A Note on Upward Pricing Pressure: The possibility of false positives[*]

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Abstract:

Farrell and Shapiro proposed a simple test of the possible upward pricing pressure (UPP) following a merger. They showed that the test may give *false negatives*, that is, indicate that a merger may not give an UPP, while a more comprehensive test would indicate the opposite. We show that their test applied to a case with asymmetric firms may give *false positives*.

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1. INTRODUCTION

Antitrust authorities receive a large number of merger notifications. Since they cannot scrutinize all mergers in detail, they need simple tools for accepting mergers that are not expected to have anti-competitive effects. Market shares and concentration ratios have traditionally been used as indicators. As explained in an article by Joe Farrell and Carl Shapiro (hereafter FS) these measures may be inaccurate in differentiated products' industries.[1] FS proposed an alternative screening tool called UPP (Upward Pricing Pressure) focusing directly on the merged firms' incentives to raise post-merger prices. The test requires limited information, in particular it does not require demand or competitor data, it is based on sound economic logic, and it is an improvement compared to the detailed focus on market definition at present.[2]

When a screen test gives a negative result, the merger will be cleared. A simple tool may err, however. It may indicate anti-competitive effects when there would be none, *i.e.*, a false positive result, or predict no price increase when the opposite would be true, which is a false negative result. If the screening leads to a false negative, one would clear a merger that should have been banned. This mistake will not be corrected later on. A false positive result, however, may be corrected in the subsequent and more detailed process. One should therefore be more concerned about false negatives than false positives.

FS show that for symmetric firms the proposed UPP may lead to false negatives, but never false positives. We show that with asymmetric firms false positives may result and is more likely the more asymmetric firms are. Since mergers with a false positive UPP test can be

[1] J. Farrell and C. Shapiro (Volume 10): *Antitrust evaluation of horizontal mergers: An economic alternative to market definition*, THE B.E. JOURNAL OF THEORETICAL ECONOMICS, article 9, 2010.

[2] The proposed UPP framework has triggered a large debate, and not all the commentators regard this approach as novel and/or suitable in merger analysis. For various views, see e.g. D. W. Carlton (Volume 6): *Revising the Horizontal Merger Guidelines*, JOURNAL OF COMPETITION LAW AND ECONOMICS, 619-652 (2010), M. B. Coate (Volume 7): *Benchmarking the Upward Pricing Pressure Model with Federal Trade Commission Evidence*, JOURNAL OF COMPETITION LAW AND ECONOMICS, 825-846 (2011), J. E. Lopatka (Volume 39): *Market Definition?*, REVIEW OF INDUSTRIAL ORGANIZATION, 69-93 (2011), R. Willig (Volume 39): *Unilateral Competitive Effects of Mergers: Upward Pricing pressure, Product Quality, and Other Extensions*, REVIEW OF INDUSTRIAL ORGANIZATION 19-38 (2011), J. J. Simmons and M. B. Coate (Volume 6): *Upward Pressure on Price Analysis: Issues and Implications for Merger Policy,* EUROPEAN COMPETITION JOURNAL 377-396 (2010), R. J. Epstein and D. Rubinfeld (Volume 10): *Understanding UPP*, THE B.E. JOURNAL OF THEORETICAL ECONOMICS, article 21 (2010), J. Farrell and C. Shapiro (Volume 10): *Upward pricing pressure in horizontal merger analysis: Reply to Epstein and Rubinfeld*, THE B.E. JOURNAL OF THEORETICAL ECONOMICS, article 41 (2010), S. Moresi: *The use of upward pricing pressures indices in merger analysis*, ANTITRUST, February 2010 (2010), and R. Schmalensee (Volume 12): *Should new merger guidelines give UPP market definition*?, CPI ANTITRUST CHRONICLE, (2009).

cleared during an in depth investigation while false negatives cannot be corrected, the argument in favor of the test proposed by Farrell and Shapiro is strengthened when we take into account the presence of asymmetric firms.

2. THE UPP TEST

The UPP test checks whether the merging parties - given stipulated reductions in marginal costs, called efficiencies - would have incentives to raise prices. Consider a case of two single-product, Bertrand price-setting firms. Let P_i, C_i, and x_i denote respectively price, marginal cost, and the volume of product i, i=1,2. Profit is $\pi_i = (P_i - C_i)x_i - F_i$ where F_i is fixed costs, and $M_i \equiv (P_i - C_i)/P_i$ is the margin on product i, i=1,2. Finally, let D_{ij}, $i \neq j$, denote the *diversion ratio* telling the fraction of diverted customers from product j that switches to product i because of a price increase of product j.

In general, optimal pre- and post-merger prices will differ. *Ceteris paribus*, a merger gives merging firms an incentive to increase prices, while efficiencies do the opposite. Gregory Werden considered the necessary efficiencies (E_i) such that optimal post-merger prices were identical to the pre-merger prices.[3] In such case, the competitors would have no incentive to increase their prices either, whereby volumes would remain unchanged, and the analyst can neglect both competitor and demand data.[4] Werden developed the following condition

$$(1) \qquad E_i = \frac{M_i D_{12} D_{21} + M_j D_{ij} \frac{P_j}{P_i}}{(1 - M_i)(1 - D_{12} D_{21})}$$

Rearranging (1) for i=1we get Werden's notion of *UPP* (compare FS-eq. (7)):

$$(2) \qquad UPP_{W1} \equiv D_{12}(P_2 - C_2) + D_{12} D_{21}(P_1 - C_1) - E_1 C_1 (1 - D_{12} D_{21})$$

with a similar condition for i=2. FS define *UPP* as follows:

[3] See G. Werden (Volume 44): *A robust test for consumer welfare enhancing mergers among sellers of differentiated products*, JOURNAL OF INDUSTRIAL ECONOMICS, 409-413 (1996).

[4] When there is an upward pricing pressure, however, and one wants to conduct a full analysis, demand and competitor data would be needed.

(3) $UPP_1 \equiv D_{12}\left(P_2 - C_2\right) \text{ - } E_1 C_1$

(2) can be written

(2') $UPP_{W1} = UPP_1 + D_{12}D_{21}(P_1 - C_1(1 - E_1)) = 0$

(2') is the correct expression for measuring the case of no upward pricing pressure as the feedback from the second product is incorporated. Lower marginal cost on one product implies that it is more profitable to pick up sales from the other product. This feedback effect will, all else equal, make it more profitable to raise prices after the merger. FS suggest using UPP_1 as the screen and argue that its basic economic logic is more transparent than introducing simultaneous equations (as eq (2') implies), and that it accords with their emphasis on simplicity and transparency.

Divide by P_2 in (3), transforming the screen into a unit-free measure, whereby the following condition signals an upward pricing pressure on product 1:

(4) $D_{12}\frac{M_2}{1-M_1}\frac{P_2}{P_1} > E_1$

Assume full symmetry, *i.e.*, the two products have equal prices and marginal cost, and hence margins $M_1 = M_2 = M$, and in addition set $D_{12} = D$ and $E_1 = E$. Then (4) becomes

(4') $D\frac{M}{1-M} > E$.

Considering both products FS find that there will be an upward pricing pressure if: [5]

(5) $\frac{D}{1-D}\frac{M}{1-M} > E$.

[5] With full symmetry diversion ratios ($D_{12} = D_{21} = D$) are equal and the efficiencies are the same ($E_1 = E_2 = E$).

Since $D/(1-D) > D$, (5) is more easily satisfied than (4'). That is, an upward pricing pressure is more likely if feedback effects are incorporated. The UPP_1 test (3) can therefore predict false negatives – no upward pricing pressure - where a more accurate test would predict an upward pricing pressure. The opposite – false *positives* – will never be the case.[6]

If we relax the symmetry assumptions, however, false positives may emerge.[7] Consider a case where the two products have identical parameters except for the diversion ratios between them, *i.e.,* $D_{12} \neq D_{21}$. Focus on the net effect: Is there *on average* an upward pricing pressure? Eq. (2) is the condition for no change in P_1, with a corresponding condition for P_2. If both conditions are met:

$$D_{12}M + D_{21}M + 2\left[D_{12}D_{21}M - E(1-M)(1-D_{12}D_{21}\right] = 0$$

Rearranging the condition, there will on average be an upward pricing pressure if:

$$(6) \qquad \frac{\frac{D_{12}+D_{21}}{2} + D_{12}\cdot D_{21}}{1-D_{12}\cdot D_{21}} \cdot \frac{M}{1-M} > E.$$

The right hand side of (6) is identical to the right hand side of (4'), whereby we can compare the left hand sides of (4') and (6). There is a larger scope for upward pricing pressure applying test (4') than test (6) if:

$$(7) \qquad D_{12} > \frac{\frac{D_{12}+D_{21}}{2} + D_{12}\cdot D_{21}}{1-D_{12}\cdot D_{21}}$$

Rearranging terms, we find that (7) is true if:[8]

[6] See Farrell and Shapiro, op.cit.
[7] Ø. Daljord and L. Sørgard (volume 31): *Single-product versus uniform SSNIPs*, INTERNATIONAL REVIEW OF LAW AND ECONOMICS, 142–146 (2011) show a similar mechanism with the critical loss test for market delineation.
[8] There are two solutions to (8) solved as an equality, but only one with D_{12} between 0 and 1.

(8) $$D_{12} > \frac{1-2D_{21}-\sqrt{1-4D_{21}\left(1+D_{21}\right)}}{4D_{21}}.$$

Condition (8) is met if D_{12} is sufficiently large relative to D_{21}. This is illustrated in Figure 1 where the solid line shows when condition (8) holds with equality.

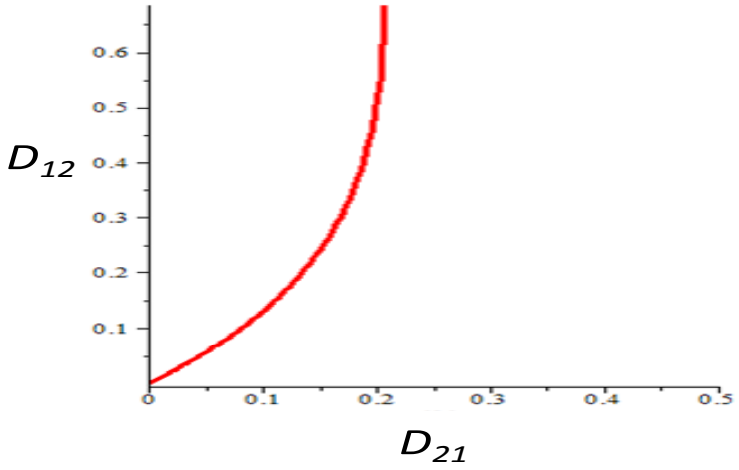

Figure 1: The UPP_1 test predicts false positives for values above the curve.

For values of D_{12} and D_{21} above the curve in Figure 1, the UPP_1 test in (4) indicates an upward pricing pressure while the accurate test in (2) does not. The intuition is that unequal diversion ratios D_{12} and D_{21} lead to different incentives to raise each of the two prices. There can be an upward pricing pressure on the product with a large diversion ratio and a downward pricing pressure on the product with the low diversion ratio. Combining the two, one may find that on average there is no upward pricing pressure. In contrast, there will be an upward pricing pressure if we allow for a price change on only the product with the large diversion ratio. Applying the UPP_1 test on the product with the largest diversion ratio can therefore lead to a false positive.

This is in line with the proposed procedure in FS. If there are mixed results, $UPP_1 > 0$ while $UPP_2 < 0$, the advice is to scrutinize this merger further. By doing so there is a risk of going along with some false positives. However, the subsequent full inquiry is then expected to clear a case where the screening led to a false positive. The costs of false positive tests in the screening phase will then be limited.

Unequal diversion ratios are often the case where one product has lower sales than the other.[9] A large fraction of customers from the smaller product will be diverted to the larger product, while the small product only picks up a small fraction of customers diverted from the large product. Thus, after the merger there is a stronger incentive to raise the price on the small product than on the large product.[10]

3. SOME NUMERICAL EXAMPLES

False positives may also result if there are other asymmetries than diversion ratios. Let us define $UPP_w \equiv vUPP_{W1} + (1-v)UPP_{W2}$, where v is the market share dependent weight on product 1. Apart from v, UPP_w has 8 parameters: P_i, C_i, (or M_i), E_i, i=1,2, and D_{12} and D_{21}. By taking ratios these are reduced to four parameters: $p \equiv P_1/P_2$, $m \equiv M_1/M_2$, $e \equiv E_1/E_2$, and $d \equiv D_{12}/D_{21}$, in addition to v.

Now we can compute border-lines for *false positive* in various two-dimensional spaces in the following way: Consider product 1 and find parameter-values that make $UPP_1 > 0$, while at the same time make $UPP_w < 0$. An efficiency gain E reduces any UPP, see eqs. (1) and (2). Thus we seek the smallest E_1 that makes $UPP_1 \geq 0$, and the largest E_2 that makes $UPP_w \leq 0$. In sum, we seek the smallest $e \equiv E_1/E_2$.

Return to Figure 1 and symmetry except for diversion ratios, *i.e.*, $p = 1$, $m = 1$, $e = 1$, and $v = ½$. Let $D_{12} = 0.2$ and $D_{21} = 0.1$, which is a point above the curve with $UPP_1 > 0$ and $UPP_W < 0$. Inserting values reveals that $UPP_1 = 0.009 > 0$ and $UPP_W = -0.005 < 0$, which signals false positive as suggested by the figure.

Alternatively, let $p = 1$, $d = 1$, and $v = ½$, and consider the m-e-space. For a given m-value compute E_1 and E_2 values, and hence an e-value, such that $UPP_1 \geq 0$, while $UPP_w \leq 0$. See

[9] In a study of a grocery stores in Voss in Norway, the relative diversion ratios $d = d_{ij}/d_{ji}$, $i \neq j$, were as low as 1:10, while relative market shares (sales), $s = s_i/s_j$, $i \neq j$, were down to 1:3. The correlation between d and s is about 0.4 supporting the intuition that a larger store picks up a larger fraction of customers than do a smaller store. See L. Mathiesen, Ø. A. Nilsen, and L. Sørgard (Volume 31): *Merger simulations with observed diversion ratios*, INTERNATIONAL REVIEW OF LAW AND ECONOMICS, 83–91, 2011.

[10] This observation is also made in merger simulations.

the middle graph ($d = 1$) in Figure 2a.[11] *m-e* values *below the* graph give *FP*. Setting $d = 0.5$ or $d = 2$, provide similar graphs, respectively below and above the one corresponding to $d = 1$. These results can be recast in *d-e*-space as in Figure 2b.

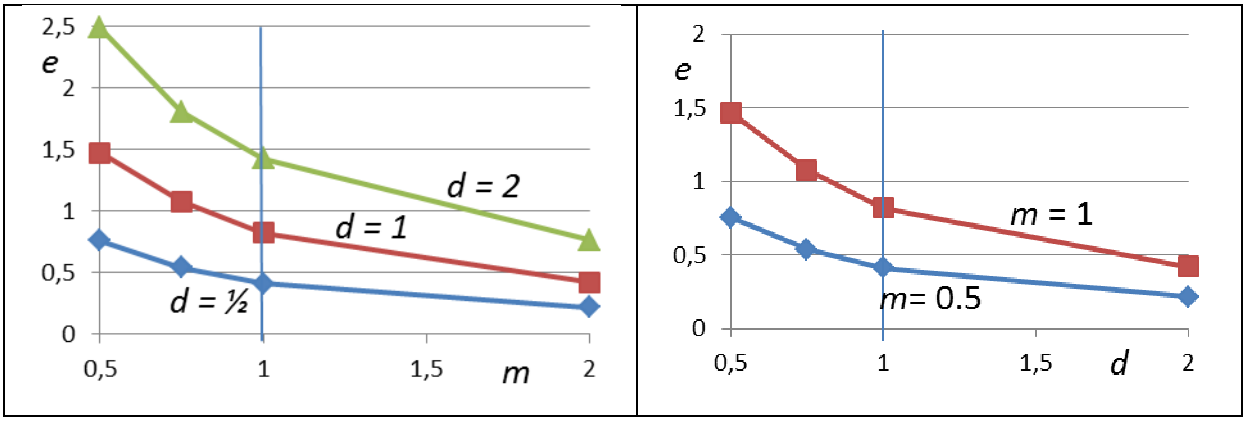

Figure 2a **Figure 2b**

Figure 2: False positive below curves in *m-e*-space.

4. SOME CONCLUDING REMARKS

The UPP framework has been presented as a very useful tool for screening mergers. One concern is that the specific *UPP* test proposed by Farrell and Shapiro, called the UPP_1 test, is biased towards giving false negatives. This is problematic for a test used for screening, since it could clear anti-competitive mergers. In this article we have shown that, contrary to what has been claimed, the test can lead to false positives. This will be true if the merging firms are sufficiently asymmetric, for example asymmetries in diversion ratios in each direction between the two merging firms' products.

This result illustrates that the specific test provided by Farrell and Shapiro is less problematic for a screening purpose then earlier indicated. On the other hand, a false positive is more problematic in the full fledge analysis of the anti-competitive effect of a merger since then it is less likely that the error is corrected later on. It is thus more problematic than earlier indicated to apply this test in the second phase of a merger procedure. There are thus good reasons for applying the proposed UPP test only for screening purposes.

[11] With $d = 1$, $E_1 = 0.101$ and $E_2 = 0{,}121$ giving $e = 0.8333$, define the border-line. That is, smaller E_1 and/or larger E_2 produce false positive.

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