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Lear Competition Note

MERGER SCREEN AND THE USE OF PRICE PRESSURE TESTS

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The control of mergers between competitors (i.e. horizontal mergers) is one of the main areas of antitrust intervention. Notably, when evaluating these mergers, one of the main anti-competitive concerns is the resulting loss in competition between the merging parties. For the reduction in the rivalry between them might lead the new entity to increase prices, or lower the quality or the level of innovation provided in the relevant market. These effects are also known as "unilateral effects".[1]

Around the world, every year, thousands of mergers take place and are notified to competition authorities that simply cannot, and should not, carry out an in depth investigation for each case. For this reason competition authorities adopt some simple tests to screen mergers as to identify those that might raise relevant unilateral effects concerns and that require additional investigation.

These tests are usually based on market shares and depend on the definition of the relevant market. However, in some market settings, this approach might fail to properly screen mergers. To address these problems alternative tests have been proposed and some have been adopted by competition authorities. This note reviews the three most widely discussed tests (UPP, GUPPI and IPR) and presents a graphical comparison of their implications.

The limits of market share tests and the need for alternative measures

The preliminary assessment of the likelihood of unilateral effects usually starts from the definition of the relevant market and then evaluates two traditional screening tests: market shares and concentration measures (like the Herfindahl-Hirschman Index –HHI)[2]. When the definition of the relevant market is straightforward (like in homogeneous product markets) this approach might be properly suited to assess unilateral effects. On the contrary, when the definition of the relevant market is problematic (like in differentiated product markets), the resulting market shares and concentration measures might incorrectly represent firms' market power and the likelihood of unilateral effects.

For example, consider firm A, B, and C, all active in the market for sports drinks with market shares of, respectively, 25%, 25% and 50%.[3] Suppose that firm A and C propose to merge. When evaluated with the traditional tools, such a merger would raise much more anticompetitive concerns than a merger between competitors A and B. However, suppose also that products A and B are considered, by athletes, much similar (i.e. closer competitors) than either product with

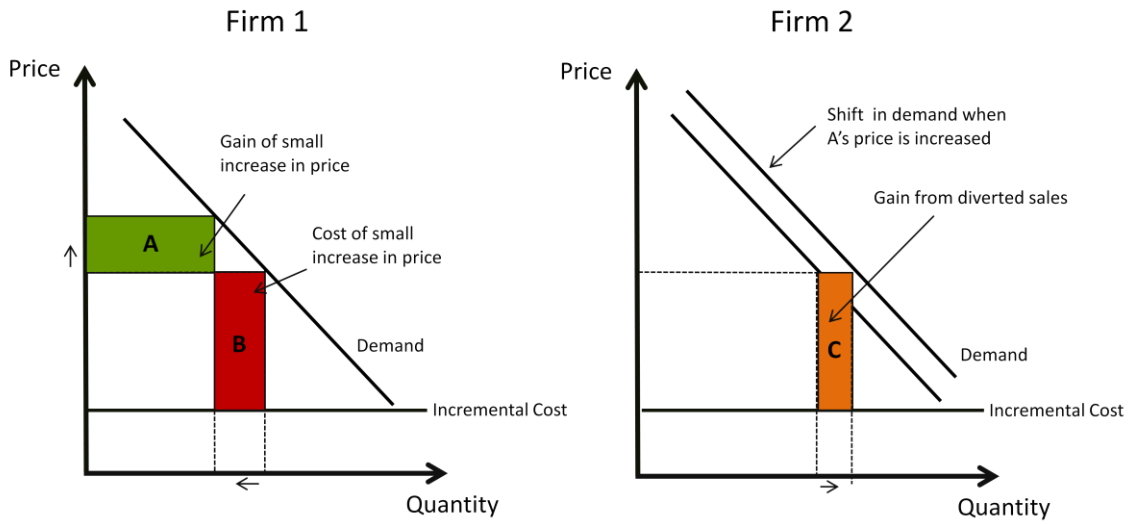
product C. For instance seven out of ten athletes would switch to product B, if product A increased its price, while only three would switch to product C. This suggests that, contrary to the conclusions reached by looking at market shares, a merger between firms A and B might be more detrimental to consumer than a merger between firms A and C. This because if firms A and B merge, and the price of product A is increased, firm B would capture a high proportion of the sales that firm A might possibly lose, making the price increase more profitable.

Also, suppose that the relevant antitrust market might encompass both sports drinks and soft drinks, and there is no striking evidence in support of a narrow or a broad market definition. In this case, the assessment of any mergers between firms A, B and C would heavily depend on the market definition adopted.

For these reasons, when evaluating mergers in differentiated product industries, tests based on market shares should be used with extreme caution. Recently, to overcome the limitation of the traditional tests there has been a lively debate about the adoption of different screens for the assessment of unilateral effects in differentiated product industries. These tests aim to evaluate directly merging firms' incentives to raise post merger prices and are based on measures of firms' closeness of competition and profitability, without resorting to market definition.[4]

The rationale of these alternative tests relies on the incentive for merged firms to raise post merger prices. Figure 1 presents a graphical intuition of these effects. Consider a market where two competitors, Firm 1 and Firm 2, propose to merge. Before the merger, if Firm 1 increases its price it will: 1) earn an extra profit margin on the retained (inframarginal) sales (green area A); 2) lose some sales and the relative profit margins (red area B). The price rise will be profitable only if the area A is greater than the area B. However, if before the merger Firm 1 is already maximizing its profits such a price rise will not be profitable. The same applies to Firm 2.

Figure 1 Upward Price Pressure – Graphical analysis



After the merger the incentive to raise the price of Product 1 changes. Following a price increase in Product 1, some customers might switch to Product 2. The merged entity will then earn some gross profit margin from the increase in the sales of Product 2 (orange area C). Therefore, post merger, the price increase of Product 1 will be profitable if the sum of the areas A and C is higher than the area B. This condition is easier to satisfy than the single firm case. Hence, the merged entity will have an higher incentive to raise prices.[5] Indeed, absent any efficiency (cost reductions) any merger between two competitors might create a pressure to raise prices.

Price Pressure Tests: UPP, GUPPI and IPR

During the last years several price pressure tests, and variants of them, have been proposed. Among these we discuss the Upward Pricing Pressure (UPP), the Gross Upward Pricing Pressure Index and the Illustrative Price Rise (IPR).

These tests are based on information on margins (hence price and cost) and on a measure of the closeness of competition between the merging firms. Tests that, beyond assessing the upward pricing pressure, also aim to predict the magnitude of the price rise, like IPR, require information/assumption on the shape of demand.

The approach of these tests is static and focuses only on demand side factors and on the two merging firms. Indeed, they do not consider the closeness of competition between the merging firms and the other competitors, the potential short term and long term supply-side responses, such as the entrance of new competitors, product repositioning, learning by doing, network effects and merger specific efficiencies (notably only UPP include an efficiency credit). Nevertheless, these simple and straightforward price pressure tests might provide a reliable quantitative *prima facie* evidence on the main incentive to raise prices. The results of these tests might then be mitigated, either during a screening phase or during an in depth analysis, by considering all the other factors that might exert a downward pricing pressure.

UPP

The UPP test, proposed by Farrell and Shapiro (2010),[6] balances two main price effects resulting from a merger. The first is the pressure to increase prices following the loss of competition between the merged firms. The second is the pressure to lower prices as merger efficiencies reduce incremental cost. The difference between these two effects represents the net upward pricing pressure following the merger.

Considering a merger between Firms 1 and Firm 2 (selling respectively Product 1 and Product 2) the formula of the UPP test is given by the following expression:

$$UPP_1 = D_{12}(P_2 - C_2) - E_1 C_1$$

where D_{12} is the (pre-merger) diversion ratio[7] from Product 1 to Product 2, P_2 is the price of Product 2, C_2 is the corresponding incremental cost, E_1 is the percentage reduction in incremental cost that is due to the merger specific efficiency[8], and C_1 is the incremental cost of Product 1.[9]

The upward pricing pressure is then captured by the term $D_{12}(P_2 - C_2)$, that represents the revenue coming from the internalization of part of the lost sales of Product 1. The downward pricing pressure is captured by the term $E_1 C_1$ that represents the reduction in Product 1's incremental cost due to the merger specific efficiencies. When $UPP_1 > 0$, the merged entity has the incentive to raise the price of Product 1 after the merger. The same analysis should be performed for Product 2 and, possibly, for all the other product pairs (if the two firms sell more than two products). If the UPP measures are positive the merger should be subject to an in-depth analysis.

In the case of symmetry between firms (similar diversion ratios, prices and costs) the above UPP measure becomes

$$\frac{dm}{1-m} > e$$

where m is the pre-merger gross profit margin ($\frac{P-C}{P}$), d is the diversion ratio and e the efficiency gain.

It is important to note that the UPP test does not aim to estimate the magnitude of the price increase as it is only informative on the likelihood of a post merger price rise. Also, the simple UPP, when assessing the pressure to increase the price of Product 1, does not account for the effect of the merger specific efficiencies on the margin of Firm 2. Indeed, if the incremental cost of Product 2 are credited with the same efficiencies credited to Product 1, the margin of Product 2 and consequently the pressure to increase Product 1 prices will increase. The UPP measure that accounts for this "feedback" effect is shown below and it implies that, *ceteris paribus,* accounting for this interdependence will identify a higher pressure to increase price.[10]

$$\frac{dm}{1-d}\frac{1}{1-m} > e$$

GUPPI

The Gross Upward Pricing Pressure Index was proposed by Salop and Moresi (2009) and Moresi (2010).[11] Remarkably this measure features in the US Horizontal Merger Guidelines (2010).[12] The GUPPI estimates the incentive of the merged firm to raise prices and can be interpreted as the value of sales diverted to Product 2 $\Delta Q_2(P_2 - C_2)$, as a fraction of the lost revenues on Product 1 $\Delta Q_1 P_1$. The higher this fraction the higher is the incentive to raise price.

Its basic formula is given by the following expression

$$GUPPI_1 = \frac{D_{12}(P_2 - C_2)}{P_1}$$

where D_{12} is the diversion ratio from Product 1 to Product 2 (that is equal to $\frac{\Delta Q_2}{\Delta Q_1}$), P_2 is the price of Product 2, C_2 the incremental cost, and P_1 the price of Product 1. In the symmetric case the GUPPI measure becomes

$$GUPPI = dm$$

where d is the diversion ratio and m the gross profit margin ($\frac{P-C}{P}$).

Notably GUPPI, like the UPP, does not need any assumption on the shape of the demand function. Moreover, GUPPI does not account for the price increase of the product of the other merging firm.[13] However, differently from the UPP formula GUPPI does not consider merger specific efficiencies, hence any merger between firms selling substitute products would result in a GUPPI greater than zero. For this reason the GUPPI has to be interpreted against some thresholds (usually 5% or 10%).

The GUPPI test can also be "modified" to predict possible price rise after the merger if we know (or assume) how the prices of the merging firms change in response to a cost change (i.e. the pass-through rate). In this case, the percentage price rise is equivalent to the product between the GUPPI and the pass through rate (R)

$$\frac{\Delta P}{P} = (GUPPI)R$$

Accordingly, for example, if we choose a threshold price rise (e.g. $\frac{\Delta P}{P} = 5\%$) and we assume linear demand (i.e. $R = 0.5$) a merger should be analyzed more closely if

$$GUPPI = dm \geq 10\%$$

IPR

Another popular variant of the price pressure tests is the Illustrative Price Rise (IPR). This test measure directly the magnitude of price increase that will arise from the merger. Notably IPR tests have been widely adopted by the two UK competition authorities (the Competition Commission and the Office for Fair Trading). Differently from GUPPI and UPP, the IPR test requires information, or assumptions, on the functional form of demand (hence the pass through rate). Assuming respectively a linear and an isoelastic (constant elasticity) demand the IPR

formulae, for the symmetric case, are given by the following expressions[14]

$$IPR_{linear} = \frac{\Delta P}{P} = \frac{md}{2(1-d)}$$

$$IPR_{isoelastic} = \frac{\Delta P}{P} = \frac{md}{(1-m-d)}$$

where m is the pre-merger symmetric margin of Firms 1 and Firm 2 (i.e. $\frac{P-C}{P}$) and d is the diversion ratio for the products of the merging firms.

Remarkably, the above basic symmetric IPR formulae, differently from the simple UPP and GUPPI, specifically account for the identical price increase in the product of the other merging firm. Given that IPR can be interpreted as the percentage price increase implied by the merger, it can be directly assessed against the price increase threshold of interest (for instance 5%). Accordingly, for example, if we choose a threshold price rise of 5% and we assume linear demand a merger should be analyzed more closely if

$$IPR_{linear} = \frac{md}{2(1-d)} \geq 5\%.$$

Diversion Ratio and Gross Profit Margin

The practical application of UPP, GUPPI and IPR relies on two main objects: 1) a measure of the closeness of competition, between the merging firms (i.e. diversion ratio) and 2) a measure of profitability (i.e the percentage gross margin).

Diversion Ratio

Diversion ratios measure the degree of substitutability between two products, in other words the percentage of unit sales lost by Firm 1 and captured by Firm 2, when Firm 1's prices increase.[15] The closer Products 1 and 2 are in the market, the higher the diversion ratio.

Diversion ratios can be estimated in different ways, with varying degrees of complexity and accuracy. An accurate approach could be to estimate them directly from the products' cross-price and the own-price elasticity.[16] However this method is extremely data demanding as it requires detailed market data (on prices, quantities and on firms/products characteristics) that might not be readily available especially at a merger screening phase. Also if this data were available more sophisticated analysis could be performed.

A less demanding approach could be to estimate diversion ratios using data collected by firms in the course of their business. Indeed firms sometimes collect data to study the source/directions of their win and lost businesses and this information might be used to estimate closeness of competition.

Another method is to design and implement ad-hoc consumer surveys that aim to study consumer switching preferences and intentions. For instance such surveys might ask questions like: "Which product would you buy if *Product X* were not available?" or "Would you switch to another product in response to a 5% price increase in *Product X*? If so, which ones?". Survey might be an effective way to collect data but should be carefully designed as to minimize the risk of biases between what consumers state and what they might actually do.

An alternative way to estimate diversion ratio is to study customers responses to particular past events like cost/price shocks specific to one firms (i.e. natural experiments). The analysis of past behaviour and consumers' reaction might indeed provide useful insights. Nevertheless, firm specific events of this kind might not be frequent.

Finally, diversion ratios could also be computed through market shares. For instance if we consider a differentiated product market in which all products are equally "distant"[17] and where diversion ratios are related to market share, the lost sale of one product are likely to be diverted to the other products in the market following market shares.[18] However, despite its simplicity, this approach is in contrast with the nature of the price pressure tests as it relies on the relevant market definition (to estimate market shares). Moreover, this approach might overestimate diversion ratios in case consumers, following a

price increase in one product, would decide not to purchase any substitute products.[19] For these reasons the direct estimation approaches seen above should be preferred.

Gross Profit Margin

Gross profit margins[20] are informative on two different dimensions, on the one hand they measure the gross profit made (lost) on additional unit of sales win (lost); on the other hand they indicate consumer's price sensitiveness as firms with high market power have higher margins.

The percentage gross profit margin is defined as

$$M = \frac{P - C}{P}$$

Where C and P are the incremental cost and the price of the product of interest. The accuracy of the measure of margins depends on the estimation of C, usually done through accountancy data. It is indeed important to estimate incremental cost appropriately as to reflect the true economic cost. The costs included in C would usually be variable but might also include some capital cost, if for example a firm is facing capacity constraint. To this extent it is crucial to consider the appropriate time frame and scale of volumes within which estimating incremental cost.

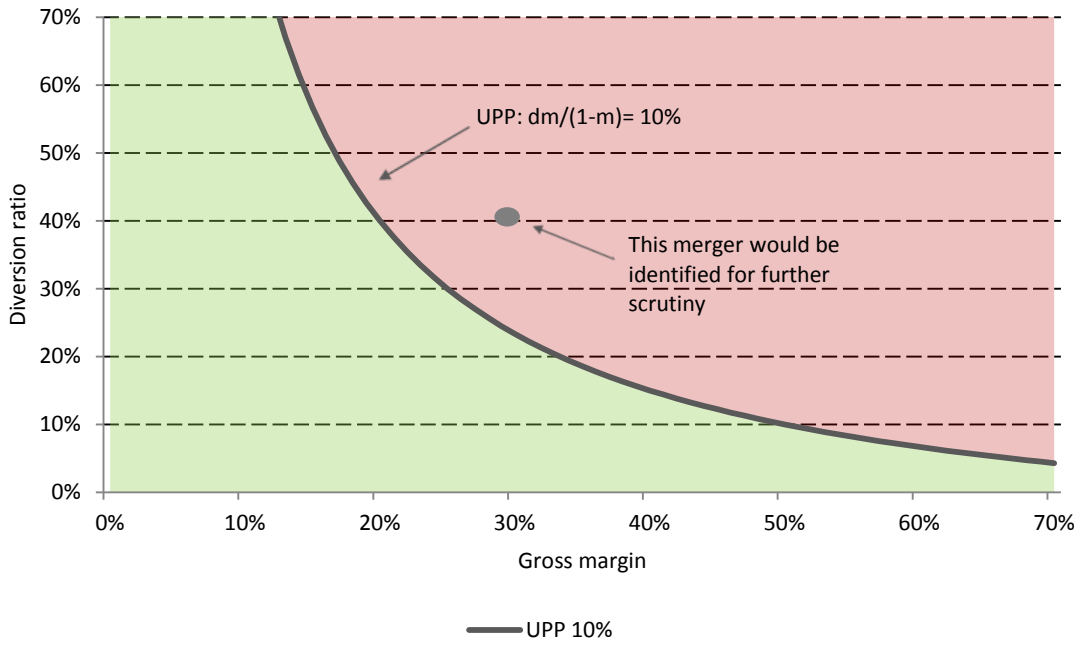
Comparison of Price Pressure Tests

The price pressure tests discussed above provide *prima facie* evidence of the likelihood of unilateral effects in mergers in differentiated products markets. To study their implications as merger screen it is useful to inspect them graphically. For instance Figure 2 considers the UPP tests and plots the combinations of diversion ratios and gross profit margins for which the UPP test is equal to the threshold of 10%. In other words the depicted line represents the combinations of $d$and m that satisfy

$$\frac{dm}{1 - m} = 10\%$$

where 10% represents the efficiency credit.

Figure 2 UPP test – Graphical Analysis

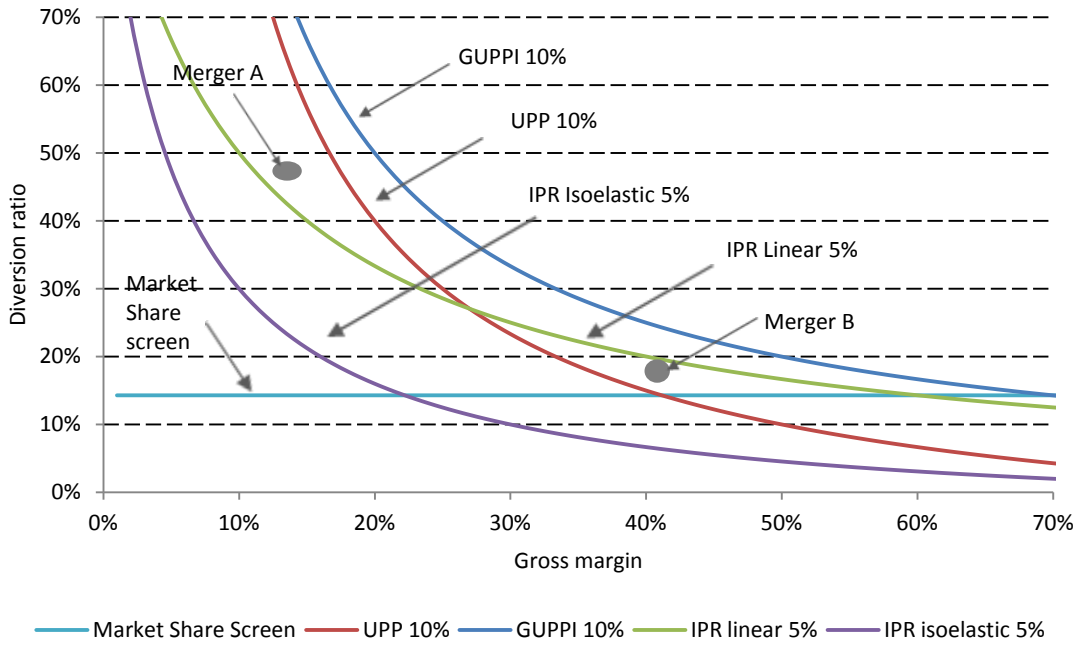


For the interpretation of the chart this means that all the combinations of diversion ratios and gross profit margins, that lie above the depicted line (red area) would trigger an in depth investigation whereas those lying below (green area) would not. For example an hypothetical merger characterized by firms with respective diversion ratios of 40% and gross profit margins of 30% under the UPP test would be identified for further scrutiny.

UPP, GUPPI and IPR are all based on the same two main inputs, diversion ratios and gross profit margins. Nevertheless, they differ in the underlining assumptions and functional forms. Therefore when used for the purpose of merger screen they might lead to different results.

To understand these differences it is useful to compare them graphically. Figure 3 plots UPP, GUPPI and IPR (linear and isoelastic), in their symmetric and simplest form. For each test the depicted line represents the combinations of diversion ratios and gross profit margins where the market screen test is just equal to the chosen threshold. For this analysis the following typical thresholds have been chosen: UPP, $\frac{dm}{(1-m)} = 10\%$; GUPPI $dm = 10\%$ (notably assuming linear demand this is equivalent to check for a SSNIP of 5%);[21] IPR linear $\frac{md}{2(1-d)} = 5\%$; IPR isoelastic $\frac{md}{(1-m-d)} = 5\%$.[22]

Figure 3 Price Pressure Tests – Graphical Comparison



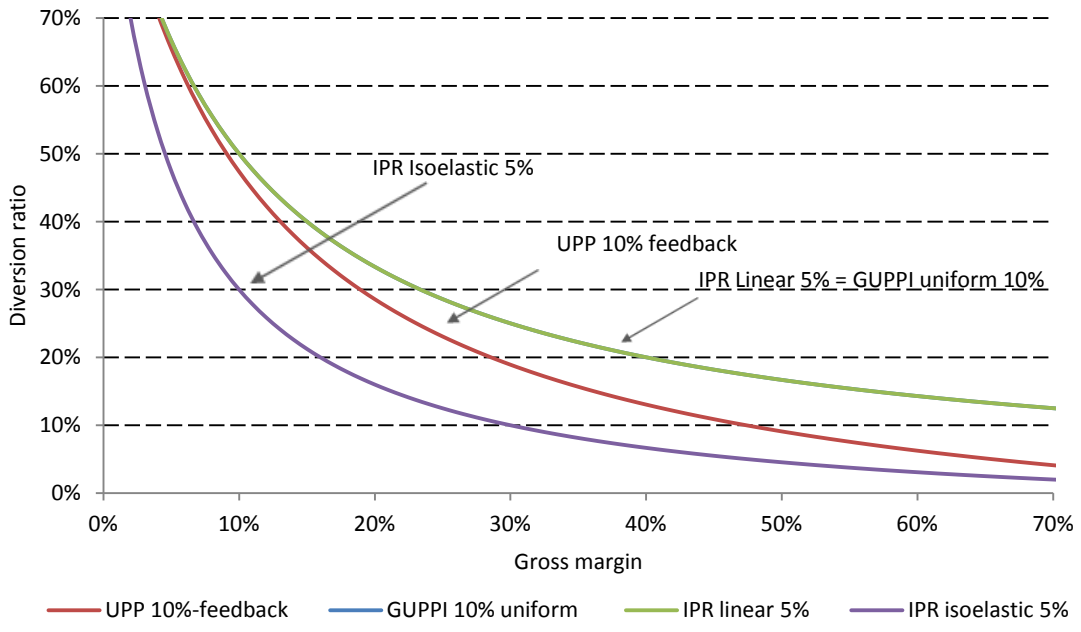
The chart also compares the price pressure tests against a market share screen, the horizontal line around 14% on the vertical axis. Where this latter value, in a symmetric differentiated product market, would represent the diversion ratio between two identical firms that post merger would have a combined market share of 25%.[23] From the graphical comparison (Figure 3) we can see that the IPR isoelastic (at 5%) is the most stringent merger screen as it will raise unilateral effects concerns at combinations of relatively low diversion ratios and gross profit margins. This is expected as the isoelastic demand predicts relatively sharp (and possibly unrealistic) price increases post merger. At the opposite end GUPPI 10% seems to be the most lenient merger screen. The depicted lines for UPP 10% and IPR linear 5% are contained within these two bounds. In particular, it is not possible to rank UPP and IPR linear as their lines cross. IPR linear 5% is more stringent than UPP 10% toward those mergers with high diversion ratio and relatively low gross profit margins, whereas it is more lenient than UPP 10% toward those mergers with high gross profit margins and relatively low diversion ratios.

We can conclude that the four tests might lead to markedly different outcomes. For instance an hypothetical "Merger A" would fail the IPR isoelastic tests and the IPR linear test while it will not be identified for further scrutiny under the UPP and GUPPI. An hypothetical "Merger B" would indeed fail the IPR isoelastic tests and the UPP test while it will not be identified for further scrutiny under the IPR linear and GUPPI.

Some of the differences that we find between these tests might be explained by the fact that only the two IPR tests consider the interactions and common incentives of the two merging firms (in the specific they assume that both merging firm will increase prices post merger). Accounting for these effects implies that firms would have an higher pressure to increase prices and the price increment might be higher.

Figure 4 presents the same analysis of Figure 3 with the only difference that we now consider the two modified versions for UPP and GUPPI. Notably, in comparison with Figure 3, the UPP and GUPPI lines shift toward the origin, with these two tests becoming stricter.

Figure 4 Price Pressure Tests – Graphical Comparison



Also, given that the modified GUPPI relies on the assumption of linearity of demand its line overlaps exactly with the line of the IPR linear. The UPP test that accounts for the feedback effect lies between IPR isoleastic and IPR linear/GUPPI.

Conclusions

Antitrust authorities need effective merger screens to identify, for further scrutiny, those horizontal mergers that might generate relevant anti-competitive effects. When the concern is that the loss in competition between the two formerly rival merging firms might lead to higher prices (i.e."unilateral effects") authorities have usually adopted quantitative mergers screens based on the relevant market definition: market shares and concentration measures. This "indirect" approach might not provide correct guidance when applied to differentiated product industries, as in these industries market definition is not straightforward and market shares are not always informative of the closeness of competition, hence the competitive constraints, between two rivals.

To overcome the limitations of the traditional tools some alternative merger screens have been proposed. These tests aim to assess directly merging firms' incentives to raise post merger prices and are based on measures of firms' closeness of competition and profitability. These tests in their simplest forms are both intuitive and appealing. Moreover, the data requirement needed for their applications does not seem to be significantly burdensome.

Among the different variants UPP, GUPPI and IPR are the three price pressure tests that received the highest attention and that have also been adopted in some countries (notably in the US, UK and South Africa).

It is important to stress that these tests do not aim to provide dispositive evidence on mergers assessment. On the contrary they aim solely to provide, at the screening stage, a more direct quantitative evidence on the incentives for firms to increase post merger prices. The outcome of price pressure tests should then be interpreted in conjunction with the other available evidence quantitative and/or qualitative.

Also, as pointed out in this note, the application of these price pressure tests might lead to markedly different outcomes. The interpretation of results should then consider the underlying differences of the tests and their practical implications.

It is important to point out that, notwithstanding their simplicity, price pressure tests should be carefully computed. For instance, many mergers do not involve symmetric firms, therefore more complex formulae, accounting for asymmetries, should be adopted. Diversion ratios should be properly estimated as to reflect actual closeness of competition. The estimation of gross profit margins requires careful economic evaluations about the incremental cost measure. Finally, given that firms usually sell more than one product, appropriate indexes or ways to aggregate results should be devised.

If you would like further information about UPP, GUPPI, IPR and their applications to merger assessment please contact us.

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Notes

[1] The other main anti-competitive effect related to horizontal merger is the possibility that the merger increases the likelihood of coordination among the remaining firms in the market. These effects are also known as "coordinated effects".
[2] The intuition is that firms' market power, hence the ability to profitably increase prices, is in theory related to market shares and to the level of concentration of the relevant market.
[3] For illustrative purposes we assume that the market is restricted to bottled sports drinks, that are those beverages designed to help athletes rehydrate when fluids are depleted after training or competition. A proper antitrust assessment should consider whether such a narrow market definition is appropriate, for instance the market might include also sports drinks in powder format or more generally be part of the soft drinks wider market.
[4] Although higher prices is only one of the anticompetitive effects that should be evaluated in merger assessment, it is the easier to quantify and accordingly the one that has received more attention by competition authorities.
[5] Of course also the price of Product 2 might increase for the same reasons.
[6] Farrell J., and C Shapiro, 2010, "Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition", The B.E. Journal of Theoretical Economics 10(1)
[7] The diversion ratio measures the amount of sales captured by one substitute product as a proportion of the amount of sales lost by the product which price is increased.
[8] Farrell and Shapiro (2010) suggest to adopt an "efficiency credit" of 10%.
[9] The UPP formula for Firm 2 takes an analogous expression. Moreover, if Firm1 and Firm 2 sell more than one product each we could have an UPP measure for each product pair sold by the two firms.
[10] It should be pointed out that this formula, although more "accurate" implies an efficiency "offence" as the higher the efficiency on Product 2, achieved through the merger, the higher is the pressure to increase Product 1 price.
[11] Salop, S.C. and S Moresi, 2009, "Updating the Merger Guidelines: Comments", available at http://www.ftc.gov/os/comments/horizontalmergerguides/545095-00032.pdf ; and, Moresi, S., 2010, "The Use of Upward Pricing Pressure Indices in Merger Analysis", The Antitrust Source, February 2010.
[12] Although the US Guidelines do not refer to this measure as GUPPI.
[13] Accounting for this effect, and assuming linear demand, the symmetric GUPPI formula would become $\frac{md}{(1-d)}$
[14] It is possible to derive also the IPR formulae for the asymmetric case. For instance the asymmetric IPR formula for the linear demand is given by $IPR_{asymmetric} = \frac{\Delta P_1}{P_1} = \frac{(D_{21}(D_{21}+D_{12})M_1+2D_{12}M_2\frac{P_2}{P_1})}{4-(D_{21}+D_{12})^2}$
[15] In some cases it might be useful to define diversion ratios not in terms of volume but in terms of value as the percentage of revenue lost by Firm 1 and captured by Firm 2, when Firm 1's prices increase.
[16] The relationship between diversion ratios and elasticity is captured by the following formula: $D_{12} = (\varepsilon_{21}Q_2)/(-\varepsilon_{11}Q_1)$ where ε_{21} is the cross price elasticity of Product 2 with respect to the price of Product 1, ε_{11} is the own price elasticity of Product 1, Q_1 and Q_2 are the unit sales of respectively Product 1 and Product 2.
[17] That is consumers purchasing one product consider all the products sold by competitors as equal alternatives to their current choice.
[18] In this case the diversion ratio from Product 1 to Product 2 can be approximated by the following formula, $D_{12} = \frac{s_2}{1-s_1}$, where s_2 is the market share of Product 2 and s_1 is the market share of Product 1. This implies that, absent Product 1, the share of sales diverted to Product 2 would be proportional to the market share of Product 2 divided by the total of the market excluding Product 1. See Shapiro, C., 1995, "Mergers with differentiated products", Antitrust, 10, p.23.
[19] Indeed, this shortcut implies that the market elasticity of demand is equal to zero, an assumption that is often violated in real markets.
[20] We refer to gross profit margins as cost does not include fixed cost but only variable cost.
[21] In this case the products sold by the merging firms would constitute by themselves a relevant market.
[22] Given that the IPR predicts the post merger price rise also the IPR is equivalent to perform a 5% SSNIP test on the products sold by the merging parties.
[23] In a symmetric differentiated product market two firms with a 12.5% market share each would have a competitors and that market share are related to diversion ratios, the diversion ratio between the two merging firm would be equal to $D_{12} = \frac{s_2}{1-s_1} = \frac{12.5\%}{1-12.5\%} = 14.3\%$ (see supra note 18). The value of 25% for the market share test has been chosen because a reference to this threshold can be found both in the UK horizontal merger guidelines ("share of supply tests") and in the EU horizontal merger guidelines.