Recent Observations About Critical Loss Analysis

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I. Background

A. The concept of Critical Loss flows from the definition of an antitrust market contained in the Department of Justice/Federal Trade Commission Horizontal Merger Guidelines.

   1. A market is the smallest group of producers that, if they behaved as a single hypothetical profit-maximizing firm, would impose at least a small but significant and nontransitory increase in price.[1] In applying this test the terms of sale of all other products are held constant

   2. The logic of this definition is to identify a group of producers that would be able to exercise market power if they could coordinate their pricing and output behavior. Market power refers to the ability to profitably maintain prices above competitive levels for a significant period of time.[2]

   3. The Merger Guidelines do not address how to determine when a price increase will be profitable.

   4. A price increase will be unprofitable if too many sales are lost because of the higher prices.

B. The Critical Loss identifies *for any given price increase* the amount of sales that can be lost before the price increase becomes unprofitable.

   1. Different levels of Critical Loss are associated with different levels of hypothesized price increases. A profit-maximizing firm by definition will choose the price increase that produces the greatest increase in profits.

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[1]   Merger Guidelines §1.0
[2]   Merger Guidelines § 0.1

2. As Greg Werden has noted, a small increase in price may not be profitable while a large increase may be profitable.[3]

C. Calculating the Critical Loss is the first step of a two-step process. The second step considers whether or not the actual level of sales lost due to the price increase will exceed the Critical Loss. This second step typically involves using traditional tools of antitrust market definition analysis such as estimating demand elasticities, other statistical analyses such as patient origin analysis, document review, customer reactions and surveys.

II. Calculating the Critical Loss

A. The Critical Loss identifies for any given price increase the quantity in sales that can be lost before the price increase becomes unprofitable.[4]

B. Intuition Behind the Critical Loss

1. Typically a price increase will cause a loss of some sales and the profits earned from them, while higher profits are earned on retained sales.

2. The per unit profit associated with customers who do not switch to alternate suppliers will increase by the amount of the hypothesized price increase.

3. The profit decrease associated with customers that do switch to alternate suppliers is the difference between the revenue that would have been received from these customers and the cost that would have been borne in serving them.

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[3] G. Werden, "Market Definitions and the Justice Department's Merger Guidelines," *Duke Law Journal*, pp. 514, 543-5 (1983). There also may be situations where a smaller price increase would be profitable, but a larger one would not. This situation occurs when relatively few sales would be lost at a slightly higher price, but a relatively large amount of sales would be lost if prices were increased further. B. Harris and J. Simons, "Focusing Market Definition: How Much Substitution is Necessary?" *Research in Law and Economics*, pp. 216, 224 (note 19), 1989.

[4] This form of the Critical Loss has been called the "breakeven" version. A different form of the Critical Loss has been called the "profit-maximization" version. The profit-maximization version of Critical Loss considers the largest reduction in quantity that a profit-maximization firm *would* accept with regard to a given price increase. See: Gregory J. Werden, "Demand Elasticites in Antitrust Analysis*" Antitrust Law Journal*, 1998 and Michael G. Baumann and Paul E. Godek, "Could and Would Understood: Critical Elasticities and the Merger Guidelines," *Antitrust Bulletin*, 1995.

4. The Critical Loss is the level of lost sales at which the group of producers is indifferent between raising the price and not raising the price.

C. Critical Loss Formula

1. The Critical Loss is equal to Y ÷ (Y + CM) x (100%) where Y is equal to the *Merger Guidelines'* hypothesized price increase and CM is equal to the contribution margin of the producers in the group.

2. The contribution margin is defined as the difference between the original price and average variable cost stated as a percentage of the original price. Variable cost is a proxy for the actual costs saved because of the reduction in sales. The variable cost element should be consistent with the level of lost sales and the associated time period.

3. Small adjustments in the formula allow for the calculation of the Critical Loss when there are supply or demand interdependencies such as when two or more products necessarily result from a single production process.[5]

D. A principal empirical insight from Critical Loss analysis is that a relatively small number of customers willing to use alternate sources of supply may be sufficient to protect all customers from the exercise of market power.[6]

III. The Use of Critical Loss in Defining Markets in Merger Cases

A. To the best of my knowledge, Critical Loss was first used at a 1986 merger trial in which the FTC attempted to enjoin a merger between producers of PVC.[7] (*FTC v. Occidental Petroleum Corporation*)

1. There was agreement among the parties that the appropriate product markets were suspension homopolymer PVC and dispersion PVC. So the analysis focused on geographic markets.

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[5] Harris and Simons, pp. 216-217.

[6] The simplest Critical Loss concept is based on situations where a single price is charged to all customers. The *Merger Guidelines*, however, recognize that markets based on price discrimination may exist. Merger Guidelines §§1.12 and 1.22. With some adjustments, Critical Loss analysis can also be used in these circumstances.

[7] See Harris and Simons, p. 219.

2. The Critical Loss associated with a 5 percent price increase was calculated at 15% for suspension homopolymer PVC resin and 10% for dispersion PVC resin.

3. Analyses indicated that U.S. customers would purchase more than these amounts from foreign suppliers and that foreign suppliers would divert sufficient PVC to U.S. customers.

4. Based in part on this analysis, the District Court concluded that the U.S. geographic market alleged by the FTC was inappropriately small for both types of PVC.

B. Critical Loss Analysis in Hospital Merger Cases

1. Critical Loss played a prominent role in *United States v. Mercy Health Services Group*, 902 F. Supp. 968 (N.D. Iowa 1995). In this merger case, the District Court turned aside the government's request for injunctive relief. The decision was based in large part on the court's rejection of the government's narrow alleged market, which was limited to the merging hospitals (the only acute-care hospitals in Dubuque Iowa) and a small number of nearby rural hospitals.[8]

2. In the Dubuque case the government alleged that prices would increase by a large amount well in excess of the standard five to ten percent. The government however, failed to present evidence about the extent patients would switch to alternative hospitals in the event of such a large price increase.

3. A more complete discussion of Critical Loss appears in *FTC v. Tenet Healthcare Corp.* 186 F.3d 1045 (Eighth Circuit 1999). In this case, the FTC attempted to block a hospital merger of the only two hospitals in Poplar Bluff, a small Missouri city.

4. In *FTC v. Tenet*, the Court of Appeals overturned the District Court and found for the defendants, based in large part on a Critical Loss analysis that showed competition from more distant hospitals was

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[8] See B. Harris, "The Economics of the Dubuque Hospital Decision," *Economists Ink*, Spring/Summer 1996. (www.ei.com/publications/spring3)

sufficient to prevent the exercise of market power by the merged hospital.

    a.   In particular, the Court of Appeals noted: "A "critical loss" analysis would identify the threshold number of patients who, by seeking care at other hospitals, could defeat a price increase by making it unprofitable. The purchasing behavior of these patients or "marginal customers" would discipline or constrain any potential price increase by a merged entity."

    b.   In reaching its decision, the court found important the "…significance of the consumers who live outside Poplar Bluff, particularly those patients within the FTC's proposed geographic market who actually live or work closer to a hospital outside that geographic market than to either of the Poplar Bluff hospitals."

5.   In *FTC v. Tenet*, the defendants presented information that established a contribution margin for the merging hospitals of between 58% and 66%, which indicated a Critical Loss for a 5% price increase between 7% and 8%. The Critical Loss associated with a 10% price increase was between 13% and 15%. The contribution margin was estimated by directly considering the costs that would be saved by the hospital in the event of a quantity decrease of ten to fifteen percent for a one-year period. Analysis of patient migration and hospital usage patterns established that the number of patients with alternatives to the merging hospitals was well in excess of the Critical Loss. The analysis included focused analyses of commercially insured patients and patients receiving the same treatments provided at the merging hospitals. These analyses were made possible by patient data that indicated each patient's residential zip code, the hospital used, the type of insurance used to pay the hospitals, and the nature of the treatment.

C. U.S. v. SunGard

1. The Critical Loss concept is typically based on situations where a single price is charged to all customers by a producer. In 2001, in *U.S. v. SunGard and Comdisco*, in a market with pervasive price discrimination the Court concluded that SunGard's acquisition of the computer disaster recovery assets of Comdisco was not likely to harm competition. The Department of Justice alleged a market consisting of a particular type of recovery services called shared "hot-site" recovery services.

2. The *Merger Guidelines* recognize that markets based on price discrimination may exist, but the existence of such a market would require SunGard to be able to distinguish between customers that would and would not switch from hot-site services to other types of recovery services. If SunGard could make this distinction, it could avoid lost sales associated with an across-the-board price increase by limiting higher prices to customers unwilling to switch. Unless there is a well-defined, identifiable group of captive customers, however, attempts at price discrimination will still involve lost sales (and lost profits) as misidentified customers switch to alternatives. Consequently, an alleged market based on price discrimination must still pass a Critical Loss test.[9]

IV.   Recent Questions about Critical Loss

A. Recent articles raise questions about the important role Critical Loss has played in antitrust analysis over the past few years.[10]

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[9]   Hausman, Leonard & Vellturo, "Market Definition Under Price Discrimination," *Antitrust Law Journal*, Volume 64, Issue 2 (1996).

[10]   The four principal articles raising questions are: Michael L. Katz and Carl Shapiro, "Critical Loss: Let's Tell the Whole Story," *Antitrust,* Spring 2003; Daniel P. O'Brien and Abraham L. Wickelgren, "A Critical Analysis of Critical Loss Analysis," *Antitrust Law Journal,* 2003, pp. 161-84; Kenneth L. Danger and H.W. Frech III, "Critical Thinking about Critical Loss in Antitrust." *Antitrust Bulletin*, 200*1;* and James Lagenfeld and Wenqing Li, "Critical Loss Analysis in Evaluating Mergers," *Antitrust Bulletin,* 2001. The issues raised in the four papers are similar. The Katz/Shapiro paper is addressed in this presentation.

1. The Katz/Shapiro article argues that users of Critical Loss analyses often claim that: When suppliers' profit margins are high any lost sales will have a big adverse impact on profits and, consequently, even a hypothetical monopolist could not profitably raise price. If such an argument is actually made, it is flawed. Whether or not the hypothesized price increase would be profitable requires consideration of the actual demand faced by the hypothetical monopolist.

2. Katz/Shapiro add that: "This story is incomplete because high margins also tend to imply that the actual loss is small, and thus a price inverse might be profitable even when the critical loss is small."

3. Katz/Shapiro base this concern on the theoretical inverse relationship between margins and elasticities encompassed in the Lerner Index. They recommend a presumption that high gross margins go along with a low elasticity of demand faced by the Guidelines' hypothetical monopolist.

4. Katz/Shapiro also note that the elasticity facing an individual firm in a market is typically higher than the elasticity facing the hypothetical monopolist.

B. There is no basis for use of the Katz/Shapiro presumption.

1. There are several reasons why large observed gross margins may be consistent with unit sales being sensitive to a price increase by the hypothetical monopolist. Katz/Shapiro identify three: (a) Firms in the candidate market are coordinating their prices rather than setting their prices independently; (b) There is a kink in the underlying demand curve; and (c) There is a kink in the underlying cost curve.

2. Katz/Shapiro fail to distinguish between a margin based on marginal and incremental cost and the variable-cost margin. The relationship between elasticities and margins captured by the Lerner Index refers to margins based on marginal or incremental cost. As Katz/Shapiro (Footnote 6) note, incremental (or marginal) cost is the cost of producing one more unit of output. By contrast, variable-cost margins as used in Critical

Loss analysis are based on average short-run variable costs that cover a larger increment of quantity.[11]

3. As Katz/Shapiro (Footnote 7) recognize: High gross margins do not imply that firms are earning monopoly profits. In the long run, gross margins must be large enough to cover (what in the short run are) fixed costs, or suppliers will lose money and exit the business.

4. Actual observations provide examples of high variable cost margins in competitive markets.

   a) Discussions with mangers of take-out restaurants, indicate that they have variable-cost margins of roughly 80%, when quantity sold is assumed to decline approximately 10% over a years' time. Typically rents and machinery are fixed and labor is largely unaffected. Labor would be affected by a larger decrease in quantity. Despite such a high variable-cost margin, these businesses sell their products in very competitive markets.

   b) Also consider bargaining situations such as exist at a car dealership. All customers have the same alternate suppliers available to them. Even if customers have different preferences, these differences are not known by the car dealer. Nonetheless, the prices paid by customers (and the resulting margins) differ.

5. Scheffman and Simons note that the relationships identified in the Katz/Shapiro paper require the imposition of strong conditions that may not be valid in a given industry setting.[12]

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[11] In delineating markets the Guidelines consider a hypothesized price increase "lasting for the foreseeable future." Earlier versions of the Guidelines had typically focused on hypothesized price increases of one year. Costs that cannot be saved over the applicable period as a result of a decline in quantity sold should not be included in short-run variable costs.

[12] David T. Scheffman and Joseph J. Simons, "The State of Critical Loss Analysis: Let's Make Sure We Understand the Whole Story," *The Antitrust Source*, November 2003.

C. Ultimately, I agree with two specific conclusions stated in Katz/Shapiro:

    1. "A critical loss calculation can thus usefully frame the empirical estimation of demand responsiveness for the purpose of delineating relevant product markets."

    2. "When price, cost and sales data, as well as other more qualitative evidence, are available, we favor using that information to estimate the elasticity of demand and/or the actual loss."

V. I strongly disagree, however, with the Katz/Shapiro proposal to use the Aggregate Diversion Ratio to test the validity of Critical Loss analysis.

A. Katz/Shapiro define the Aggregate Diversion Ratio for a price increase of a particular product as the fraction of overall sales lost by that product to other products in the candidate antitrust market. That is, the Aggregate Diversion Ratio considers what happens when one price in the candidate market is increased.

B. Unless the different products within a candidate antitrust market increase prices by different amounts, it is likely there will be little substitution among the products within the candidate market. Consequently, when there is a price increase across all products in the candidate market the value of the Aggregate Diversion Ratio is likely to be close to zero.

    1. Under most circumstances, market delineation focuses on a common price increase for all products in a candidate market.

    2. Recall that the purpose of delineating antitrust markets is to identify a group of producers that would be able to exercise market power if they could coordinate their pricing and output behavior. Typically, it will be difficult to exercise market power through coordinated effects requiring different price increases for different products.

C. The Aggregate Diversion Ratio is difficult to estimate. The estimation of Aggregate Diversion Ratios typically involves estimating the demand elasticities of the various products in the candidate market. Sometimes these underlying demand relationships are estimated based on some simplifying assumption such as cross elasticities being related to existing market shares.

1. There is little if any economic justification for such an assumption.

2. Calculating market shares requires identifying the appropriate antitrust market, which cannot be known in advance since it is the goal of the analysis.

VI. **Conclusion:** Critical Loss Analysis is commonly used in delineating markets by the Federal Trade Commission, Department of Justice, and private parties. Critical Loss remains an appropriate technique for these purposes, so as long as proper care is used in estimating the variable-cost margin and the actual loss associated with hypothesized exercises of market power.