Merger screening in markets with differentiated products

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Content

1. An introduction

It is a challenge for competition authorities to decide which mergers out of all proposed mergers that should be investigated in detail. There is a large need for a procedure that can help them to clear early on those mergers with no anti-competitive effect, and at the end of the procedure block only those with an anti-competitive effect.

In most merger cases it has been a large focus on the number of firms in an industry and market shares of the merging parties. This is illustrated by the use of concentration indexes and the merging parties' market shares as threshold levels for clearing mergers early on. In the merger assessment in a later phase of the merger control we have also seen that such structural characteristics in an industry can be crucial for the decision to block a merger or not. One example is the merger assessment done by the Norwegian Competition Authority. We observe that their competitive assessment typically starts out with reporting the market shares of the merging parties and often the HHI index, and then they report the change in market shares and the HHI index following the merger.

Such an assessment can be problematic, especially when considering horizontal mergers in markets with differentiated products. In such cases market shares may not be a good proxy for the rivalry between the merging parties. In this article I will first explain why market shares and concentration may not capture the anticompetitive effects from a merger in such a market (see section 2). Then I explain an alternative approach (see section 3). The main point is that the analysis is focusing directly on the competitive constraints between the merging parties. We also relate this approach to (the modern version of) the SSNIP test. In section 4 I report how this approach can be applied in various cases, illustrated by a competition case in the ferry market in the North Sea, retail mergers in the UK, and a merger in the grocery sector in Norway and. Finally, I offer some concluding remarks (Section 5).

2. The role of market shares

Market shares are in many jurisdictions still the most important factor for merger screening, as well as for the detailed scrutiny in the late phase of a merger investigation. Concerning merger screening, the important role of market shares follows directly from merger guidelines in, for example, the US and EU.[1]

[1] In the US Merger Guidelines from August 2010, they apply Herfindahls-Hirschmann index (*i.e.,* the sum of the squares of the individual firms' market shares – HHI) to distinguish between industries with, low medium and high concentration (see p. 18/19). On the other hand, in another section of the guidelines they warn against

If two firms both have large market shares, it would imply that a merger between them would eliminate a large part of the competitive pressure in an industry. In the extreme case with two firms with 50 % market share each, the merger would lead to a monopoly in that particular market.

Despite the intuitive appeal of market shares, the market share approach can be problematic. This is particularly true in industries with differentiated products. To illustrate this, let us consider an acquisition in the UK grocery market in 2005.

In 2005 Somerfield acquired 115 Safeway grocery stores from Morrison. Office of Fair Trading (OFT) undertakes the first phase of the merger control in the UK, and they made a so called isochrones analysis. For each acquired store, they draw a circle around that store with 10/15 minutes travel time in city/rural areas for one-stop shopping and 5/10 minutes travel time for smaller stores in city/rural areas. Then they counted the number of independent rivals after the merger. If three or less independent rivals, then they recommended a further scrutiny of the acquisition of that particular store. By using such a method they found that the acquisition of one of the one-stop shopping stores and 22 of the smaller stores were problematic, and they referred the acquisition to Competition Commission for a phase II investigation. In Figure 1 we have shown an illustration, where you see that a Morrison store is replaced with a Somerfield store.

There are numerous problems with such an approach. Counting is a very rough measure of market shares. Then it is an implicit assumption that all firms inside the relevant market are of equal size. But even if we correct for that by using turnover for each store to calculate market shares, there are some serious problems that remains.

First, there is a very binary way to define the competitive pressure from another store. Either you are inside the circle and counts fully, or you are outside and do not count at all. In Figure 1 we see that one Sainsbury’s store is just outside the circle, and a small change in the size of the circle would imply that this store would also be included. This is about the size of the geographic market, where it is defined in a rather restrictive way without any kind of scaling of the geographic differentiation.

Second, there is no distinction between various types of stores. This is about product differentiation as such. It might be that those consumers that visit Morrison would be more attracted by Budgens

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putting too much weight on the HHI index (see below). See also EU horizontal merger guidelines, where they refer to both market shares and HHI index (see paragraphs 16-22). See also Baker (2007), who argues that market definition has been decisive for the outcome in merger cases in the US than any other substantive issue.

stores than by Somerfield stores, for example because they find the product range more in line with their preferences in Budgens than in Somerfield stores. If so, the geographic distance is a misrepresentation of the actual 'distance' from a broader perspective, when we take into consideration both geographic and product differentiation.

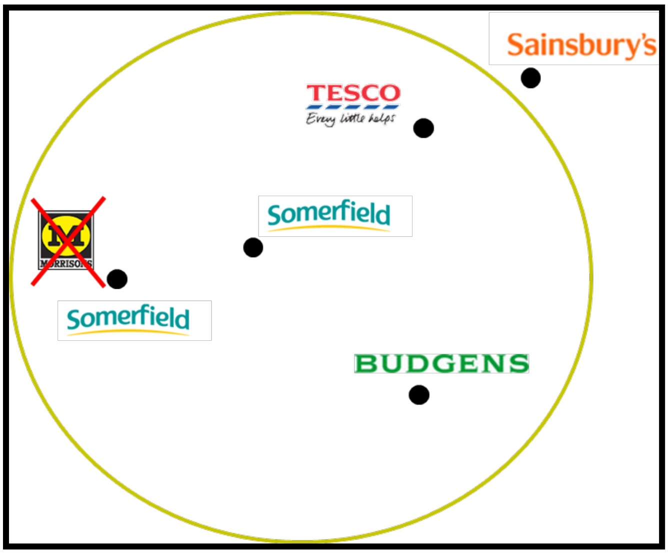

Figure 1: An example of an isochrones analysis

The main lesson from this exercise is that a counting of the number of stores can be a very crude measure of the anti-competitive effects of a merger. We need more information about the overlap between the various stores. In particular, will many of the consumers at Morrison have the nearby Somerfield store as their best alternative? This is the main question that was asked by Competition Commission in the second phase investigation of this acquisition. In what follows we will explain the background for the method used by Competition Commission.

3. Markets with differentiated products

Let us consider a market with differentiated products. We can think of for example grocery outlets, as in the previous example. Two firms merge, and we are concerned about the possible anti-competitive effect. As explained above, it seems quite obvious that we need to say something about market shares. However, recently we have seen the development of theory for merger assessment where there is no need for considering the market shares. This is the so called Upward Pricing Pressure (UPP) approach. We will explain this approach, and also explain how we can extend that approach to what is called Illustrative Price Rise (IPR). Finally, we return to the traditional approach by comparing these approaches to the well known SSNIP approach for market definition.

3.1 Upward Pricing Pressure (UPP)

Let us consider a market where firms set prices and sell differentiated products.[2] We assume that there is no potential for collusion, and consider only possible non-coordinated (unilateral) effects of a merger. It implies that we consider Bertrand competition with differentiated products, and how a merger between two firms will change the price setting of the merging firms.[3]

Let us assume that firm 1 and 2 merge. They produce one product each. Let c_i^k denote marginal cost for firm *i*, where *i* = 1,2, and let *k* either be *0* (pre merger) or *M* (post merger). For the moment we are focusing on product 1, and assuming that there can be changes in prices and marginal costs following the merger only on product 1. Profits for the merged firm will be as follows:

$$\pi = \left(p_1 - c_1^M\right) \cdot q_1 + \left(p_2 - c_2^0\right) \cdot q_2 \tag{1}$$

From the first order condition, we know that the price of product 1 will not change following the merger if:

$$q_1 + \left(p_1 - c_1^M\right) \frac{\partial q_1}{\partial p_1} + \left(p_2 - c_2^0\right) \frac{\partial q_2}{\partial p_1} = 0 \tag{2}$$

We also know that prior to the merger firm 1 set its own price such that the following condition is met:

$$q_1 = -\left(p_1 - c_1^0\right) \frac{\partial q_1}{\partial p_1} \tag{3}$$

If we replace q_1 in (2) with the expression in (3), we find that the price of product 1 will not change after the merger if:

$$c_1^0 - c_1^M = \left(p_2 - c_2^0\right) \frac{\partial q_2 / \partial p_1}{\partial q_1 / \partial p_1} \tag{4}$$

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[2] For details, see Farrell and Shapiro (2010a). The approach with Upward Pricing Pressure, although not with such a name on it, was first introduced in Farrell and Shapiro (1990) for Cournot competition and identical products. Werden (1996) discussed the same issue in a market with Bertrand competition and differentiated products.

[3] In principle the theory can be extended to consider changes in other parameters following a merger. For example, Willig (2011) have extended the UPP framework to a change in quality rather than prices.

We see from (4) that there are three factors that will determine whether the price will increase after the merger:

- The size of the reduction in marginal cost (the left hand side)
- The price-cost margin on each unit of sales of product 2 (the first term on the right hand side)
- How large fraction of the reduction in sales of product 1 following a price increase that is picked up by product 2 (the second term on the right hand side)

A sufficient large reduction in marginal costs will give the merged firm incentives to set a lower price after the merger. Such cost savings leads, all else equal, to a downward pricing pressure.

On the other hand, the elimination of rivalry between the two firms after the merger leads to an upward pricing pressure. To understand the mechanism at work, let us define the third factor above as the diversion ratio between product 1 and 2, D_{12}:

$$D_{12} = - \frac{\partial q_2}{\partial p_1} / \frac{\partial q_1}{\partial p_1} \tag{5}$$

It tells us how large fraction of the reduction in sales of product 1 that is diverted to the sales of product 2. For example, D_{12} = 40 % implies that for every 100 units sales reduction of product 1 the sales of product 2 increases with 40 units. In addition, we see that the price-cost margin is also of importance for the upward pricing pressure. If the profit margin is large on each unit, the merged firm will earn a large amount on each unit that is picked up by the other product.

The upward pricing pressure has a simple explanation. If an increase in the price of product 1 leads to (i) a large diversion of sales to product 2 and (ii) the profits for each unit that is picked up by product 2 is large, then the merged firm has strong incentives to increase the price of product 1.

Let us assume that E_i denotes marginal cost after the merger relative to the marginal cost before the merger and $L_i = (p_i - c_i^0)/p_i$. By rearranging (5) it is found that there will be an upward pricing pressure if:

$$D_{12} > E_1 \cdot \frac{(1 - L_2)}{L_2} \tag{6}$$

Until now we have only made a partial analysis. The merged firm will consider changes in prices both on product 1 and 2, and reduction in marginal cost not only for product 1 but also for product 2. It implies that there will be an analogous condition for upward pricing pressure on product 2 as we in (6) has shown for product 1. Let us assume symmetry by setting $c_1^M = c_2^M$, $E_1 = E_2 = E$, $p_1 = p_2$ and $D_{12} = D_{21} = D$. If we solve simultaneously for the first order conditions concerning price setting on product 1 and 2, we find that both prices will increase after a merger if:

$$\frac{D}{1-D} > E \cdot \frac{1-L}{L} \qquad (7)$$

We then see, as explained above, that it is more likely with an upward pricing pressure after the merger the (i) more limited the reduction in marginal cost (ii) the higher the price-cost margin and (iii) the larger the diversion ratios.

So far we have not said anything about market shares. In fact, market shares are not relevant for the question of upward pricing pressure after a merger. To understand this, note that the possible anticompetitive effect comes from the rivalry between the two firms being eliminated. So the driving force concerning upward pricing pressure is how intense they compete head to head prior to the merger and how much they gain after the merger from pricking up the lost sales of the other merging firm's product if they raise prices. This is clearly recognized in the US merger guidelines:

'Diagnosing unilateral price effects based on the value of diverted sales need not rely on market definition or the calculation of market shares and concentration. The Agencies rely much more on the value of diverted sales than on the level of the HHI for diagnosing unilateral price effects in markets with differentiated products. If the value of diverted sales is proportionately small, significant unilateral price effects are unlikely.' (p. 21)

Note also that this method implicitly may capture how intense the rivalry will be from other non-merging firms. If there is a large diversion ratio between the merging firms' products, then there cannot be a large diversion from the merging firms to other non-merging firms. If so, we can conclude that the rivalry with non-merging firms is limited.

One could argue that market shares as such can be a proxy for diversion of sales. If a consumer leaves a product, it is more likely that it diverts to a product with a large sale than a product with a limited sale. Following such a line of reasoning, we could argue that market shares can be a proxy for diversion ratios.[4] Let s_0 denote those consumers that leave product *i* and does not divert to any of the products in the relevant market, and let s_i be the market share of product *i*.

$$D_{ij} = s_0 \cdot \frac{s_j}{1 - s_i} \tag{8}$$

However, market shares can be the combined results of several attributes for the products in question. For example, in the retail sector both space (distance between stores) and product range (number of products in each store) can be of importance. In such a case market shares can be a bad predictor for diversion ratios between two products.[5]

The formulas we presented in equations (6) and (7) also shows that the larger the price-cost margin the larger the potential for an upward pricing pressure. The intuition is that such a high price-cost margin would indicate that those two merging firms do not have close substitutes to their product. If they had, they would not find it profitable to set such a high price-cost margin. When the firm after the merger set a higher price on product 1, it will then earn a large price-cost margin for each unit of sales that is diverted to product 2. Since it earns a lot by picking up the diversion of sales, it has strong incentives to increase the price after the merger. This is in line with what is stated in the merger guidelines in the UK:

'If the variable profit margins of the products of the merged firms are high, unilateral effects are more likely because the value of sales recaptured by the merged firm will be greater, making the price rise less costly.' (p. 42)

Since $D < 1$, it is obvious that $D < D/(1 - D)$. By comparing equations (6) and (7) we can then conclude that it is more likely that we predict an upward pricing pressure if we allow both prices to rise rather than only one price. The intuition is straight forward. A higher price on product 1 will make it more profitable to raise the price of product 2, since the price-cost margin on the sales diverted to product 1 will then be higher. This implies that the one price test shown in equation (6) can produce false

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[4] This is often called the proportionality assumption, since reduction in one product's sales is assumed to divert to other products proportional to their relative sales in the relevant market. See, for example, Epstein and Rubinfeld (2001). They impose proportionality in their PCAIDS merger simulation model. The same is true with the logit model, a model often used for merger simulations (see Werden and Froeb, 2002). For a more detailed discussion of the proportionality assumption, see Werden and Froeb (2008).

[5] This is noted in, among others, Willig (1991). He argued that inferences of the nature of competition from market shares are problematic if the products are differentiated by characteristics salient to consumers. In such markets he suggested collecting information beyond market shares.

negatives – no upward pricing pressure – where a more accurate test as the one shown in equation (7) would predict an upward pricing pressure.

Farrell and Shapiro (2010a) recommended the use of the one product UPP test we reported in equation (6). This is also the test that is proposed in the US merger guidelines:

'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)

Farrell and Shapiro (2010a) argue that this one product UPP test is intuitive and simple, and they denote it UPP_1. But if it typically produces false negatives, then such a screening could lead to clearing of mergers with an anticompetitive effect. If so, it is problematic.

However, we have assumed symmetric firms. If we relax that assumption, false positives may be the outcome from the one price test. For example, asymmetric diversion ratio – higher diversion ratios from product 1 to product 2 than in the opposite direction – may imply an upward pricing pressure from the one price test of the product with the largest diversion ratio. But when we allow for a change in both prices, the downward price pressure on the other product may lead to a downward price pressure on average. [6]

Often we do have asymmetries in diversion ratios, and then the risk of false negatives is less likely if we focus on the product with the largest diversion ration and do not clear a merger with an upward pricing pressure for the product with the largest diversion ratio. On the other hand, such a procedure can lead to false positives. But this is probably a limited problem, since such a merger would most likely be cleared later on during a more detailed investigation. Farrell and Shapiro (2010a) suggest further scrutinizing a merger when there is an upward pricing pressure on at least one of the products. It means that they regard the UPP framework as a screening device in an early phase of the merger investigation.

[6] This is shown in Mathiesen *et al.* (2012).

One very appealing aspect with the UPP framework is that you do not have to make some strong assumptions concerning the demand structure. In fact, you do not have to make any assumptions concerning the demand function. Since we test for whether a firm after a merger will deviate from the prices prior to the merger, we do not have to take into account how demand change when we move away from the initial price. This implies that there is no need to specify the curvature of the demand function, for example specify whether it is linear or iso-elastic (or it has another curvature).

3.2 From UPP to IPR (Illustrative Price Rise)

One drawback with the UPP approach is that it is not predicting how large the price increase will be if there is an upward pricing pressure.[7] After all, the magnitude of the price increase after a merger is what we are concerned about. This is especially important when the final decision is made. This indicates that the UPP approach is best suited for early screening. For the final decision, we would ike to know more about the price increase. Given that we have information about diversion ratios and price-cost margins, it is possible to estimate the price increase following a merger. But we then have to put some restrictions on the demand structure. Unfortunately, the curvature of demand is decisive for the magnitude of the price effect following a merger.

Let us assume that two symmetric firms that produce differentiated products decide to merge. Furthermore, let us focus on the case with no synergies, *i.e.,* no change in marginal costs.[8] As shown in Shapiro (1996), the price increase on both products are the following:[9]

- Linear demand (IPRL): $\frac{DL}{2(1-D)}$ (9)

- Iso-elastic demand (IPRO): $\frac{DL}{1-D-L}$ (10)

These formulas have been used in several merger investigations in the UK, and they have labeled this an 'Illustrative Price Rise' (IPR) (see section 4.1).

[7] This critique of the UPP approach is, among others, found in Schmalensee (2009).

[8] Note also that the simple formula with linear demand is made possible by imposing a strong assumption concerning demand. The demand for each unit is defined such that the slope of each demand curve is equal to – 1.

[9] A simple formula for the price increase following a merger is also presented in Moresi (2010), who introduced a formula denoted GUPPI (Gross Upward Pricing Index). See also Schmalensee (2009). Hausmann, Moresi and Rainey (2011) report the exact formula for a price increase with asymmetries and linear demand.

We see that for the calculation to make sense for iso-elastic demand, then $D < 1 - L$. If this condition is not met, the merged firm can make arbitrarily high profits by setting higher and higher prices. This is a warning against using this formula for a case with a combination of high diversion ratios and high price-cost margins.

In Figure 2 we have shown the predicted price increase following a merger assuming linear and iso-elastic demand, respectively, given that price-cost margin is 30 %. For high diversion ratios the predicted price increase with iso-elastic demand becomes very high, as noted above, and it is not defined in this particular case if the diversion ratio is 70 % or higher.

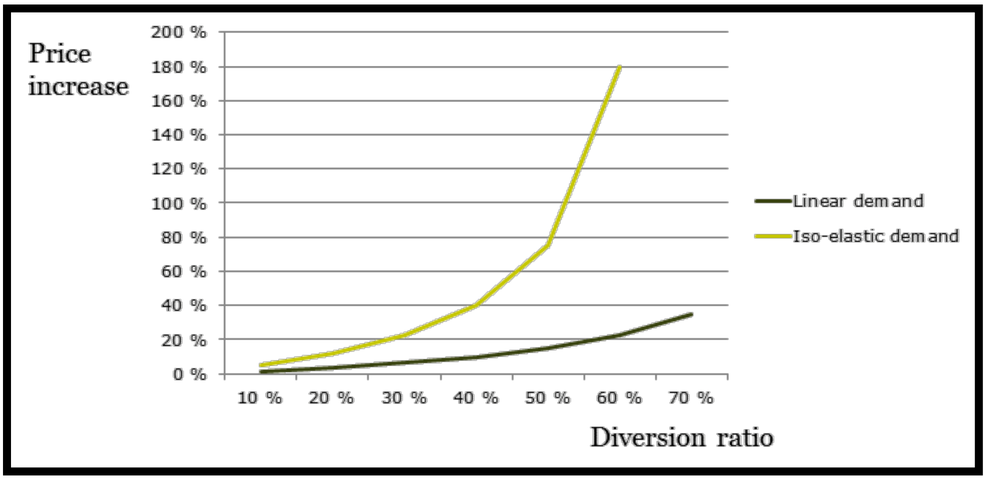

Figure 2: Price increase with linear and iso-elastic demand, given that L = 30 %

The large variation in predictions, depending on the chosen demand function, should be a concern. It turns out that the demand curvature will have a decisive role for the price increase also in more full-fledged merger simulation models than the simple formula we have shown here.[10] One approach would then be to use the demand function that leads to the most conservative prediction when mergers are scrutinized in detail. The linear demand function would then be the appropriate one, and it would avoid false positives (wrongly finding that the merger is anticompetitive).

Often it is argued that there are large asymmetries. For example, a small firm might impose a smaller competitive constraint on a large firm than vice versa. Then a merger between a small and a large firm may lead to a larger price increase on the small product. We could then take the extreme case where only the price of one of the products is changed after the merger. As shown in Shapiro (2012),

[10] This is shown in Crooke *et al.* (1999) and Froeb *et al.* (2005), where they apply merger simulation models to illustrate how price predictions will depend on the curvature of the demand function.

the price increase on one of the two products following a merger and given that the demand function is linear is the following:

$$\frac{p_1 - p_0}{p_0} = \frac{DL}{2} \tag{11}$$

There are similarities between the IPR approach and the UPP approach. To illustrate this, let us check how each of them could be used for screening. To do that, we have to define some threshold levels for any potential anticompetitive effects. One alternative is to assume a reduction in marginal cost and apply the UPP_1 approach, and for example use 10 % reduction as a default as proposed by Farrell and Shapiro (2010a) as an illustrative threshold level. Then we check whether there is an upward pricing pressure. An alternative would be to not focus on possible cost savings, but the possible price increase as such. We could apply the IPR approach and tolerate minor price increases, but let 5 % be the threshold level.[11] Given these threshold levels, we can compare the UPP and the IPR approach.

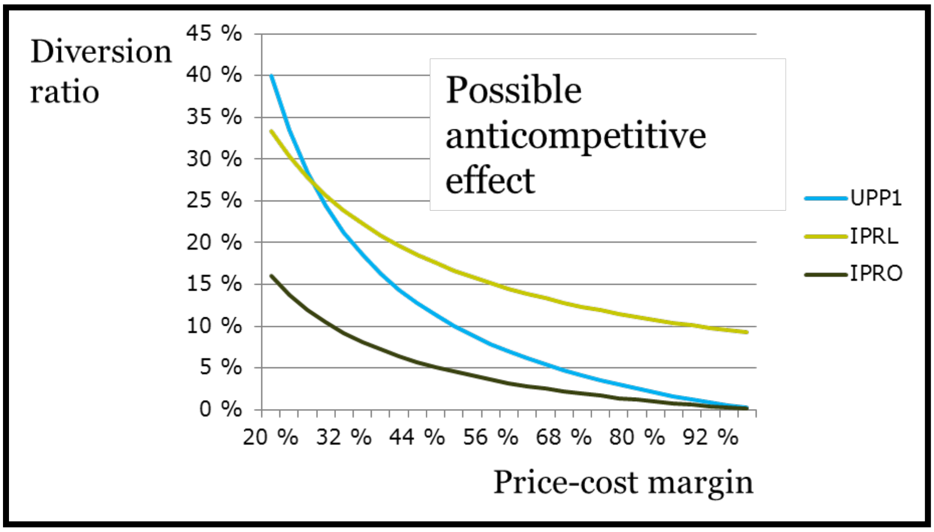

Figure 3: **Threshold level with an UPP approach, an IPR approach and (i) linear demand (IPRL) and (ii) IPR and iso-elastic demand (IPRO)**

[11] One argument for using 5 % is that it is in line with the SSNIP test. However, in merger guidelines this threshold level is set solely for methodological reasons and should not be regarded as a tolerance level. Alternatively, one could argue (as in Schmalensee, 2009) that agencies must prioritize between mergers and then have to choose the ones with the largest anti-competitive effect and for that reason sets a 5 % threshold level. The competition authorities in the UK have applied a 5 % threshold level for the IPR test, se OFT (2011), Section 4.

In Figure 3, we have shown the critical diversion ratio that leads to no upward pricing pressure from the UPP_1 formula and a 5 % price increase from the IPR formula for iso-elastic and linear demand, (IPRL and IPRO, respectively).

Interestingly, we see that those two approaches share a similar pattern when we plot them as in Figure 3. Any possible anticompetitive effect may arise if the price-cost margin is high and the diversion ratios between their products are high as well. In our case the IPR approach will we more lenient as a screening device if we assume a linear demand, and more restrictive as a screening device if we assume an iso-elastic demand function (except for sufficiently low price-cost margins).

One obvious shortcoming with the IPR approach is that the non-merging firms are by assumption not changing their prices. Given that firms set prices, we know that a price increase by the merging firms will give the non-merging firms incentives to increase their prices as well. This shows that if we only allow for price increases on the merging firms' products this typically will underestimate the price increases in the industry. However, some of the restrictive assumptions imposed when the simple IPR formulas were derived may imply that those formulas overestimate the price increase in some cases.[12] Other responses to the merger, such as for example repositioning by the outsiders following a merger, may dampen the merged firms' price increases and therefore may imply that the simple calculation based on the merged firms' price response alone may not be an overestimate of the overall price effects.

3.3 UPP vs IPR vs SSNIP

Apparently, the approach we have described differs substantially from the traditional approach. Market definition has played an important role in merger cases, and then the SSNIP test is decisive for the definition of concentration and the merging firms' market shares. As is well known, the SSNIP test is a hypothetical monopoly test for whether a 5-10 % price increase is profitable. Although apparently different from the approach shown in the previous section, the modern version of the SSNIP test can be directly compared with the approaches we have discussed. The mathematical formula for the SSNIP test is reported in the so called critical loss analysis. O'Brien and Wickelgreen (2003) have reformulated the critical loss test, so that it depends on (i) the price increase, (ii) the

[12] Note that the formula for iso-elastic demand will obviously overestimate the price increases if the diversion ratios and the price cost-margin are sufficiently high (see above). Note also that the formula for linear demand is derived given that we assume each products price elasticity to be equal to – 1. Moreover, asymmetries call for a more complicated formula for price increases, as reported in Hausmann *et al.* (2011) for the case of linear demand.

price-cost margin and (iii) the diversion ratios.[13] They have shown that two symmetric products belong to the same market if:

$$D > \frac{\alpha}{\alpha + L} \tag{12}$$

α is the relative price increase. In line with the UPP approach, we should in such a case check whether a price increase on only one of the products would be profitable for the hypothetical monopoly firm. As shown in Daljord *et al.* (2008), in such a case the two products belong to the same market if:

$$D > \frac{\alpha}{L} \tag{13}$$

Now we can extend Figure 3 to also including the two-product SSNIP test in (12) and the one-product SSNIP test in (13), denoted SSNIP2 and SSNIP1 respectively. In line with the assumption in the IRP test, we assume a 5 % price increase as the threshold level.

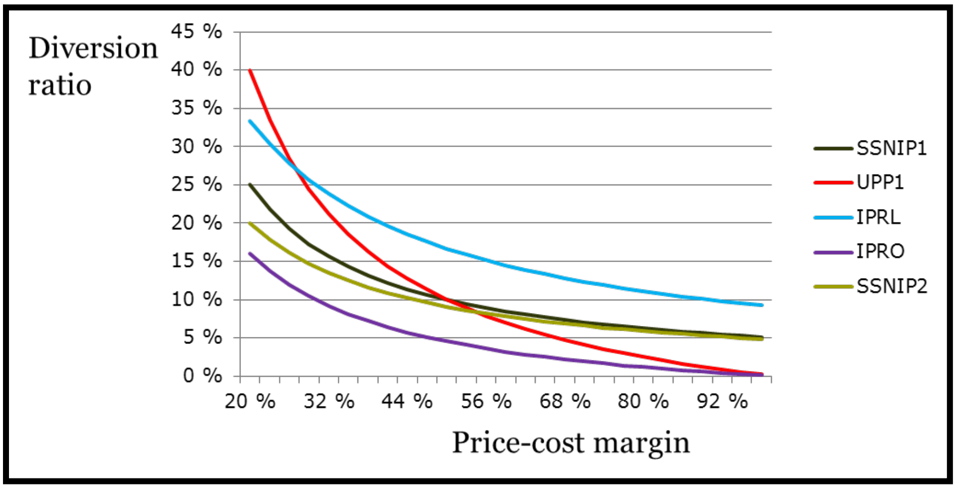

Figure 4: **A comparison of threshold levels from the UPP approach, the IPR approach and the SSNIP approach**

We see from Figure 4 that SSNIP1 and SSNIP2 are located as threshold levels in between what we find from IPR with linear and iso-elastic demand, respectively. This will give us a rough idea of the

[13] See also Katz and Shapiro (2003), who at the same time introduced an analogous approach. The critical loss analysis was first presented in Harris and Simons (1989).

consistency between various threshold levels, either threshold levels for market definition or threshold levels for the anti-competitive effects.

Figure 4 indicates that the threshold levels we can derive from SSNIP, IPR and UPP are not necessarily very different. Although this is interesting, it should be of a concern if those various tests are used at different phases of the merger screening. In the first phase of the merger investigation we should not be very concerned about false positives, since one expects that those mergers should be cleared later on following a more in depth merger assessment. But if we apply the same test later on as a major part of the final competitive assessment, false positives should be a larger concern. Simons and Coate (2010) warns that the UPP test with a 10 % marginal cost reduction as the threshold level can lead to a large number of mergers being characterized as problematic, and they claim that it will be much more mergers defined as problematic than what has been the case under the traditional approach. This calls for a careful use of the threshold levels from these modern approaches when used in the final phase of the merger investigation. In particular, it is a warning against using the IPR formula with isoelastic demand for predicting price increases at the final stage of the merger assessment since that at least in the symmetric version seems to be the most restrictive test.

4. Some applications

In the previous sections we have warned against using market shares and the change in market shares as proxies for the anticompetitive effects of a merger in a market with differentiated products. Moreover, we have shown how we can use simple formulas based on diversion ratios and price-cost margins to assess the anticompetitive effects as well as the delineation of the relevant market. In this section we discuss how this approach is used in practice, and discuss the potential improvements and pitfalls when applying such an approach compared to the traditional approach.

Diversion ratios are crucial for detecting the possible anticompetitive effect of a merger. There are numerous ways one can find the diversion ratios. One would be to estimate it from internal documents from the merging parties. For example, they might have done their own study that might reveal diversion ratios. An alternative would be to apply detailed data for prices and quantities of the products sold by the merging parties to estimate a demand system. From the price elasticities it is possible to derive the diversion ratios. Unfortunately, such data are in many merger cases not available in the short time frame of a merger investigation.

A more realistic alternative – given the time frame of merger control – would be to exploit information from a shock in the market, an event that can give information about the overlap between products. For example, how consumers reallocate when there is a sudden change in the capacity available for the production of one of the products. In what follows we illustrate this approach with a case from the ferry market in the North Sea (see Section 4.1).

Diversion ratios can also be derived from surveys among consumers. For example, asking them questions that can reveal their second choice, *i.e.,* which product that would be the best alternative if they did not buy the one they actually have chosen. Obviously, there are potential problems associated with applying a survey.[14] In what follows we sidestep from these issues, and show how diversion ratios derived from surveys have been applied in retail mergers in the UK (see section 4.2). In addition, we report from a merger case in the grocery sector in Norway where we have more detailed information about diversion ratios than in the merger cases in the UK (see Section 4.3).

4.1 A shock in the ferry market

Although it was not a merger case, the Norwegian Competition Authority was questioning whether two ferry routes between Norway to Denmark were close substitutes. That was Color Line's ferry route from Southern Norway to Northern Denmark, and Fjord line's ferry route from Western Norway to Northern Denmark.[15] In Figure 5 we have illustrated those two ferry routes.

[14] For a discussion of UK competition authorities' use of survey for detecting diversion ratios, see Hughes and Beale (2005) and Reynolds and Walters (2008). See also Bertrand and Mullainthan (2001), discussing potential problems with surveys more in general.

[15] Color Line entered in April 2005 the route between Bergen and Northern Denmark. The Norwegian Competition Authority investigated whether this was predation by Color Line, trying to force Fjord Line to exit. If those two routes shown in Figure 5 are close substitutes, it would imply that such a behavior would dampen the competition between Fjord Line and the route between Southern Norway and Denmark. In July 2006 the Norwegian Competition Authority concluded that this was not predation.

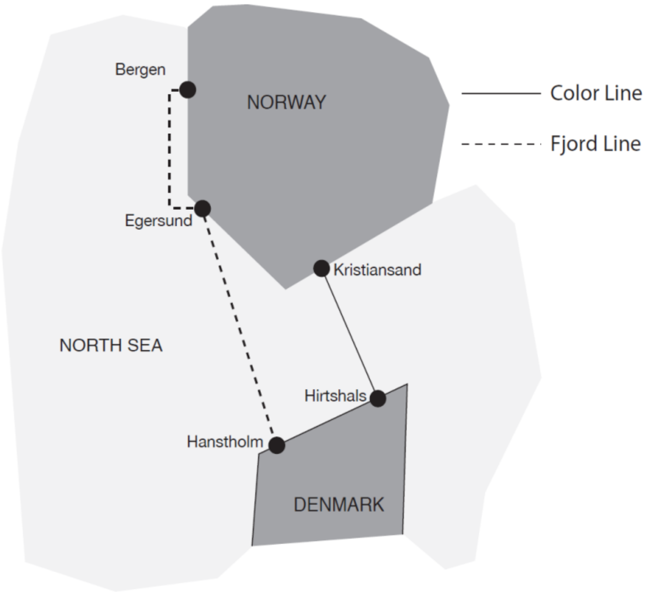

Figure 5: Two ferry routes between Norway and Denmark[16]

To check whether these two routes are close substitutes, we could apply the approach above. In particular, we could try to detect the diversion ratios between those two products.

Daljord *et al.* (2007) exploits a shock in this market to detect diversion ratios. In April 2003 the ferry company Fjord Line expanded its capacity by 50 % on its route between the West coast of Norway and the North coast of Denmark. The question is whether this sudden expansion in capacity had any effect on the number of passengers on the other ferry route, the one owned by Color Line.

There is a large asymmetry between Fjord Line's and Color line's route. Color Line has a much larger number of passengers than Fjord Line. Furthermore, Color Line's pricing will be constrained by other ferries from the eastern part of Norway. This indicates that if those two firms merged, there would be a larger price increase on Fjord Line's than on Color Line's route. This is an argument for applying an asymmetric test, where prices increase only on Fjord Line's ferry after a possible merger.

The shock in April 2003 can be used to derive the diversion ratios from Fjord Line to Color. Note, though, that the shock is reversed compared to the effects of a price increase. In order to increase sales following a capacity expansion, Fjord Line must lower its prices. Given that we observe any reduction in Color Line's number of passengers, it would indicate that any change in Fjord Line's prices would affect Color Line and thereby that there will be an overlap. If Color Line responded to

[16] This is Figure 1 in Daljord *et al.* (2007).

this shock by also reducing its prices, this would dampen the diversion from Color Line to Fjord Line. In that respect any detected diversion ratio is expected to underestimate the true diversion ratio.

A ferry on this route typically serves three different consumer groups: (i) passengers with a car going to or from Denmark, (ii) cargo traffic and (iii) passengers that take the ferry as a cruise experience. Consumer groups (ii) and (iii) are spread out throughout the year, while consumer group (i) is especially active in the summer months (bringing their car on a holiday).

The capacity utilization is very seasonal. For example, in January and February the ferries have idle capacity while in July there is no idle capacity. This implies that an expansion of capacity is expected to have no effect except in the months with no idle capacity initially. To exploit this feature, let us focus on the month July, and see how the capacity expansion changed the number of passengers on the Fjord Line and the Color Line routes. One interpretation would then be that the shock can reveal the substitution between those two ferries for consumer group (i), those passengers with a car.

In Figure 6 we have shown the monthly passengers on those two routes from July 1993 to April 2005.[17] The seasonal pattern is very visible. The dotted line shows the introduction of a larger capacity on Fjord Line's route. In off-peak months it is not easy to see any difference at all following the capacity expansion. This is in line with what we predicted, since capacity is not a binding constraint in off-peak months. In July we see that there is a much larger number of passengers. If we look more carefully, we see that there seems to a tendency of a change in the number of passengers on those two routes in July after the capacity expansion. It seems as if Fjord Line has more passengers, and Color Line fewer passengers.

[17] The data are from ShipPax and they are publicly available. We cannot use data for later months, because Color Line entered with a new route from Bergen to Denmark in May 2005.

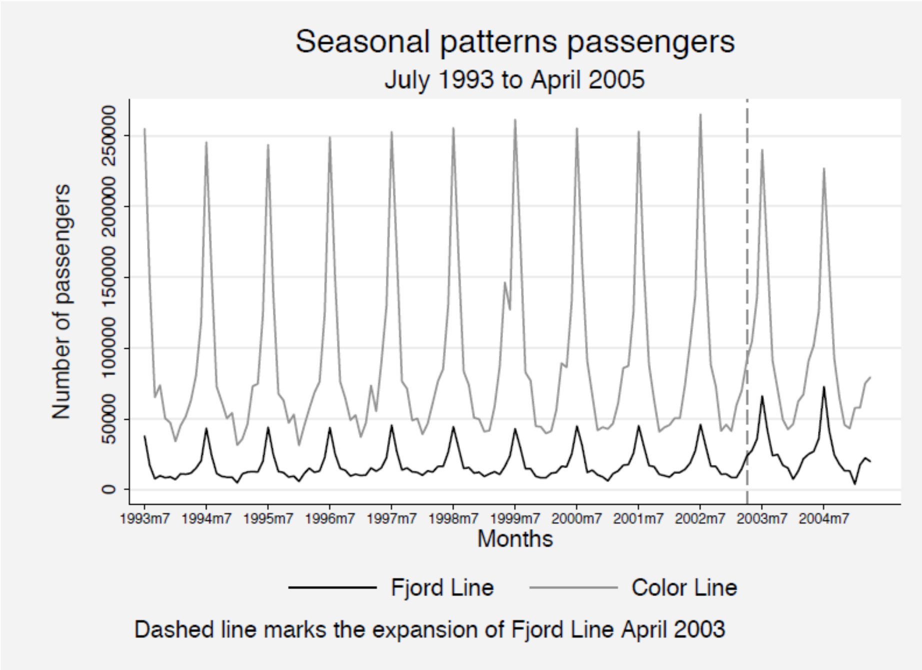

Figure 6: Monthly passengers on Fjord Line and Color Line[18]

In Daljord *et al.* (2007) they report a very simple regression that is done to find a measure of the effects in July of the capacity expansion. Since the seasonal pattern is so evident, they included dummies for elven moths and one constant. To measure the effects of the capacity expansion, a dummy was included for the months after the capacity expansion. The diversion ratio will then be measured by the July shock dummy for each of the ferry routes. They found that the capacity expansion resulted in an increase in the number of passengers for Fjord Line in July with 25.600 and a reduction in the number of passengers for Color Line with 20.100. The diversion ratio is therefore 78 %. This is a rather high diversion ratios, which all else equal is indicating that the two products are close substitutes for this particular consumer group. Note, though, that we have few observations after the capacity expansion, which is an argument for a careful interpretation of this result. In Daljord *et al*. (2007) it is also discussed which price cost margins that will imply that we can conclude that those two products are close substitutes. In particular, they show how one from an observed diversion ratio can derive the critical price-cost margin that is the lowest one that leads us to conclude that those two products are close substitutes.

This simple analysis illustrates how diversion ratios can be found just by exploiting an event in the industry. In this case we considered a capacity expansion. Another example would be a sales campaign for one product. If the price of one product is cut drastically for a period, we could observe

[18] This is Figure 2 in Daljord *et al.* (2007).

the change in the sales of other products with no change in prices. If there is no change in the sales of those other products, then this indicates that they are not close substitutes. On the other hand, with changes in sales we can use the formulas derived in the previous section to find out whether they are close substitutes or not.

4.2 Retail mergers in the UK

We illustrated our critique of the traditional approach, focusing on market shares and the number of firms, with an example from an acquisition in UK in 2005. An isochrones analysis was applied by OFT in the first phase of the merger investigation of Somerfield's acquisitions of Safeway stores. We argued that such an approach has some obvious shortcomings. This motivated our discussion of the UPP as well as the IPR approach, and the comparison with the modern SSNIP approach. However, in that particular merger case the phase II investigation undertaken by Competition Commission (CC) did apply such an approach we have presented here.

CC conducted surveys among shoppers outside many of the Safeway stores. The aim was to detect the shoppers' second choice, *i.e.*, which store they would prefer if this particular store was not available. CC could from each of these surveys find the diversion ratios between the acquired Safeway store and the nearest Somerfield store. In addition, they made assumptions concerning the price-cost margin. Given the symmetric SSNIP test formula shown in equation (12), they found that D = 14.3 % was the cutoff point.[19] If the diversion ratio between the acquired and the acquiring store was higher than that, it indicated that the acquisition would have an anticompetitive effect in that local area.

By such a procedure they came to the conclusion that Somerfield had to sell out 14 of 115 acquired stores for the merger to be approved. Interestingly, the method used for reaching such a conclusion was primarily based on the SSNIP test. In particular, they applied the formula we reported in equation (12) although they only knew diversion ratios in one direction to pick those stores that should be sold out. Their approach implied that they implicitly assumed the diversion ratio in the other direction was identical to the one they had observed. To illustrate the potential price increase if no divestiture, they also applied the formulas for estimated price increases in equations (9) and

[19] Although not stated explicitly, it is straight forward to see that given a price increase of 5 % and a diversion ratio of 14.3 %, the price-cost margin has to be equal to 30 %.

(10) given linear and iso-elastic demand, respectively. Unfortunately, some of the estimated price increases become highly unrealistic.[20]

A shift away from just counting number of rival stores towards diversion ratios is clearly an improvement. In later merger cases both OFT and CC has further developed their method.[21] First, they have focused more directly on the anticompetitive effect rather than the size of the relevant market. Instead of focusing primarily on the SSNIP test and thereby the relevant market, they have focused more directly on the potential price increase. Given that the method has been used to decide whether a merger should be permitted or not, it is natural with such a shift in their approach. On the other hand, we have shown that it is in reality not a fundamental shift in focus. The main input in their estimates of harm (or market size) is diversion ratios and price-cost margins, and then it is more a matter of setting the threshold level. As shown above, a 5 % price increase in the SSNIP test is rather similar to assuming a 5 % price increase in the IPR test. In that respect there is not much of a change in method. In more recent merger cases they moved away from estimating price increases and instead focused on whether the price increase would exceed 5 %. It then became even closer to the initial method where they applied the symmetric SSNIP test with a threshold level.

Second, they have become concerned about asymmetries. They recognized that firms differ. This may imply that diversion ratios from product A to product B can be very different from the diversion ratio in the opposite direction. If so, one product will be a more restrictive constraint on the rival's price setting than vice versa. This was first recognized in the Amazon/LoveFilm merger by OFT, when they applied the SSNIP test where they increased the price on only one of the products (as in the formula in equation (13) above). In later cases they applied the asymmetric IPR test, as for example in the Asda/Netto merger case. OFT argued that the competitive constraint that Asda exercised on Netto was greater than the constraint that Netto exercised on Asda. It implies that they expected the diversion ratio from Asda to Netto to be smaller than the diversion ratio from Netto to Asda. They then used the following screening procedure[22]:

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[20] For one of the acquired stores they predicted from the formula for the iso-elastic demand function that the price increase would be larger than 1898.4 %! See Annex E in the final decision made by Competition Commission.

[21] For a description of merger cases where this approach was applied, see OFT (2011).

[22] See the final decision by OFT in Asda Stores Limited's acquisition of Netto Foodstores Limited, published 20 October 2010, p. 9-10.

- Stage 1: Counting the number of rivals (isochrones analysis), to clear stores with more than three rivals
- Stage 2a: Survey outside Netto to find diversion ratios. Applied the symmetric IPR test, assuming symmetric diversion ratios.
- Stage 2b: Survey outside remaining Asda stores to find the diversion ratio from Asda to Netto. This combined with the diversion ratio in the opposite direction (see 2a) was used to estimate the asymmetric version of the IPR formula.

It was set a 5 % threshold level for the price increase. Note that at stage 2a it is assumed that the diversion ratio from Asda to Netto is identical to the one they have found in the opposite direction. Since they expect the diversion ratio from Asda to Netto to be smaller than from Netto to Asda, it implies that such a test leads to false positives. This sounds plausible for screening at that stage, since false positives can be cleared later on when a closer scrutiny is undertaken at stage 2b.

The closer scrutiny at stage 2b is done by finding diversion ratio in the opposite direction for those stores not cleared at stage 2a, and to apply an asymmetric version of the IPR formula assuming isoelastic demand.[23] By using such a formula one will find that asymmetric diversion ratios leads to asymmetric price increases, in this particular case a larger price increase for Netto than for Asda after the acquisition. The method therefore takes into account that the main competitive concern in this case is the possible price increase at Netto stores after the acquisition.

As explained above, though, assuming an isoelastic demand curve may lead to false positives. After calculating IPRs, OFT took into consideration any other evidence that may mitigate the possible anticompetitive effect found when calculating IPRs. In particular, they considered evidence concerning cost reductions passed on to consumers through lower prices, any gains from re-positioning of some of the stores and thereby more differentiated stores, and the likelihood of entry. Following an overall evaluation, OFT concluded that the acquisition would have anticompetitive effects in 47 local areas. Asda offered to divest those 47 stores, and the acquisition was cleared in March 2011 with these remedies.[24]

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[23] They applied a formula analogous to equation (1) in Shapiro (2012), except that the formula they used assumed isoelastic (not linear) demand.

[24] See the decision made by Office of Fair Trading March 9 2011. Note that Asda was not able to sell one of the 47 stores, and OFT accepted in November 2011 that they did not sell that store.

Third, we have witnessed that the size of the price-cost margin has become a more controversial issue. Since price setting is the issue, one should take into consideration those costs that are relevant for price setting. This is the marginal (also called variable) costs. The parties have realized that it matters a lot for the test, irrespective of whether an IPR or a SSNIP test is applied. No surprise that the parties and the competition authorities in some cases disagree on the estimate of the price-cost margin. One important issue is the time period considered. The longer time period, the larger fraction of total costs is variable and the lower is the short run price-cost margin. In the Asda/Netto merger, for example, the OFT used one month as a reasonable period over which to assess the variable price-cost margins. It has been argued that the time horizon that should be applied is the same as the time horizon for the price change.[25]

4.3 An acquisition in the Norwegian grocery market

In 2007 the retail chain Norgesgruppen (NG) acquired the rival chain Drageset. NG is the largest retail chain in Norway, with a national market share close to 40 %, while Drageset was a small chain only present in a few local markets. Screening based on market shares indicated that the acquisition might have an anticompetitive effect in the local market at Voss. The acquisition would imply that NG, with four out of the eight largest stores prior to the acquisition, would increase its market share from below 50 % to over 60 % in that local area.

As a part of their master thesis two students undertook a survey among 100 shoppers outside each of the eight largest stores in Voss. Among other things customers were asked about their second choice. From these answers the expenditure-weighted diversion ratios (d_{ij}) among all 56 pairs of stores were calculated.[26] We will use this information to illustrate several aspects of the tests we referred to above.

First, let us see how well market shares predict the observed diversion ratios. If it turns out that it is a good proxy for diversion ratios, then market shares can capture quite well the anticompetitive effects of a merger. From market shares s_i and s_j and an assumption that a fraction s_0 of customers (sales) leaves the market, the diversion ratio (proportional to market share) is computed as $D_{ij} = s_0\, s_j /(1-s_i)$. Consider the index $I_{ij} = d_{ij} /D_{ij}$, shown in Table 1 for all combinations of stores. The first five stores that are listed are located in the center of the village, the sixth one 1,5 km to the East while

[25] See Katz and Shapiro (2003), footnote 6.

[26] For details of the study, see Halleraker and Wiig (2008). The study is also described in Mathiesen *et al*. (2011).

the two remaining stores are located 3 km to the North. If market shares are good predictors for diversion these index-numbers should be 1.[27]

Table 1. The relative diversion ratios: $I_{ij} = d_{ij}/D_{ij}$ $j \neq i$.

Stores	Kiwi V	Spar	CoopM	Rimi	Meny	Kiwi P	Drageset	CoopP
Kiwi V		1,84	0,49	1,13	0,09	1,17	0,33	0,52
Spar	2,00		2,66	0,48	0,82	0,70	0,53	0,31
Coop Mega	1,40	2,48		2,18	2,19	0,82	1,21	0,96
Rimi	1,65	0,25	0,53		0,46	1,59	0,36	0,34
Meny	0,26	1,01	1,14	0,92		1,78	0,97	0,49
Kiwi P	2,80	0,62	0,22	1,66	1,33		0,61	0,89
Drageset	0,02	0,24	0,15	0,14	0,89	0,22		2,83
Coop Prix	0,12	0,29	1,62	0,94	0,32	0,38	3,54	

Mathiesen *et al*. (2011) argue that the stores at Voss are differentiated along several dimensions. First and most obvious, stores are located in different areas. The acquired store is located to the North together with Coop Prix that remains outside the acquisition; observe the very high index-numbers of this pair of stores (2,83 and 3,54, respectively). Several other pairs of index-numbers of neighboring stores are also well above one showing that location is important. Second, four stores offer few brands, while the other four stores offer a larger number of brands at somewhat higher prices.[28] Some customers answer that their main concern is price, while others say they prefer a larger number of brands. The observed diversion ratios are largely consistent with such answers, indicating that the dimension the number of brands is also important for differentiation. For example, the neighboring stores Meny and Rimi have index numbers in Table 1 lower than one which can be explained by those two stores belonging two different segments concerning the number of brands.

Second, let us check the possible asymmetry between diversion ratios. Since the survey took place at all outlets, they could estimate diversion ratios in both directions for each pair of outlets. This made it possible to detect any asymmetry in diversion ratios. Figure 7 reports the diversion ratios for each

[27] A chi-square-test makes us reject the hypothesis that the observed and the inferred diversion ratios are equal.

[28] The four stores offering few brands are Rimi, Coop Prix and the two Kiwi stores.

pair of outlets. Since there are eight outlets, there will be 28 different pairs of outlets. The diversion ratios in both directions for each pair of outlets are shown in Figure 7 with a diagonal square mark.

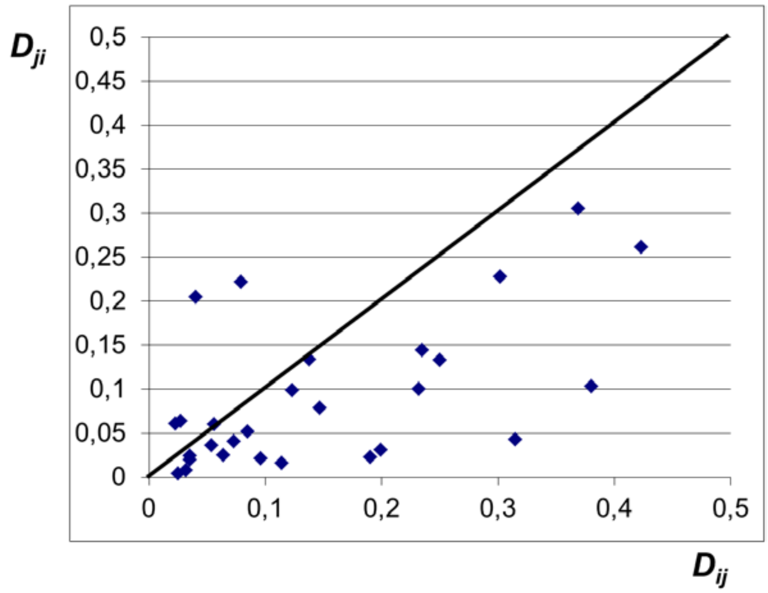

Figure 7: Asymmetries in diversion ratios at grocery stores at Voss

If we have a square mark on the 45^0 line, then the diversion ratios for that particular pair of stores are identical. We see that this is not met for any stores, and for some of the square marks for the pair of diversion ratios are located far away from the 45^0 line. This indicates that for many of the stores the diversion rate in one direction differs considerably from the diversion ratio in the other direction. Although this is just one example from one local market, it indicates that one should be careful with imposing symmetry in diversion ratios after observing the diversion ratio in only one direction.

Third, we compare the proposed UPP_1 test in equation (6) – a price change on only one product – with the more accurate UPP test in (7) with a price change on both products (or in this case all products). The acquired store, Drageset, has a sale that amounts to approximately 1/3 of the joint sales of all four NG stores. Let us consider increasing only the price of Drageset and assess the required reduction in its marginal costs. A cost reduction could follow because this store would become part of a much larger retail chain with presumably more efficient distribution and lower input prices. The aggregate observed diversion ratio from Drageset to the stores in NG – Meny, Spar, Kiwi V and Kiwi P, is 38.9 %. With a price-cost margin of 25 %, from the formula in equation (6) we find there will be an upward pricing pressure on Drageset unless marginal costs are reduced by at least 12.9 %. From the more accurate test in equation (7) we find that the critical change in marginal cost is 12.7%. It illustrates the point that when products are sufficiently asymmetric, the accurate UPP may be more conservative than the UPP_1 test on only one product (false positives).

Fourth, let us illustrate the importance of the non-merging firms' price response. When the price on only the acquired store is increased, Shapiro (1996, 2012) offers the price-prediction formula $M_2 \cdot D_{12}/2$.[29] Filling in our numbers, we obtain a price increase of 5.8 %. In Mathiesen *et al.* (2011) it is reported how the diversion ratios can be applied to calibrate a demand system, and then to simulate possible price effects of this acquisition. When applying this merger simulation model it also predicts a 5.8% price increase for the Drageset store when the prices of all other stores are constrained at pre-acquisition levels. This merger simulation model predicts a 7 % price increase for Drageset when also the other NG stores increase their prices, and 7.5 % when also outsiders respond. If price increases from others than the acquired firm are modelled, the acquired firm then sets a price that is almost 30 % higher. This indicates that ignoring the price response from other products and firms can lead to a substantial downward bias on the predicted price increase.

Finally, let us compare predictions of average price increase for two merger simulation models, one (called OBS) based upon the observed diversion ratios and one (called MS) where cross price elasticities are calibrated from market shares.[30] The OBS model predicts an average price increase that is 40 % lower than the prediction from the MS model. This is because market shares overestimate the diversion from Drageset to the other NG stores. It illustrates the point in Willig (1991) that inferring demand from market shares may lead to a serious bias in predictions. In other cases the bias may of course go in the opposite direction.

5. Some concluding remarks

I have argued that the traditional approach with focus on market shares and concentration indexes can be a bad predictor for estimating the anticompetitive effect, and in particular in markets with differentiated products. The new approach with focus on diversion ratios and price-costs margins is much more targeted towards measuring the unilateral effects of a merger. It might not be more demanding to find data for diversion ratios than for market shares, as illustrated by the simple method for finding diversion ratios in the ferry market.

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[29] See also the price prediction test put forward in Moresi (2010) and defined as GUPPI*, Gross Upward Pricing Pressure Index*. It can be seen as a reformulation of the UPP test, and thereby implicitly assuming no price response from non-merging firms. See also Schmalensee (2009).

[30] For details concerning the merger simulations, see Mathiesen *et al.* (2011). See also Farrell and Shapiro (2010b) and Epstein and Rubinfeld (2010) for a discussion of merger simulation model and the use of market shares for calibration.

It is of interest to contrast how the new approach is applied in the US versus some European countries. The UPP approach in the US is meant to be a screening device early in the merger investigation. Those not cleared should be scrutinized further. In that respect the UPP approach, with no prediction of the magnitude of the expected price increase, makes sense. In European countries, and in particular in the UK, the competition authorities have applied the analogous approach IPR as an important test for whether a merger should be blocked in the final phase of an investigation. Then it seems more appropriate to consider the magnitude of the price increase, as they do with the IPR approach.

However, when we compare the various test – UPP, IPR and SSNIP – we observe that they share several features. In all these tests it is found that the relevant market will be narrow and the mergers will be seen as potential anticompetitive if (i) the diversion ratios between the merging firms are high and (ii) the price-cost margins are high. This shows that the merger assessment, as well as the market definition, should focus on those two factors. It is interesting to note that in two recent mergers in Norway they have focused on the diversion ratios. In my view this is an improvement compared to the traditional approach used earlier.[31]

One concern, though, is the definition of the threshold level. As long as the test is used as an early screening, one should not be very concerned about false positives since those mergers can be cleared later on during a more in depth merger assessment. But if an analogous test is used as an input for the final merger decision, one should be more careful and be more concerned about false positives since there is less of a change to correct a false positive. This calls for a higher threshold level for the final decision than for the merger screening early on. If the new approach is used as an important input for the final decision, it is also natural to exploit all the information that is available at that stage. This could imply that one should not use the simplified formula where it is assumed symmetry, but rather apply the more complex but also more precise formula – such as the one reported in Hausmann *et al.* (2011) – that takes into account asymmetries between firms.

Finally, it is worth noting that the new approach is not necessarily in conflict with the traditional approach. Those two methods can supplement each other. Note that the UK competition authorities still use concentration and market share thresholds in the first initial screening. For example, they still use isochrone analysis in the first phase in some of the retail mergers. There can be practical reasons for this, simply the time restriction in the first phase that does not make it possible to

[31] See decision V2012-11 (A-pressens acquisition of Edda Media) on 28.06.2012, and decision V2012-18 (Plantasjen's acquisition of Oddernes Gartneri) on 22.08.2012.

estimate diversion ratios. Furthermore, there are aspects concerning the anticompetitive effects of a merger that will not be taken into account in the new approach. In particular, the new merger assessment approach should be supplemented with a discussion of other aspects such as barriers to entry and repositioning of the products in the industry.

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