Upward Price Pressure in Two-Sided Markets: Incorporating Feedback Effects

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Abstract

In two-sided markets it is important to consider feedback effects following a merger, *i.e.* how a price change on one side of the market affects the price change on the other side of the market. Affeldt *et al.* (2013) introduced the Upward Pricing Pressure (UPP) for two-sided markets, and we extend their approach to take into account such feedback effects. We then discuss the implications of our results for the assessment of two-sided mergers.

Keywords: merger assessment, two-sided markets, Upward Pricing Pressure.
JEL codes: L13, L40, L82.

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1 Introduction

Merger assessment has undergone substantial changes since the 90s, from an approach based on market definition, market shares and concentration index, to the application of methods that can directly indicate the potential price increase following a merger. Simplified approaches that focus on the post-merger pricing incentives of the insiders have been proposed by Werden (1996) and Shapiro (1996).[1] This method has been further developed by Farrell and Shapiro (2010) into the Upward Pricing Pressure (UPP) approach.[2] Since 2005 various antitrust authorities have applied the method in many cases, and it has become a standard method that is referred to in merger guidelines.[3] It is either applied for screening of mergers, or as an important input for the analysis of the competitive harm when banning mergers or solving them with remedies.

More recently, the UPP approach has been extended by Affeldt *et al.* (2013) to mergers on two-sided markets. Instead of having two firms producing one product each, they considered a situation where two firms were both active in a two-sided market. Each of them then served two different groups of users. They applied their model to

[1] While Shapiro (1996) insisted on the diversion ratios to compute the post-merger price increase assuming linear or constant elasticity of demand, Werden (1996) focused on the marginal cost reductions necessary to offset the post-merger price increase. See also Goppelsroeder, Schinkel and Tuinstra (2008) and Werden and Froeb (2011) for further discussions of the Compensating Marginal Cost Reduction method with Bertrand competition and product differentiation. By the same token, Farrell and Shapiro (1990) had considered instead Cournot competition in order to derive the condition for how large the reduction in marginal cost should be to counterveil any upward pricing pressure.

[2] The condition for an upward price pressure was then further developed into a more complex and realistic formula in Hausmann *et al.* (2011). Moresi (2010) introduced the gross upward pricing pressure index (GUPPI), and computed the upward pricing pressure absent any efficiencies. Other simple formulas have also been applied by antitrust authorities, for example the indicative price increase (IPR) first introduced in Shapiro (1996) and further developed in Shapiro (2010).

[3] The method was first applied in a merger case in the grocery sector in the UK in 2005 (Somerfield/Morrison, 02.09.2005). Although many national competition authorities in Europe applied the UPP method from 2005 and onwards, the European Commission first used it in a phase-II assessment for the Hutchison 3G Austria/Orange Austria merger in 2012. The US Federal Trade Commission (FTC) and Department of Justice (DoJ) has applied the method in several cases, see for example Electrolux/GE Appliance and Dollar Tree/Family Dollar. FTC and DoJ endorsed the UPP methodology in the August 2010 Horizontal Merger Guidelines. The UK competition authorities (Office of Fair Trading and Competition Commission) did the same in their Merger Assessment Guidelines in September 2010.

the newspaper market, where each firm served both advertisers and readers. In the spirit of Farrell and Shapiro (2010), they focused on the upward pricing pressure for the products sold by one of the merging parties. They derived criteria to identify an upward pricing pressure on each of these two products, given that the prices of all the other products were fixed.

Our main concern is how a price change on one side of the market can feed back on the optimal price on the other side of the market. This effect, which we label the feedback effect, is not taken into account in the criterion developed in Affeldt *et al.* (2013). We show that if we incorporate such a feedback effect, the qualitative results can be reversed. A merger leading to upward pricing pressure on one side of the market may lead to a downward pricing pressure on the other side of the market, even if there are no efficiencies and margins on both sides are non-negative. This is well known in the literature on two-sided markets, but then even more problematic when this mechanism is not taken into account in the criterion in Affeldt *et al.* (2013). We present a simple criterion for how this kind of effect can be captured in a simple upward pricing pressure framework.

Digital markets in general, and platform mergers in particular, are attracting growing attention and increased antitrust scrutiny.[4] The feedback effect that we focus on can be particularly relevant for the assessment of a merger between online platforms, where there may typically be positive externalities from users to advertisers. In that case we show that the feedback effect can lead to an upward pricing pressure on the advertising side while at the same time downward pricing pressure on the user side. If prices are not flexible, for example the users have access to the platform for free, then what we label a downward pricing pressure may lead to a higher investment in quality of the platform. The reason is that higher quality is a substitute for lower price for attracting users.

Our results indicate that competition agency's decision may depend on whether they consider each side of the market separately or both sides in total.[5] For example,

[4]The Google/DoubleClick, Facebook/WhatsApp or Deutsche Börse/NYSE Euronext are some examples of front-page cases. Stepstone/Evenbase and Ticketmaster/Seatwave are two merger cases in the UK. For more examples of mergers in two-sided markets, see Filistruchi *et al.* (2014), Foros, Kind and Sørgard (2015) and Wismer *et al.* (2016).

[5]In Europe for instance, the General Court and the European Court of Justice made clear that the

ignoring the feedback effect might in some situations overstate the upward pricing pressure on the user side of the market. In fact, it might wrongly predict an upward pricing pressure when there is a downward pricing pressure on that side of the market. This shows that an approach where the competition agency focuses on only one side of the two markets, which we have seen some examples of, can lead to an erroneous decision.[6]

In what follows we contrast the derivation of UPP in two-sided markets to that in one-sided markets. Then we highlight the bias in Affeldt *et al.* (2013) that we correct by incorporating the feedback effect. We discuss our results and conclude on their implications for the practice of competition agencies.

2 UPP in one-sided vs two-sided markets

2.1 UPP in a one-sided market

Consider a hypothetical merger between firm 1 and 2 operating in the same market. The firms sell one product each. To see whether the merger may create adverse effects, and to which degree, the simple idea presented in Farrell and Shapiro (2010) is to check whether the merger leads to an Upward Pricing Pressure (UPP) on one of the two products.[7] Let P_i and C_i be the price and marginal production cost (assumed to be constant) for product $i = 1, 2$ before the merger. The profit for firm i pre-merger is then simply $\Pi_i = (P_i - C_i) Q_i$, and the first-order profit maximizing condition with

market's two-sides should be examined and considered separately as far as the welfare analysis goes - see the MasterCard decision (Case T-111/08).

[6] Wismer *et al.* (2016) provides an overview of recent merger cases for two-sided markets, and they report that in some of the cases each side of the market is defined separately. See also the *Archant/Independent News* and *Media* merger in the UK in 2004, which involved two local newspapers. In that case the competition agency only considered one side of the two-sided market (the advertising side).

[7] Note that 'upward pricing pressure' is indicating that the firm's competitive constraint is less strict. This can make it profitable to raise its price. Alternatively, it can increase profits by investing less in quality.

respect to the price P_i is

$$\frac{\partial \Pi_i}{\partial P_i} = (P_i - C_i)\frac{\partial Q_i}{\partial P_i} + Q_i = 0. \tag{1}$$

We can write the profit for the merged firm as $\Pi_{1+2} = \sum_{i=1}^{2} (\Pi_i + E_i C_i Q_i)$, where $E_i = \left(C_i - C_i^N\right)/C_i$ is the proportionate reduction in marginal cost (from C_i pre merger to C_i^N post merger) for product $i = 1, 2$. Suppose that the price for firm 2, P_2, does not change after the merger. The profit maximizing condition for the merged firm with respect to the price P_1, is now

$$\frac{\partial \Pi_{1+2}}{\partial P_1} = \frac{\partial \Pi_1}{\partial P_1} + \frac{\partial \Pi_2}{\partial P_1} + E_1 C_1 \frac{\partial Q_1}{\partial P_1} + E_2 C_2 \frac{\partial Q_2}{\partial P_1} = 0. \tag{2}$$

We may then note that there is an upward pressure on the price for product 1 after the merger, as long as $\frac{\partial \Pi_{1+2}}{\partial P_1} - \frac{\partial \Pi_1}{\partial P_1} \geq 0$, or as long as

$$(P_2 - C_2)\frac{\partial Q_2}{\partial P_1} + E_1 C_1 \frac{\partial Q_1}{\partial P_1} + E_2 C_2 \frac{\partial Q_2}{\partial P_1} \geq 0. \tag{3}$$

To express the condition using diversion ratios, we divide by $-\partial Q_1/\partial P_1 > 0$ to obtain

$$UPP_1 = (P_2 - C_2) D_{12} + E_2 C_2 D_{12} - E_1 C_1 \geq 0. \tag{4}$$

where $D_{12} = [\partial Q_2/\partial P_1] / [-\partial Q_1/\partial P_1]$ is the diversion ratio from firm 1 to firm 2. Hence, given that the price for product 2 remains the same, the firm would like to increase the price for product 1 after the merger as long as $UPP_1 \geq 0$. Condition (4) is a trade-off between downward price pressure from a lower marginal cost $E_1 C_1$, and the upward pricing pressure from the value of diverted sales $(P_2 - (1 - E_2) C_2) D_{12}$. The upward pricing pressure from the latter effect is explained in US Horizontal Merger Guidelines (2010):

> 'Adverse unilateral price effects can arise when the merger gives the merged entity an incentive to raise the price of a product previously sold by one merging firm and thereby divert sales to products previously sold by

the other merging firm, boosting the profits on the latter products. Taking as given other prices and product offerings, that boost to profits is equal to the value to the merged firm of the sales diverted to those products. The value of sales diverted to a product is equal to the number of units diverted to that product multiplied by the margin between price and incremental cost on that product.' (p. 21)

Let us define $L_2 = (P_2 - C_2)/P_2$ as the relative price-cost margin (pre-merger) for firm 2. By ignoring any efficiencies on product 2 (i.e., set $E_2 = 0$ and assuming again that P_2 does not change), it can be shown that there is an upward pressure on the price for product 1, as long as (see Farrell and Shapiro, 2010):

$$D_{12} \geq E_1 \frac{1 - L_2}{L_2} \tag{5}$$

Hence, as long as the diversion ratios between the firms are not too large, the merger should not cause any concerns. However, so far we have only considered a price increase on one of the products following the merger. In reality, the merging parties may change all their prices. In this particular case it would imply that the merging parties may change not only the price of product 1, but also the price of product 2. A change in the price for product 2 can potentially have an effect on the optimal price for product 1, and vice versa. In line with Farrell and Shapiro (2010), we call this the *feedback effect*.

To incorporate the feedback effect, we may characterize the efficiencies E_1 and E_2 required to keep *both* prices from rising after the merger. First, note that the size of the efficiency $\widehat{E}_2$ necessary to keep P_2 from rising after the merger, all else equal, is given by the condition $UPP_2 = 0$, or

$$\widehat{E}_2 = \frac{P_1 - C_1}{C_2} D_{21} + E_1 \frac{C_1}{C_2} D_{21}. \tag{6}$$

When substituting $\widehat{E}_2$ for E_2 in condition (4) above, and imposing symmetry ($D_{ij} = D$, $P_i = P$, $C_i = C$, and $E_i = E$ for all $i \neq j \in \{1, 2\}$), we obtain that the firm would

like to increase prices after the merger if the following condition holds:

$$\frac{D}{1-D} \geq E\frac{1-L}{L}. \tag{7}$$

When comparing (5) to (7), again assuming symmetry, we observe that because $D/(1-D) > D$ it is more likely that condition (7) will be satisfied. The reason is that, when the margin on product 2 increases, which it will after the merger (either because of low efficiencies or because of a price increase due to less competition), the value of the firm's diverted sales increases as well – which in turn causes a strong incentive to increase the price on product 1, and vice versa. This effect is incorporated in condition (7), but not in condition (5). This illustrates that the simple test that is formulated in Farrell and Shapiro (2010), i.e. condition (5) above, and verbally described in the US Horizontal Merger Guidelines, is typically conservative, in the sense that it will underestimate the upward pricing pressure following a merger.[8]

2.2 UPP in two-sided markets

Let us now turn to a two-sided market. We let each firm, 1 and 2, produce two products each, which we call product A and product R. To fix ideas, think about this as two newspapers that have both advertisements and news content.[9] They sell advertisements to advertisers and the newspaper with content (and advertisements) to readers. Let superscript R denote the reader side, and A the advertiser side of the market. The simple approach in Farrell and Shapiro (2010) (as well as the US Horizontal Merger Guidelines) is to consider a possible price increase on the product sold by one of the two merging parties. Analogous to this, we consider here only the incentives for one of the firms, say firm 1, to change its prices $\left(P_1^R, P_1^A\right)$ after the merger (assuming the prices of the other firm remain constant). Furthermore, in line with the approach in Farrell and Shapiro (2010), we only allow for possible reductions in marginal costs for

[8]Note that in the criterion we have derived, we assume that the two products are symmetric. If we relax this assumption, it is shown in Mathiesen *et al.* (2012) that the criterion in the US Horizontal Merger Guidelines can overestimate the price increase following a merger. In what follows, we assume symmetry such that our results should be compared to Farrell and Shapiro (2010).

[9]Alternatively, we could think of this as an online platform with users (instead of readers) and advertisers.

firm 1.[10]

Let $\Pi_i = \sum_S \left(P_i^S - C_i^S\right) Q_i^S$ be the profit for firm i before the merger, where superscript $S \in \{A, R\}$ indicates the side of the market. Then we can define

$$\Pi_{1+2} = \sum_{i=1}^{2} \Pi_i + \sum_S E_1^S C_1^S Q_1^S \tag{8}$$

as the firm's overall profit after the merger. Analogous to the case of a one-sided market, there will be a upward pressure on the price for firm 1's product on side R, P_1^R, as long as $\frac{\partial \Pi_{1+2}}{\partial P_1^R} - \frac{\partial \Pi_1}{\partial P_1^R} \geq 0$, or as long as

$$\begin{aligned} \left(P_2^R - C_2^R\right) \frac{\partial Q_2^R}{\partial P_1^R} + \left(P_2^A - C_2^A\right) \frac{\partial Q_2^A}{\partial P_1^R} & \\ + E_1^R C_1^R \frac{\partial Q_1^R}{\partial P_1^R} + E_1^A C_1^A \frac{\partial Q_1^A}{\partial P_1^R} & \geq 0. \end{aligned} \tag{9}$$

To express this condition with diversion ratios, we divide by $-\partial Q_1^R / \partial P_1^R > 0$, to obtain the following condition (Affeldt *et al.* (2013)):

$$\begin{aligned} UPP_1^R = \left(P_2^R - C_2^R\right) D_{12}^{RR} + \left(P_2^A - C_2^A\right) D_{12}^{RA} & \\ - E_1^R C_1^R + E_1^A C_1^A D_{11}^{RA} & \geq 0. \end{aligned} \tag{10}$$

The equivalent condition for the price on side A, P_1^A, is

$$\begin{aligned} UPP_1^A = \left(P_2^A - C_2^A\right) D_{12}^{AA} + \left(P_2^R - C_2^R\right) D_{12}^{AR} & \\ - E_1^A C_1^A + E_1^R C_1^R D_{11}^{AR} & \geq 0. \end{aligned} \tag{11}$$

Like in a one-sided market, we may note that there is a downward pressure on the price P_1^R due to possible reductions in the marginal cost, expressed through the third term in condition (10), $-E_1^R C_1^R$. Moreover, as for a one-sided market, this downward pressure is mitigated by the value of diverted sales to firm 2 on the same side, the first term in condition (10), $\left(P_2^R - C_2^R\right) D_{12}^{RR}$.

[10] We relax this assumption in the Appendix.

Unlike a one-sided market, however, the downward price pressure from a lower marginal cost on side R, may either be weakened or strengthened indirectly through cost reductions on the opposite side of the market, the fourth term in condition (10), $E_1^A C_1^A D_{11}^{RA}$. Moreover, the upward price pressure from the value of diverted sales to firm 2 on side R, may be strengthened (or weakened) by the value of diverted sales to firm 2 on the opposite side of the market, the second term in condition (10), $\left(P_2^A - C_2^A\right) D_{12}^{RA}$. A higher reader price for firm 1 after the merger will lead to fewer readers for firm 1 and more readers for firm 2, all else equal. This will normally make firm 2 more attractive to advertisers, and some of them will therefore divert from firm 1 to firm 2's product. However, we may also note that, because of the cross-effects described here, a negative margin on one side of the market can lead to a downward pricing pressure on the opposite side, following a merger.

The incentive for upward pricing pressure on the reader side for firm 1 is therefore due to (i) the diversion of readers to the other merging firm and (ii) the diversion of advertisers to the other merging firm. The first is a traditional own-side effect, while the latter effect is across the two sides of the market (a cross-side effect therefore). Hence, we can write the gross upward pricing pressure (ignoring efficiencies) for firm 1 on each side of the market as (Affeldt *et al.* (2013))

$$GUPPI_1^{R+} = m_2^R \frac{P_2^R}{P_1^R} D_{12}^{RR} + m_2^A \frac{P_2^A}{P_1^R} D_{12}^{RA} \tag{12}$$

and

$$GUPPI_1^{A+} = m_2^A \frac{P_2^A}{P_1^A} D_{12}^{AA} + m_2^R \frac{P_2^R}{P_1^A} D_{12}^{AR}. \tag{13}$$

where $m_i^S = \left(P_i^S - C_i^S\right) / P_i^S$ is firm i's margin on side S.

We have seen that in a two-sided market there are both own-side and cross-side effects.[11] But so far we have only considered a change in one price at a time. In a one-sided market we saw that even if we ignore the feedback effects between the two products, the qualitative results would not change. Moreover, the resulting test (eq. (5) above) would be a conservative measure of the upward price pressure following a

[11] Note that in terms of vocabulary, Affeldt *et al.* (2013) label as feedback effects what we call here cross-side effects.

merger. This is not the case in a two-sided market. If we ignore the feedback effects between firm 1's products (on opposite sides of the market), as is done in eqs. (10)-(13) above, the resulting tests may either understate or overstate the price pressure following the merger, depending on the situation. In particular, this is a valid cause for concern for the cases where eqs. (10) through (13) *overstate* the actual price pressures, as this will cause more Type 1 errors, and thus the authorities wasting resources on mergers that should have been cleared at an earlier stage.

3 Incorporating the feedback effects for two-sided markets

To capture the relevant feedback effects between firm 1's products, we should consider how a price change on one product could feed back on the optimal price setting on the other product. Consider the price pressure on side R, assuming there are no efficiencies. The third term in eq. (10) is then not relevant. On the other hand, we can reinterpret the term $E_1^A C_1^A$ in eq. (10) as the increased profit on the opposite side, not from lower costs, but from a possible increase in the price on side A, i.e. $\Delta P_1^A > 0$. Condition (10) can then be rewritten so that there is an upward pricing pressure on firm 1's product R as long as

$$-D_{11}^{RA}\Delta P_1^A < \left(P_2^R - C_2^R\right) D_{12}^{RR} + \left(P_2^A - C_2^A\right) D_{12}^{RA} \tag{14}$$

ΔP_1^A is the absolute price increase on firm 1's product on side A, and D_{11}^{RA} is the within-firm diversion ratio from side R to side A (i.e., the loss in readers that is recaptured through sales to the advertisers). The two terms on the right hand side are the ones that lead to an upward pricing pressure (see the explanation above). Given that advertisers are positively affected by readers, a loss in readers will translate into a loss in the amount of advertising, i.e. $D_{11}^{RA} < 0$. Hence, in this case the left-hand side of the inequality will be positive if the price increase ΔP_1^A on side A is also positive. A higher price on side A then gives firm 1 an incentive to increase the sales of product R. The reason is that each additional reader leads to a higher advertising revenue on the margin. Given this price change on the advertising side, firm 1 has an incentive

to set a lower reader price and thereby boost circulation. The mechanism, leading to a downward pressure on the reader price, is quite well known in the literature on two-sided markets. Higher prices on ads will make it more attractive to have a high number of readers, which in turn will increase the demand for advertisements. A higher price on one side of the market may therefore cause a lower price on the other side of the market, all else equal.

In a similar fashion, we can rewrite condition (11), so that there is an upward pricing pressure on firm 1's product A as long as

$$-\Delta P_1^R D_{11}^{AR} < \left(P_2^A - C_2^A\right) D_{12}^{AA} + \left(P_2^R - C_2^R\right) D_{12}^{AR} \tag{15}$$

where ΔP_1^R is the change in the price for firm 1 on side R.

The problem with applying the formulas in eqs. (12)-(13) is that we ignore the feedback effects described above; how a change in a price on the other side of the market feeds back on the optimal price on this side of the market. As shown in eqs. (14) and (15), the sign of the hypothesized price effect can then be wrong. This is in contrast to a one-sided market, where we know that the qualitative results do not change when we include such feedback effects.

In eqs. (14)-(15) we have only imposed exogenous shifts in firm 1's prices. To obtain a more exact measure of what will happen to the firms' margins after the merger, we need to either make assumptions about the curvature of demand, or about the realized efficiencies.

Let us start by assuming, for simplicity, that demand is linear, which may be a good approximation locally. Then it is easy to show that the amount by which the price on side S increases or decreases after the merger, holding costs and other prices fixed, is simply

$$\Delta P_1^S = \frac{GUPPI_1^{S+}}{2} P_1^S. \tag{16}$$

If we substitute (16) into eqs. (14)-(15), and rewrite, then we obtain the following

modified GUPPIs for each side of the market

$$\begin{aligned} GUPPI_1^{R*} &= m_2^R \frac{P_2^R}{P_1^R}\left(D_{12}^{RR} + \frac{D_{11}^{RA}}{2} D_{12}^{AR}\right) \\ &\quad + m_2^A \frac{P_2^A}{P_1^R}\left(D_{12}^{RA} + \frac{D_{11}^{RA}}{2} D_{12}^{AA}\right) \end{aligned} \tag{17}$$

for side R, and

$$\begin{aligned} GUPPI_1^{A*} &= m_2^A \frac{P_2^A}{P_1^A}\left(D_{12}^{AA} + \frac{D_{11}^{AR}}{2} D_{12}^{RA}\right) \\ &\quad + m_2^R \frac{P_2^R}{P_1^A}\left(D_{12}^{AR} + \frac{D_{11}^{AR}}{2} D_{12}^{RR}\right) \end{aligned} \tag{18}$$

for side A. Each of the indices (17)-(18) is a result of the following thought experiment: Suppose there is no price increase on side R $[A]$ for firm 1, and assume that prices remain the same for firm 2. By how much will the price either increase or decrease on side A $[R]$ after the merger? If we take this price increase/ decrease on side A $[R]$ into account, what then are the incentives to increase the price on side R $[A]$?

As an alternative way to capture the relevant feedback effects, we now consider the hypothetical efficiencies that are required to keep the price on each side from rising after the merger, all else equal. These are

$$\widehat{E}_1^A = \frac{P_2^A - C_2^A}{C_1^A} D_{12}^{AA} + \frac{P_2^R - C_2^R}{C_1^A} D_{12}^{AR} \tag{19}$$

for side A, and

$$\widehat{E}_1^R = \frac{P_2^R - C_2^R}{C_1^R} D_{12}^{RR} + \frac{P_2^A - C_2^A}{C_1^R} D_{12}^{RA} \tag{20}$$

for side R. $\widehat{E}_1^S$ is the efficiency that solves $UPP_1^S = 0$ while assuming that there are zero efficiencies on the opposite side. By substituting $\widehat{E}_1^A$ for E_1^A in eq. (10), and $\widehat{E}_1^R$ for E_1^R in eq. (11), and then imposing $E_1^R = E_1^A = 0$ afterwards, we obtain the

following modified GUPPIs for firm 1 on each side of the market.

$$\begin{aligned} GUPPI_1^{R**} &= m_2^R \frac{P_2^R}{P_1^R}\left(D_{12}^{RR} + D_{11}^{RA} D_{12}^{AR}\right) \\ &\quad + m_2^A \frac{P_2^A}{P_1^R}\left(D_{12}^{RA} + D_{11}^{RA} D_{12}^{AA}\right) \end{aligned} \tag{21}$$

for side R, and

$$\begin{aligned} GUPPI_1^{A**} &= m_2^A \frac{P_2^A}{P_1^A}\left(D_{12}^{AA} + D_{11}^{AR} D_{12}^{RA}\right) \\ &\quad + m_2^R \frac{P_2^R}{P_1^A}\left(D_{12}^{AR} + D_{11}^{AR} D_{12}^{RR}\right) \end{aligned} \tag{22}$$

for side A. Unlike (17)-(18), the indices (21)-(22) are a result of the following thought experiment: Suppose that absent any price change on side R $[A]$, there is no incentive for firm 1 to change its price on side A $[R]$ after the merger. This has to mean that firm 1's efficiency on side A is large enough to counter any incentive to increase the price on that side. Taking this efficiency into account, what are firm 1's incentives for a price change on side R, gross of any efficiencies on that side, and holding constant the prices and costs for firm 2?

To see how ignoring the feedback effect affects the GUPPI for each side, we can subtract $GUPPI_1^{S*}$ from $GUPPI_1^{S+}$, to obtain

$$\alpha_1^R = -\frac{D_{11}^{RA}}{2}\left[m_2^R \frac{P_2^R}{P_1^R} D_{12}^{AR} + m_2^A \frac{P_2^A}{P_1^R} D_{12}^{AA}\right] \tag{23}$$

for side R, and

$$\alpha_1^A = -\frac{D_{11}^{AR}}{2}\left[m_2^A \frac{P_2^A}{P_1^A} D_{12}^{RA} + m_2^R \frac{P_2^R}{P_1^A} D_{12}^{RR}\right] \tag{24}$$

for side A. α_1^S is the amount by which (12) overstates or understates the price pressure on side S.

To better seize this result, it is useful to give some examples, and we do so below. Suppose advertisers benefit from having more readers, so that $-D_{11}^{RA} > 0$. If readers

are largely unaffected by advertising (which some studies seem to indicate[12]), then we expect that $D_{11}^{AR} = D_{12}^{AR} = 0$. We are then left with

$$\alpha_1^R = -m_2^A \frac{D_{11}^{RA}}{2} \frac{P_2^A}{P_1^R} D_{12}^{AA} > 0$$

and $\alpha_1^A = 0$. Hence, in this case the price pressure for firm 1 is appropriately measured by $GUPPI_1^{A+}$ for side A, while $GUPPI_1^{R+}$ overstates the price pressure on side R, as long as the value of diverted sales $(P_2^A - C_2^A)D_{12}^{AA}$ is strictly positive on side A. On the other hand, if readers enjoy advertisements[13], then we have both $D_{11}^{RA} < 0$ and $D_{11}^{AR} < 0$, while $D_{12}^{AR} \geq 0$ and $D_{12}^{RA} \geq 0$. In this case $GUPPI_1^{R+}$ and $GUPPI_1^{A+}$ both overstate the price pressure caused by the merger. Finally, if readers dislike ads[14], then $D_{11}^{AR} > 0$ while $D_{12}^{AR} \leq 0$. In this case we may find that $GUPPI_1^{R+}$ overstates the price pressure, assuming of course that $\left(P_2^R - C_2^R\right) D_{12}^{AR} + \left(P_2^A - C_2^A\right) D_{12}^{AA} > 0$, while $GUPPI_1^{A+}$ understates the price pressure.

We may note that the sign of the bias shown in eqs. (23) and (24) is the same, irrespective of which modified version we use, $GUPPI_1^{S*}$ or $GUPPI_1^{S**}$.

Finally, it is worth reminding that the feedback effects that we have highlighted through eqs. (14) and (15), are only partial, to the extent that we did not allow for changes in firm's 2 prices. Typically, with a positive externality from side R to side A, one would expect an increase in firm's 2 price on side A to trigger a downward pressure on the prices of both 1 and 2 on side A. A full-fledged two-sided UPP would allow for this, and in the Appendix we derive the corresponding GUPPIs.

[12]For instance, Argentesi and Filistrucchi (2007), van Cayselee and Vanormelingen (2010) and Fan (2013) find no effect of advertising on the sales of daily newspapers in Italy, Belgium and the US respectively.

[13]Kaiser and Song (2009) for instance report that readers of magazines do not dislike advertising, and may even like it depending on the type of magazine.

[14]It would appear that ads are mainly disliked when they are not targeted and cannot be avoided, as it is rather the case for TV and radio - see for instance Wilbur (2008).

4 Discussion

The intuition for the difference between the GUPPIs proposed here, and the ones proposed by Affeldt *et al.* (2013), is the following. When Affeldt *et al.* (2013) calculate the price pressure on the reader side, they do not take into account that the merger may also cause higher margins on the advertising side, which is not unreasonable to assume, given that the media firms are rivals (i.e., when $D_{12}^{AA} > 0$). Hence, if we assume that firm 1 does not change its price on the advertising side, then the implicit assumption we are making is that there are efficiencies for firm 1 on side A that are large enough to counteract any price increase, i.e. $E_1^A C_1^A > 0$. Hence, whether we assume a price increase on side A or not, the implication is that margins are higher on side A after the merger, as long as $E_1^R = 0$ and $D_{12}^{AA} > 0$. This is not taken into account in eq. (12). Higher margins on side A imply that firm 1 should reduce its price on side R, as long as there is a positive effect of readership on advertising demand. Hence, in that case the price effect in (12) is overstated, as indicated by (23).

Note that the modified GUPPIs that we propose above, require no additional information compared to the joint information required by the indices presented in Affeldt *et al.* (2013). However, when looking at the indices for each side in isolation, we can see that to calculate $GUPPI_1^{R*}$, for example, we need the information required to calculate both $GUPPI_1^{R+}$ and $GUPPI_1^{A+}$. Hence, $GUPPI_1^{R*}$ requires the competition authorities to collect more data compared to what they need to derive $GUPPI_1^{R+}$. We will argue that this is not a problem, as the authorities are normally required to perform screening tests on both sides of the market anyway. The data should therefore already be collected. However, a much bigger problem, which is highlighted both here and in Affeldt *et al.* (2013), is how to collect and interpret the survey data that we need to calculate all the diversion ratios, both cross-sides and on each side of the market.

Given that merger investigations involve substantial costs both for the authorities and for the firms, it would be best to have a conservative test for the price effects, so as to avoid Type 1 errors. We argue that the indices we have proposed, $GUPPI_1^{S*}$ or $GUPPI_1^{S**}$, are likely to be more conservative than a simpler index that does not take into account the feedback effects between the two sides. However, we cannot rule out situations where for example we would have $\alpha_1^R > 0$ and $\alpha_1^A < 0$, *i.e.*, where

the original test is less conservative on one side, and more conservative on the other. For these cases, one obvious solution would be to sacrifice some precision and use the most conservative test on each side, whatever it turns out to be - for instance, using $GUPPI_1^{R*}$ on side R and $GUPPI_1^{A+}$ on side A.

5 Some concluding remarks

The upward pricing pressure framework has been applied in many merger cases recently, and competition agencies receive increasing numbers of two-sided merger submissions. It is therefore potentially very important to adapt the UPP methodology to two-sided markets. The approach proposed by Affeldt *et al.* (2013) makes it possible to capture cross-side effects, such that higher reader prices for one merging party leads to diversion of advertisers – in addition to the traditional one-sided diversion of readers – to the other merging party. Their analysis also encompasses possible own-side and cross-effects of changes in marginal costs for the merging parties.

However, their approach neglects what we call the *feedback* effect: a price change on one side of the market may feed back on the optimal pricing on the other side of the market. We show that when we take this into account, the qualitative results in Affeldt *et al.* (2013) can be reversed. A merger leading to a price increase on one side of the market may lead to a price reduction on the other side, even if there are no efficiencies and margins are non-negative.

The feedback effect we have focused on can be very relevant for mergers in, for example, the newspaper industry. Empirical studies indicate that there is a positive externality from reader to advertisers: more readers will increase the demand for advertising, quite obviously.[15] However, there is no consensus on the existence of a positive or negative externality the opposite way: readers may not care much about, or even dislike, advertising.[16] Given this, the most important feedback effect would be from

[15] See for instance Kaiser and Wright (2006) and Kaiser and Song (2009) for evidence that advertising increases readers demand for magazines in Germany

[16] Sonnac (2000) provides empirical evidence on the effects of advertising, and finds that the effect of advertising on readers depends on the type of media and on the country. More importantly, agencies sometimes explicitly ignored that the level of advertising in a newspaper might affect demand from readers - see for example the 2002 de-

readers to advertisers. As a result, with higher prices on the advertising side of the market after the merger, there is a potential for a downward pricing pressure on the reader side of the market. To capture this, one should apply the formulas we have presented previously, and not those in Affeldt *et al.* (2013).

A similar mechanism can be present following a merger between two competing online platforms. If the main externality is from users to advertisers - more users makes the platform more attractive for the advertisers - then a merger might lead to a downward pressure on the user prices. If there are no user payment, what we have called a downward pressure on prices can lead to an investment in higher quality of the platform. The point is that the feedback effect makes it more valuable for the platform to attract more users after the merger. More users can be attracted to the platform either by lowering the user payment, or increasing the quality of the platform.

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Appendix

The two-sided UPP incorporating cost savings for the second platform

Here we extend the analysis sketched by Affeldt et al. (2013) in their section 2.1.2, where they incorporated efficiency gains for the second platform[17] by adjusting the

[17]This is all the more relevant that the cost savings possibly explaining the change in prices are supposed to be firm-specific.

margins on both sides of the market. In other words, eqs. (10) and (11) now become

$$\begin{aligned}\overline{UPP}_1^R = \left(P_2^R - C_2^R(1-E_2^R)\right) D_{12}^{RR} + \left(P_2^A - C_2^A(1-E_2^A)\right)D_{12}^{RA} \\ -E_1^R C_1^R + E_1^A C_1^A D_{11}^{RA} \geq 0\end{aligned} \tag{25}$$

and

$$\begin{aligned}\overline{UPP}_1^A = \left(P_2^A - C_2^A(1-E_2^A)\right) D_{12}^{AA} + \left(P_2^R - C_2^R(1-E_2^R)\right) D_{12}^{AR} \\ -E_1^A C_1^A + E_1^R C_1^R D_{11}^{AR} \geq 0\end{aligned} \tag{26}$$

respectively. Take for instance eq. (25): as compared with eq. (10), the downward price pressure from a lower marginal cost on side R will be further weakened or strengthened through the other firm's cost savings on both sides, $E_2^A C_2^A D_{12}^{RA} + E_2^R C_2^R D_{12}^{RR}$.

To capture these additional feedback effects, we may start by identifying the hypothetical efficiencies necessary for firm 2 to keep its prices constant on each side, assuming that firm 1 does not change its prices. More precisely, denote $\overline{E_2^R C_2^R}$ and $\overline{E_2^A C_2^A}$ the cost savings that solve for $UPP_2^R = 0$ and $UPP_2^A = 0$ respectively under the assumptions that each time there are no price changes on the opposite side for firm 2 and also prices are constant for firm 1. Then we have that

$$\overline{E_2^R C_2^R} = (P_1^R - C_1^R)D_{21}^{RR} + (P_1^A - C_1^A)D_{21}^{RA} \tag{27}$$

and

$$\overline{E_2^A C_2^A} = (P_1^A - C_1^A)D_{21}^{AA} + (P_1^R - C_1^R)D_{21}^{AR}. \tag{28}$$

By plugging $\overline{E_2^R C_2^R}$ and $\overline{E_2^A C_2^A}$ into eqs. (25) and (26) respectively, and assuming every time the lack of efficiency gains on the opposite side, we get the necessary cost savings for firm 1 to keep its prices constant on each side, $\overline{E_1^R C_1^R}$ and $\overline{E_1^A C_1^A}$, where

$$\begin{aligned}\overline{E_1^R C_1^R} \;=\; & D_{12}^{RA}(P_2^A - C_2^A) + D_{12}^{RR}(P_2^R - C_2^R) \\ & +(P_1^A - C_1^A)(D_{12}^{RA}D_{21}^{AA} + D_{12}^{RR}D_{21}^{RA}) \\ & +(P_1^R - C_1^R)(D_{12}^{RA}D_{21}^{AR} + D_{12}^{RR}D_{21}^{RR})\end{aligned} \tag{29}$$

and

$$\begin{aligned}\overline{E_1^A C_1^A} &= D_{12}^{AA}(P_2^A - C_2^A) + D_{12}^{AR}(P_2^R - C_2^R) \\ &+(P_1^A - C_1^A)(D_{12}^{AA}D_{21}^{AA} + D_{12}^{AR}D_{21}^{RA}) \\ &+(P_1^R - C_1^R)(D_{12}^{AA}D_{21}^{AR} + D_{12}^{AR}D_{21}^{RR}).\end{aligned} \tag{30}$$

By substituting $\overline{E_1^R C_1^R}$ into eq. (26) and $\overline{E_1^A C_1^A}$ into eq. (25) and afterwards ignoring own side efficiency gains, we obtain the $\overline{GUPPI}_1^S$ (we do not write the GUPPIs as a percentage here):

$$\begin{aligned}\overline{GUPPI}_1^R &= (P_2^A - C_2^A)(D_{12}^{RA} + D_{11}^{RA}D_{12}^{AA}) + \left(P_2^R - C_2^R\right)\left(D_{12}^{RR} + D_{11}^{RA}D_{12}^{AR}\right) \\ &+(P_1^A - C_1^A)(D_{12}^{RA}D_{21}^{AA} + D_{12}^{RR}D_{21}^{RA} + D_{11}^{RA}D_{12}^{AA}D_{21}^{AA} + D_{11}^{RA}D_{12}^{AR}D_{21}^{RA}) \\ &+(P_1^R - C_1^R)(D_{12}^{RA}D_{21}^{AR} + D_{12}^{RR}D_{21}^{RA} + D_{11}^{RA}D_{12}^{AA}D_{21}^{AR} + D_{11}^{RA}D_{12}^{AR}D_{21}^{RR})\end{aligned} \tag{31}$$

and

$$\begin{aligned}\overline{GUPPI}_1^A &= \left(P_2^A - C_2^A\right)\left(D_{12}^{AA} + D_{11}^{AR}D_{12}^{RA}\right) + \left(P_2^R - C_2^R\right)\left(D_{12}^{AR} + D_{11}^{AR}D_{12}^{RR}\right) \\ &+(P_1^A - C_1^A)(D_{12}^{AA}D_{21}^{AA} + D_{12}^{AR}D_{21}^{RA} + D_{11}^{AR}D_{12}^{RA}D_{21}^{AA} + D_{11}^{AR}D_{12}^{RR}D_{21}^{RA}) \\ &+(P_1^R - C_1^R)(D_{12}^{AA}D_{21}^{AR} + D_{12}^{AR}D_{21}^{RR} + D_{11}^{AR}D_{12}^{RA}D_{21}^{AR} + D_{11}^{AR}D_{12}^{RR}D_{21}^{RR}).\end{aligned} \tag{32}$$

These indices provide the incentives for firm 1 to change its prices on each side, gross of any efficiencies on that side, while explicitly taking into account the efficiency gains that keep firm's 2 prices constant on each side.