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Critical Loss v. Diversion Analysis: Another Attempt at Consensus

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I. INTRODUCTION

In our paper *Critical Loss vs. Diversion Analysis: Clearing up the Confusion*, we tried to bridge the gap between the merger analysts that prefer to begin the market definition exercise with firm level relationships (e.g., the Lerner Index) in conjunction with diversion ratios and those of us that prefer to start at the group or market level and to apply natural experiment and other evidence within the Critical Loss construct.² In our article, we developed the concept of the Retention Rate to link firm level to market level analysis. Given a theoretical estimate of the firm's sales diverted to rivals within the market in response to a single-firm price increase, the Retention Rate defines the share of those initially diverted sales that are "retained" within the market in response to an across-the-board price increase. The retained portion of the theoretical diversion can then be used as an adjustment to the Critical Loss analysis. Farrell & Shapiro's ("F&S") comment presents a graphical illustration of our Retention Rate concept.³ Either approach can be used to describe how sales are diverted to rivals in the hypothetical market in response to a market-wide small, but significant and non-transitory increase in price ("SSNIP").

In this rejoinder, we will first elaborate on the Critical Loss consensus identified in the Farrell & Shapiro paper and then move on to address the areas of misunderstanding associated with our work. As noted in our original paper, we do not disagree with the mathematics of Farrell & Shapiro's single-firm SSNIP analysis applied to a linear demand structure.⁴

II. MODELING THE RETENTION RATE

In the appendix to their response, Farrell & Shapiro present a graphical illustration of an application of the SSNIP market definition model. Their analytical structure represents the outcome of a discrete choice demand structure in which consumers choose among BMWs,

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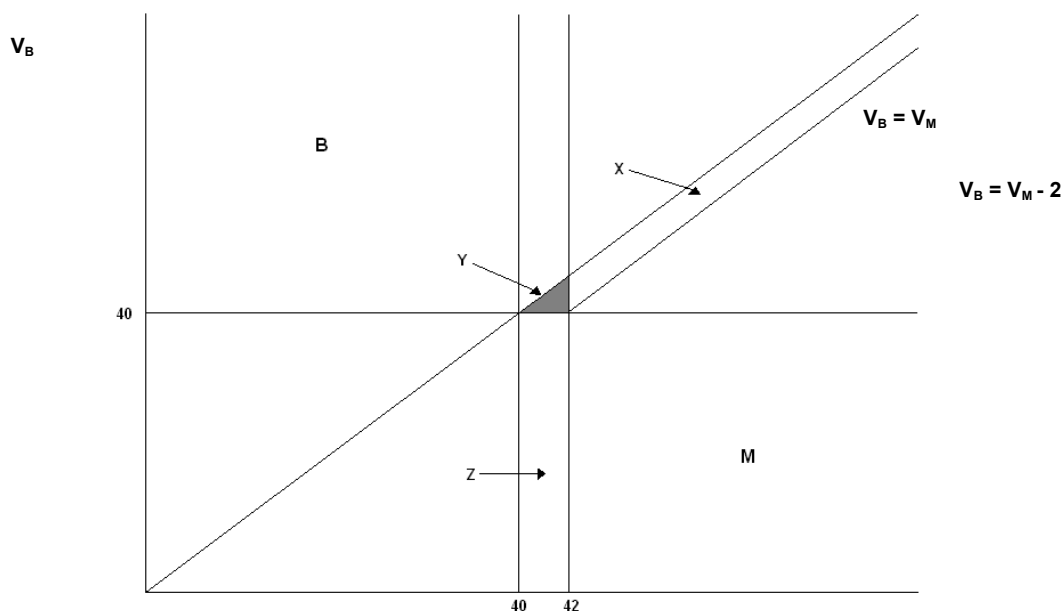
² Malcolm B. Coate & Joseph J. Simons, *Critical Loss vs. Diversion Analysis: Clearing Up the Confusion*, CPI ANTITRUST CHRONICLE (Dec (1) 2009) at <https://www.competitionpolicyinternational.com/critical-loss-vs-diversion-analysis-clearing-up-the-confusion>.

³ Joseph Farrell & Carl Shapiro, *Upward Pricing Pressure and Critical Loss Analysis: Response*, CPI ANTITRUST JOURNAL, (Feb 2010) at <https://www.competitionpolicyinternational.com/assets/Free/Shapiro-FarrellFEB10.pdf>. This note focuses only on critical loss. For an analysis of the Upward Pricing Pressure model, see Joseph J. Simons & Malcolm B. Coate, *Upward Pressure on Price (UPP) Analysis: Issues and Implications*, (2010). Available at SSRN: <http://ssrn.com/abstract=1558547>.

⁴ We do, however, believe that this line of analysis has limited applicability and its predictions must be considered unconfirmed.

Mercedes, and all other goods. The axes in Figure 1 measure the value that the consumer places on BMW (V_B), and Mercedes (V_M). Each point on the graph represents a possible consumer choice, and the density of consumer choice parameterizes the model. Any point B above the 45-degree line implies consumers value BMWs more than Mercedes and any point M below the 45-degree line suggests the Mercedes would be preferred. Equilibrium price is assumed to be \$40,000 for each car.⁵ Within their region of preference, consumers would purchase their favored automobile if the car were valued at or above \$40,000 and purchase an alternative good (possibly another car) if their favorite car is valued at less than \$40,000. In terms of the graph, consumers located above both the \$40,000 horizontal line and the 45 degree line buy BMW (area B), consumers located to the right of the \$40,000 vertical line and below the 45 degree line buy Mercedes (area M). The remaining customers (below and to the left of the \$40,000 lines) choose other products.

Figure 1 – Model of Consumer Choice – BMW, Mercedes or other good
(dollars in thousands)



While the graph clearly subdivides the universe of consumers into BMW buyers, Mercedes buyers, and other goods buyers, it does not generate any direct implications for the location of consumers. In effect, consumer location is exogenous to the F&S model. However, it appears clear that the location of consumers across Figure 1 depends on the modeling of competition. While standard theory considers the prices of other goods to be exogenous to consumer demand for the product,⁶ once differentiation is introduced into the analysis, it is important to understand that the willingness to pay for any specific good (i.e., a BMW) depends on characteristics of that good (product), information provided about that good

⁵ The focus on two rivals, the use of the 45-degree line, and the assumption of equal prices are for expository convenience. The model readily generalizes to consider more complex cases. For example, income effects could induce consumers to switch to relatively lower priced goods when the market price of all goods increases by 10 percent.

⁶ Demand functions depend on a laundry list of considerations, including income, prices of substitute and complementary products, and tastes. These factors are all considered exogenous to competition within the market.

(promotion), and distribution regime implemented to sell that good (placement). Moreover, the willingness to pay for that good also depends on product, promotion, and placement of the directly competitive goods (in this model, a Mercedes). The product attributes of other goods (outside the narrow market) also matter, here reducing the consumer's value for both BMW and Mercedes, when an alternative good adopts a more attractive set of price, product, promotion, or placement characteristics. In effect, by complicating the market model with product differentiation, the analysis makes all product-attribute decisions endogenous to the competitive process. Given equilibrium values for all these considerations, consumers will position themselves in Figure 1 and enable the market analysis.

Of course, the equilibrium values of price, product, promotion, and placement are all chosen by firms to gain sales and maximize profits. For example, firms like Audi, Lexus, Acura, and Volvo (to name a few) may very well choose their business strategies to induce former BMW and Mercedes consumers (among others) to purchase their products by effectively lowering their valuations below the critical purchase numbers (\$40,000 in Figure 1). These competitive policies are also likely to lower the valuations of loyal BMW and Mercedes customers, pushing these consumer valuations close to equilibrium price of \$40,000. Thus, it is likely that the density of consumers will be much higher for the marginal regions just above the \$40,000 valuation. Moreover, BMW and Mercedes are also maximizing profits and competing to design cars that appeal to both groups of customers. As these two close competitors add features, they expect to move customers from just favoring BMW to favoring Mercedes (or the other way around). As a bottom line, the competitive process appears likely to load consumers into the marginal area just above \$40,000 and on either side of the 45-degree line.

Now return to Figure 1, and observe that a single firm SSNIP by Mercedes can be modeled with a shift in both the price line (from \$40,000 to \$42,000) and a parallel shift in the 45 degree line to reflect the fact that the marginal consumer substitutes to the cheaper car.⁷ F&S use their graph to identify areas in which consumers either (1) divert purchases to suppliers outside the market (area Z) or (2) divert sales to the rival firm, BMW (area X+Y), in response to the unilateral SSNIP. Now consider the effect when the BMW also imposes a price increase. Both price lines are now set at \$42,000 and the choice separation line shifts back to the 45-degree line. As long as customers value the BMW or Mercedes at \$42,000 or more, the car is still purchased. Customers with values between \$40,000 and \$42,000 now purchase some other good. This further analysis shows how the area associated with the Mercedes diversion to BMW is subdivided into (1) a region in which purchases are diverted to products outside the market (the triangular area Y, for original Mercedes customers) and (2) a region which is regained by Mercedes when the unilateral SSNIP is transformed into a market-wide SSNIP by the BMW price increase (area X). An exactly analogous analysis can be undertaken for BMW customers and another triangle defined (just above the triangle Y). F&S correctly note that our Retention Rate is defined by the ratio of X to X+Y and thus the consumer density in the triangle is crucial to the analysis. In effect, F&S agree that the retention rate can take on any value ranging from 0 to 1 and thus implicitly accept the validity of the calculations in our Tables 2 and 3.⁸ In conclusion, our core result is accepted.

⁷ More complex response structures could be considered, but they would confuse the example.

⁸ The calculations in Table 1 match those in Table 1 of Daniel O'Brien & Abraham Wickelgren, *A Critical Analysis of Critical Loss Analysis*, 71 ANTITRUST L.J. 161 (2003) and thus are not at issue.

F&S go on to suggest that their model has implications for the density of consumers in the relevant areas, noting the relevant triangle is “very small” while the region in which customers are likely to remain with their current supplier is “very large.” Thus, they suggest that the Retention Rate is likely to be close to one and therefore, our correction to the F&S model would have little impact on market definition analysis. In effect, it could be assumed away. While we have always noted that this result could occur (See results in Table 3, with Retention Rate set at 1), we believe that F&S overstate the case for assuming the Retention Rate must be high.

In our analysis of their model, we suggested that it was the two triangles (one for BMW and the other for Mercedes) that would be densely settled with customers. Rivalry between BMW and Mercedes tends to induce both BMW and Mercedes consumers to choose locations along the 45-degree line and rivalry with Audi, Lexus, Acura, Volvo and others would then induce these same customers to move towards the \$40,000 price point. In effect, the competitive process may pack the triangles full of marginal customers. It would appear quite reasonable for a narrow group of firms/products to fail the Critical Loss test.

To resolve this dispute, the merger analyst must go to the evidence. In some cases, natural experiment, customer, or documentary evidence will point to a potential for substantial substitution, suggesting the critical region is densely packed with consumers. In other cases, the evidence will show minimal competition at the margin and thus it will be possible to show that the critical region Y is relatively empty. When direct evidence is not available, the analyst may end up focusing on a set of relatively unique characteristics such that it is possible to conclude that the critical region Y is relatively empty of consumers. Here, the across-the-board SSNIP is likely to be profitable.⁹ Other evidence may show a broad set of differentiated products are relatively interchangeable in price-adjusted terms and only a broad market makes sense. Product differentiation and the associated diversion ratios are not controlling.

III. RESPONDING TO THE OTHER ISSUES

Farrell & Shapiro raise a number of tangential issues with our analysis that also require response. While not directed at the core of the paper (as they admit our core point is correct, as noted above), these issues have generic implications for merger analysis. We address the important points in the text and footnote the less important concerns.

Farrell & Shapiro first take issue with the comment “Theory cannot trump Fact.” While we will admit that the comment is a little colorful for an academic discussion, our fundamental point must be emphasized. Farrell & Shapiro suggest that their paper is about how to weigh and interpret evidence concerning demand responsiveness. The evidence at issue involves the use of margin data to predict demand elasticity via the Lerner formula, which as Farrell & Shapiro say follows from standard price *theory* taught in any undergraduate economics class. That relationship between the margin and demand responsiveness, however, is a theoretical one, derived from the mathematics underlying the classical monopoly model.¹⁰ It has not been

⁹ In producer goods industries, a range of changes in the production process may allow a firm to substitute one good for another. To the extent that the analyst can evaluate the cost of these changes, it is possible to compute the profitability of switching and infer an answer to the standard SSNIP hypothetical. In consumer goods, the choices are often more difficult to quantify and thus the analysis may become more qualitative.

¹⁰ In a companion paper, we note Lerner index analysis is not applicable when the market exhibits product homogeneity or dynamic differentiation. See Malcolm B. Coate & Joseph J. Simons, *Critical Loss: Modeling and Application Issues*, 2009, available at SSRN: <http://ssrn.com/abstract=1520069>.

demonstrated to reliably predict demand elasticities, especially in more competitive markets.¹¹ Our point is that when the demand elasticity predicted by the theoretical relationship conflicts with empirical evidence such as natural experiments, the theoretical evidence cannot trump the factual evidence.¹²

Margins play an important role in both the standard Critical Loss Analysis and theoretical modeling. However, we pointed out in our paper how standard Critical Loss Analysis uses margins (and marginal cost) measured over the interval associated with the output lost from the SSNIP, while theoretical models need the marginal cost (and margin) to be evaluated at the “theoretical” point of equilibrium. In practice, if the evidence clearly shows constant costs over the relevant range, this problem is not relevant. However, when empirical evidence suggests a broad market and the theoretical evidence points to a narrow market, the mis-measurement of marginal cost at the equilibrium point does represent one possible explanation for the inconsistency.¹³

In section IX, Farrell & Shapiro say that we do not follow the Guidelines. We certainly agree that our analysis focuses on break-even Critical Loss for a market-wide SSNIP and not the profit-maximization variant associated with a variable SSNIP.¹⁴ The classic break-even Critical Loss approach can be readily operationalized and has been used for roughly 25 years both at the Agencies and in the courts. Regardless of how the Guidelines are interpreted, the variable SSNIP approach is rarely if ever used in practice,¹⁵ and for good reason.¹⁶ If the Guidelines are revised, we recommend the break-even across-the-board SSNIP be accepted as the standard, with the profit-maximizing variable SSNIP reserved for very special cases where the standard approach fails.

Finally, Farrell & Shapiro note that one of our paragraphs misrepresents their analysis. They complain that we misapply their formula in Proposition 1 by using a different definition of the Aggregate Diversion Ratio and thus defining a different market. We had used Proposition 1

¹¹ This critique of the application of game theory to Industrial Organization and antitrust is certainly not new. See Franklin M. Fisher, *Games Economists Play: A Noncooperative View*, 20 RAND 113-124 (199) and Sam Peltzman, *The Handbook of Industrial Organization: A Review Article*, 99 J. POL. ECON. 201-217 (1991).

¹² Turning to the second objection (page 9), we are willing to note that the term “designed to” may not be semantically correct in reference to the F&S technique; however, the fundamental point is accurate. Analyses based solely on Lerner relationships and diversions generally lead to narrow market. We illustrate that these narrow markets can be generated even when margins are “low-to-moderate.”

¹³ Closing out our response to Section VIII, our point is simply that models based on the Lerner index must predict higher prices when demand becomes more inelastic, as long as the products are substitutes and costs do not change. We do not consider this observation to be controversial.

¹⁴ While the particular paragraph cited from the Guidelines appears clear, the entire Market Definition section needs to be read to determine the “Guideline” approach. And while the profit maximization language was introduced in the 1984 revision, it seemed to serve as more of a supplement, than a substitute, for the 1982 language. Our analysis was not meant to revisit the would/could profitably debate, but to evaluate how the Critical Loss algorithm should be generalized for product differentiation.

¹⁵ And, as we noted in our paper, the profit-maximizing variable SSNIP approach appears to be much more useful as method to directly estimate competitive effects than indirectly define a relevant markets. When the theoretical analysis is confirmed by exogenous empirical evidence, the analyst clearly has reason for competitive concern and a full review of the overall merits of the merger case is required. Farrell & Shapiro (*supra* note 3 at 15) imply that they would infer concerns (absent offsetting Guidelines-related evidence) when diversion is substantial, suggesting the logical jump from market definition to competitive effects. Our point is that evidence is needed to confirm the initial implications of the model prior to any inference of a competitive problem.

¹⁶ See Appendix in Coate & Simons, *Critical Loss vs. Diversion Analysis: Clearing Up the Confusion*, *supra* note 1.

to note that Aggregate Diversion would be less than Critical Loss, if (as we believe is often the case) there is no or very little diversion among firms in the candidate market when all of them raise price by a SSNIP.¹⁷ In such case, markets will tend to be broad rather than narrow (as Farrell & Shapiro suggest).

Although the footnote to Proposition 1 states clearly that this test applies to a market-wide (uniform) SSNIP, aggregate diversion, A , is defined in the text as applying to a single firm SSNIP. This seems to be the source of the complaint. However, in their appendix, A is defined to be constant over the relevant range of the uniform SSNIP, an assumption that implies it equals a closely related Aggregate Diversion Ratio defined directly for an across-the-board SSNIP.¹⁸ Thus, for Farrell & Shapiro the two aggregate diversion concepts appear to take on equal values.

We relax F&S's modeling structure to foreshadow our Retention Rate analysis. Instead of allowing the firm's aggregate diversion with respect to a single firm SSNIP to equal the firm's aggregate diversion with respect to an across the board SSNIP, our text posits that the value of this aggregate diversion declines as the prices of rivals within the hypothetical market increase. When all firms in the hypothetical market increase price by the SSNIP, aggregate diversion among those firms may fall to zero. Our paragraph simply applies Proposition 1 to show that markets may be broad under these circumstances.¹⁹ This result is nothing more than an implication of our retention analysis.

We did have one mis-statement in the paragraph in question. Farrell & Shapiro assume a linear demand structure in Proposition 1. We relax that assumption in our generalization of their model, because we believe that it is not likely to apply and, at a minimum, its applicability is an empirical issue. Our paragraph should not have retained this demand qualification. The language in our paper (correct for both clarity and context) should have read (changes in bold):

For example, if Mercedes, BMW, and Audi all raise price simultaneously by the same amount, why would we expect any Mercedes customers to switch to BMW or Audi? We think that generally the Mercedes customers would not but, at a minimum, it is an empirical issue. If the answer is that we do not expect such switching, then the Farrell and Shapiro approach (with the linear demand **assumption relaxed as described below**), would result in expanding the candidate market for across the board SSNIPs because **the Aggregate Diversion Ratio associated with the relevant across the board SSNIP**

¹⁷ Applying an across-the-board SSNIP simultaneously suggests the customers that would divert to rivals in response to a single firm SSNIP will remain with their current supplier or divert to suppliers outside the market. Here, we refrain from considering the more complicated situations that could occur if the symmetry assumption was relaxed.

¹⁸ Joseph Farrell & Carl Shapiro, *Improving Critical Loss*, ANTITRUST SOURCE, Feb. 2008 at A1. <http://www.abanet.org/antitrust/at-source/08/02/Feb08-Farrell-Shapiro.pdf>. Given symmetry, firm-level aggregate diversion linked to a market-wide SSNIP implies the representative market aggregate diversion for a uniform SSNIP also equals A . (An average of identical numbers is simply that number undergoing averaging.)

¹⁹ Proposition 1 is derived by equating Actual Loss (the product of the elasticity-based estimate of Actual Loss (s/m)) and the adjustment for Aggregate Diversion to rivals within the market ($1-A$) with the Critical Loss and solving for A . Farrell & Shapiro, *supra* note 18 at A1. By replacing A with $R*A$ (where R is the Retention Rate that defines the portion of the Aggregate Diversion that is retained within the market in response to a market-wide SSNIP, and A represents the aggregate diversion in response to a unilateral SSNIP), it is possible to define an adjusted firm-level formula for a uniform SSNIP that requires $R*A$ to be greater than or equal to the Critical Loss to establish a market. For sufficiently small values of R , the product of the Retention Rate and the aggregate diversion in response to a single firm SSNIP will be less than the Critical Loss and the market must be broad.

would be less than $S/M+S$ (**the Critical Loss**) in **a version of** their Proposition 1. This result is the opposite of the one they seek to draw.

We apologize for the confusion, but there is no disagreement on the basic analysis.

IV. CONCLUSION

Farrell & Shapiro are correct that diversion to rivals within a market may play a role in defining markets for differentiated product markets. However, Aggregate Diversions, standing alone, do not tell the entire story. Both our Retention Rate and Farrell & Shapiro's triangle of substitution analyses serve to correct the theoretical diversion results when moving from a single firm SSNIP to the standard market-wide SSNIP for market definition. Our disagreement is now and has always been mostly empirical. We believe that the Retention Rate will often be low and the triangle will often be packed with consumers, in which case an assumption that diversion from a single firm SSNIP and an across the board SSNIP will be equal is not appropriate. Farrell & Shapiro argue the Retention Rate will usually be close to one and the triangle will not be densely packed with consumers such that standard diversion calculations will be close to accurate. Case-by-case analysis will determine whose insights are generally correct.