given that Farrell and Shapiro (1990) show that a merger requires synergies to reduce the price. That is, the post-merger marginal cost must be less than the minimum of pre-merger marginal costs in order to reduce the price. Therefore, the minimum rather than the average of pre-merger marginal costs seems more appropriate to calculate mergers savings. Of course, this critique of FW test is irrelevant if all the firms involved in the merger have exactly the same marginal costs.[2]

A numerical example can be helpful to understand the critique. Suppose that two firms intend to merge and their costs at the margin are \$20 and \$15, respectively. Suppose also that the high cost firm has 10% while the low cost firm has 20% of the market. The weighted average of the marginal costs of these firms is $c_o \approx 16.67$. The firms may argue that their marginal cost after

[2] Note that the average and the minimum are equal if all firms have the same marginal costs.

merger will be $c_F = 14$. This number may seem reasonable if we think that it represents about 7% cost savings compared to the low cost firm. However, it seems unreasonable if we think that it represents about 19% savings compared to the firms' weighted average marginal cost.

In favor of the approach followed by Froeb and Werden (1998), we should say that the test they propose is valid even if firms have capacity constraints. The argument runs as follows. Suppose that firms have capacity constraints before the merger and these constraints will still be binding after the merger. As explained earlier, a merger requires synergies to reduce the price. Assume the worst case scenario for the test. That is, assume that the merged firm achieves significant cost savings that would reduce the price in the absence of a capacity constraint. The test would say that the merger does not increase the price. Although the constraint impedes a price reduction because the merged firm cannot produce more, it is still true that the firm has no incentive to produce less of what pre-merger firms were producing. Hence, the price will not increase as the test says.

There is a subtle difference between the original tests of Farrell and Shapiro (1990) and Froeb and Werden (1998). Farrell and Shapiro (1990) look for conditions that allow mergers to reduce the price. As we explained in the previous argument, this version of the test would be affected by a capacity constraint. However, we write the two tests like Froeb and Werden (1998) looking for conditions that avoid a price increase. Therefore, capacity constraints do not affect our analysis.

We can continue discussing about cost savings provoked by mergers or the advantages of one test over the other. However, from a practical point of view, it is convenient to know that FW and FS tests are equivalent. Therefore, the authority can use one test or the other as long as it has a clear understanding of the way in which cost savings are measured.

References

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