

# Critical Loss Analysis: Its Growing Use in Competition Law

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Critical loss analysis has gained increasing importance in competition law. A critical loss is the loss in sales or output necessary to make a given price increase unprofitable, and thus it determines the amount of substitution needed to expand a provisional relevant market definition. Critical loss analysis remedies a number of deficiencies in the current approach to market definition, which focuses excessively on product characteristics and absolute price differences, and ignores the profitability of hypothetical price increase. It is a relatively simple calculation that better reflects the market definition test and fills a gap in the way market definition is determined. Critical loss analysis also forces those looking at markets to recognise that it is not necessary for most, the majority or the average customer to react to a price increase, but that a relatively small number of customers willing to use alternative sources of supply can often be sufficient to protect all customers from the exercise of market power. Despite the increasing use of critical loss in US antitrust,<sup>1</sup> it has been ignored in the European Community. Indeed we are not aware of any

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1 See B.C. Harris and J.J. Simons, "Focusing Market Definition: How Much Substitution is Necessary?" (1989) 12 *Research in Law and Economics* 207; K. Danger and H.E. Frech III, "Critical Thinking About 'Critical Loss' in Antitrust" (2001) 46 *Antitrust Bulletin* 339; J. Langenfeld and W. Li, "Critical Loss Analysis in Evaluating Mergers" (2001) 46 *Antitrust Bulletin* 299; M.G. Baumann and P.E. Godek, "Could and Would Understood: Critical Elasticities and the Merger Guidelines" (1995) 40 *Antitrust Bulletin* 885; F.L. Johnson, "Market Definition under the Merger Guidelines: Critical Demand Elasticities" (1989) 12 *Research in Law and Economics* 235; G.J. Werden, "Four Suggestions on Market Delineation" (1992) 37 *Antitrust Bulletin* 107. G.J. Werden, "The 1982 Merger Guidelines and the Ascent

EC decision or proceedings where it has been used. However, the draft merger guidelines of the UK Competition Commission published in November 2002 under the new Enterprise Act 2002 list critical loss as one approach to market definition.<sup>2</sup> Here the concept and its recent use in US antitrust cases are explained, in the hope that greater attention will be placed on this and other empirical tests of market definition as the European Commission reforms its merger law and procedures.

## Background

The Department of Justice/Federal Trade Commission Merger Guidelines<sup>3</sup> define a relevant product market as a group of producers for whom a "small but significant and nontransitory" price increase would be profitable. The EC Notice on Market Definition<sup>4</sup> adopts a similar approach, referring to a change in relative price of two or more products. This test is often referred to as either the Hypothetical Monopolist Test (HMT) or, as it is called in the United States, the SSNIP test.

Although the HMT is now central to US antitrust analysis, until recently the issue of how to determine when such a price increase would be profitable was not addressed in case law. For example, the US Supreme Court has enunciated the standard of "reasonable interchangeability" such that two products are in the same market only if they are reasonably interchangeable. Most products are employed in a variety of uses, and often there are substitute products available in only some of the uses. The court has never explained whether

of the Hypothetical Monopolist Paradigm" DOJ seminar celebrating 20th Anniversary of the 1982 Merger Guidelines: The Contribution of the Merger Guidelines to the Evolution of Antitrust Doctrine, June 2002 ([www.usdoj.gov/atr/hmerger/11256.htm](http://www.usdoj.gov/atr/hmerger/11256.htm)).

2 UK Competition Commission, Draft, Merger References: Competition Commission Guidelines, September 2002, para.2.18.

3 US DOJ/FTC, Horizontal Merger Guidelines, issued April 2, 1992; revised April 8, 1997. See [www.usdoj.gov/atr/public/guideliens/hmg](http://www.usdoj.gov/atr/public/guideliens/hmg).

4 Commission Notice on the definition of the relevant market for the purposes of Community competition law [1997] O.J. C372/5; [1998] 4 C.M.L.R. 177 (hereinafter "Market Definition Notice"). Similar and more detailed guidelines have also been set out by the UK Office of Fair Trading (OFT) under the Competition Act 1998 (*Market Definition*, OFT 403, March 1999). Indeed, the HMT will shortly have a much wider ambit when new telecommunications regulation is introduced in the EC which makes market definition and dominance critical triggers for *ex ante* regulation: Draft Guidelines on market analysis and the calculation of significant market power under Article 14 of the proposed Framework Directive on common regulatory framework for the electronic communications networks and services, February 21, 2002.

products must be interchangeable in 10 per cent, 50 per cent or 75 per cent of their sales to be considered in the same market. The court has instead turned to seemingly arbitrary and ad hoc line drawing to resolve this issue.

The same can be said of EC law, where the approach to market definition remains multifaceted. The Market Definition Notice states that the relevant product “market comprises all those products and/or services which are regarded as interchangeable or substitutable by the consumer, by reason of the products’ characteristics, their prices and their intended use”.<sup>5</sup> It continues that the relevant geographical “market comprises the area in which the undertakings concerned are involved in the supply and demand of products or services, in which the conditions of competition are sufficiently homogeneous and which can be distinguished from neighbouring areas because the conditions of competition are appreciably different in those area”.<sup>6</sup> The Market Definition Notice refers to the HMT as one way of looking at market definition but fails to draw out the differences between it and consumer substitutability. Further, EC law tends to be less quantitative than its US counterpart, relying on impressionistic views of interchangeability with far less pressure to establish (or reject) substitution possibilities in a quantitative fashion. As far as we are aware it has never linked market definition to profitability of price increases. Notwithstanding this, in the pecking order of EC antitrust empirics overall price responsiveness is virtually ignored, and the impact on output and producer profitability definitely ignored!

Competition law practitioners have viewed the HMT as a purely “hypothetical” test which is impossible to verify in practice. This proposition is incorrect. When combined with critical loss analysis the HMT “requires amazingly little information”<sup>7</sup> and is easily calculated.

## Calculating the critical loss

The concept of critical loss flows from the definition of a relevant or antitrust market in both EC and US competition law. It was developed by Barry Harris and Joseph Simons,<sup>8</sup> who derived a formula which asks what the group of producers (*i.e.* the hypothetical monopolist) in a proposed market could gain or lose from a price

increase. Typically, a price increase will cause the group of producers to lose some sales and the profits earned from them. At the same time, they will earn increased profits from higher prices on the retained sales. The price increase will be profitable if profits lost due to reduced sales are less than profits gained from higher prices. 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, *i.e.* where it has a negligible impact on profits.<sup>9</sup>

The formula used to calculate the critical loss depends only on the magnitude of the price increase being considered, and the contribution (or profit) margin (CM) of the group of firms attempting to increase prices. More precisely, in its simplest form, the critical loss is equal to  $Y/(Y + CM) \times (100 \text{ per cent})$ , where:

Y = the hypothesised price increase (*e.g.* 5 or 10 per cent) expressed as a proportion (*e.g.* 0.05 or 0.10), and

CM = the contribution margin defined as the difference between the original price and average variable cost stated as a proportion of the original price.

Small adjustments to 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.

To illustrate the critical loss calculation, consider a merger between two cruise operators such as was investigated in 2002 by the UK Competition Commission,<sup>10</sup> US Federal Trade Commission,<sup>11</sup> and the European Commission.<sup>12</sup> In that case there were two competing bids for P&O Princess Cruises by Carnival Corp and Royal Caribbean Cruise Lines. The issue at hand was whether the relevant product market was wider than oceanic cruises, oceanic cruises only, or some sub-class of oceanic cruises such as premium oceanic cruises, which was initially favoured by the European

5 Market Definition Notice, para.7.

6 *ibid.* para.8.

7 OFT, *Quantitative techniques in competition analysis*, Research Paper No.17 (October 1999), para.10.8.

8 B.C. Harris and J.J. Simons, “Focusing Market Definition: How Much Substitution is Necessary?” (1989) 12 *Research in Law and Economics* 207.

9 A related concept often used is the critical elasticity. This is the maximum pre-merger elasticity of demand for a candidate group of products and area, such that a hypothetical monopolist with control of the candidate market could profitably increase price by at least an established threshold value such as 5%. See references cited at n.1 above.

10 *P&O Princess Cruises plc and Royal Caribbean Cruises Ltd.*, Cm. 5536 (June 2002), paras 5.3–5.6 and App. 5.

11 Statement of the FTC concerning *Royal Caribbean Cruises Ltd/P&O Princess Cruises plc and Carnival Corp/P&O Princess Cruises plc*, FTC File No.021 0041, October 2002.

12 Case COMP/M.2706 *Carnival Corporation/P&O Princess*, July 2002 ([www.competition-commission.org.uk/reports/468pando.htm#full](http://www.competition-commission.org.uk/reports/468pando.htm#full)).

Commission. In the UK Competition Commission's report, individual operator critical loss figures were calculated for a hypothetical 5 and 10 per cent price increase per passenger cruise day.<sup>13</sup> However, assume for illustrative purposes that the contribution margin for oceanic cruises was 48 per cent, then for a 5 per cent hypothetical price increase the critical loss would be  $9.5 \text{ per cent} = .05 / (.05 + .48) * 100 \text{ per cent}$ . That is, in the absence of price discrimination, for the potential relevant market to be wider than oceanic cruises the hypothetical monopolist of all oceanic cruises would have to anticipate losing 9.5 per cent or more of its total passenger cruise days, and less than 9.5 per cent for oceanic cruises to define the relevant market.

The critical loss only identifies the reduction in output which would have to occur to make the hypothetical price increase unprofitable. It does not tell one whether such a reduction would actually occur. To estimate actual lost sales would require analysis of the reactions of consumers (demand-side factors), and the reactions of producers, whether of the same or other products. This may require considerable data, possibly including an econometric analysis known as residual demand analysis.<sup>14</sup>

Nonetheless, the critical loss provides important information on the magnitude of the output effects required for market definition purposes which can be compared to company, industry and general market information to see whether substitution effects greater than or less than the critical loss seem plausible and reasonable. If the estimated response is less than the critical loss, the group of firms under review constitutes a relevant product market or antitrust market.

In the cruise merger example above, the three competition authorities all defined the market as "oceanic cruises". Two of the three began their discussion of market definition by referring to critical loss estimates. The FTC concluded (without providing the evidence): "[i]n view of a high elasticity of demand in the cruise industry relative to the critical loss, an across-the board price increase would be unprofitable and unlikely under current market conditions". Therefore absent price discrimination oceanic cruises were considered not to be a

relevant product market. The UK Competition Commission was more agnostic but used critical loss estimates to launch its discussion of market definition stating "[t]hrough fully aware of its [critical loss] limitations, we found this estimate a useful benchmark against which to compare views on customers' likely responsiveness to price changes, and to assess the profitability of a 5 to 10 per cent price rise".<sup>15</sup> The European Commission on the other hand ignored the issue, commenting in a footnote that it "has . . . been unable to gather data that would enable it to perform any quantitative tests on the boundaries of the relevant market".<sup>16</sup>

### Recent application in US merger cases

In the United States the concept of critical loss first appeared in *FTC v Occidental Petroleum Corp.*<sup>17</sup> This occurred in a 1986 merger trial in which the FTC sought to block a merger between producers of polyvinyl chloride resin (PVC). The FTC alleged a geographic market was confined to North American producers while the parties claimed it was much wider and should include foreign producers of PVC resins. The FTC failed to obtain a preliminary injunction when the trial judge, relying in part on critical loss analysis, ruled that European and other producers outside North America were properly included in the relevant geographic market even though many consumers in the United States would not use imported products.

In *Occidental Petroleum* the FTC alleged several product markets, including markets for suspension homopolymer PVC resin and dispersion PVC resin. The parties agreed that these constituted relevant product markets, and, consequently, the analysis focused on the definition of the relevant geographic markets. Industry documents provided evidence that the price of PVC resin was approximately 25 cents per pound with variable costs of about 18 cents per pound. The price of dispersion PVC resin was approximately 49 cents per pound with variable costs of about 27 cents per pound. This information provided contribution margins of 28 and 15 per cent respectively. Using these values in the formula for critical loss produced estimates of 15 per cent for suspension homopolymer PVC resin and 10 per cent for dispersion PVC resin using a 5 per cent hypothetical price increase. These critical loss estimates

13 In the report individual cruise operator critical loss estimates are given of 9.5% and 11.5% for P&O Princess and Royal Caribbean respectively. For confidentiality reasons the report does not give the contribution margins but they can be derived from the formula, given the figures, by manipulating the critical loss formula to give  $CM = Y(100\%/CL - 1)$ . This gives contribution margins of 48% and 38% for Royal Caribbean and P&O Princess respectively, and individual operator critical losses are, for Royal Caribbean  $.05 / (.05 + .48) * 100\% = 9.5\%$ , and for P&O  $.05 / (.05 + .38) * 100\% = 11.5\%$ .

14 OFT, *Quantitative techniques in competition analysis*, Research Paper No.17 (October 1999).

15 *P&O Princess Cruises plc and Royal Caribbean Cruises Ltd*, Cm. 5536 (June 2002), para 5.6.

16 See n.12 above.

17 *FTC v Occidental Petroleum Corp*, 1996-1 Trade vs. (CCH) 67,071 (D.D.C. 1986).

were equivalent to approximately 875 million pounds of suspension homopolymer PVC resin and 45 million pounds of dispersion PVC resin in 1985.

Given these estimates the issue was whether foreign-produced PVC resin could be profitably sold in the United States. Evidence was produced from a number of customers that a sufficient number would purchase foreign-produced PVC resins if domestic-produced resin's price increased by 5 per cent. The analysis then considered whether foreign producers had the ability to respond. The evidence showed that they had excess capacity and that exports to other destinations could be diverted, enabling the potential supply of a quantity well in excess of the critical loss estimates. The District Court concluded that the United States was an inappropriately small geographic market for both types of PVC resin.

A more complete discussion of critical loss appears in *FTC/Tenet Healthcare Corp*<sup>18</sup> involving an attempt by the FTC to block a hospital merger in a small city with only the two merging hospitals. In its decision, the Court of Appeals defined: "[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." 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".

In *Tenet Healthcare* the defendants presented information that established a contribution margin of between 58 and 66 per cent, which indicated a critical loss between 7 and 8 per cent. Analysis of patient migration and hospital usage patterns established that the number of patients with alternatives to the marginal hospitals was well in excess of the required 8 per cent. The analysis included focused inquiries 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.

Critical loss analysis is not only a tool used by defendants wishing to expand an alleged market. In 2000, the FTC relied on a critical loss analysis to stop a proposed acquisition by Swedish Match of the loose leaf chewing tobacco business of National Tobacco Company.<sup>19</sup> The parties agreed that the critical loss associated with a 5 per cent price increase was only 7 to 8 per cent, but the FTC prevailed because it was able to establish that consumers would not substitute in sufficient numbers, even with this low critical loss, between loose leaf and moist snuff. Consequently, the relevant product market was found to be limited to loose leaf tobacco products.

The critical loss concept can also be used when price discrimination is a feature of the proposed market. In 2001, in *US v SunGard and Comdisco*,<sup>20</sup> a US District Court relied in part on critical loss analysis in a market with pervasive price discrimination, ruling against the US Department of Justice in concluding 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.

The US Merger Guidelines recognise 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. An analysis of computer disaster recovery services customers by industry, size, location and type of computer failed to identify any group that did not already include customers meeting their disaster recovery needs without using shared hot-site services. Consequently, all customers could credibly threaten to use these alternative services, which in turn meant that the appropriate antitrust market to evaluate the SunGard/Comdisco transaction needed to include the full range of alternatives already being used.

18 *FTC v Tenet Healthcare Corp* 186 F. 3d 1045 (Eight Circuit 1999).

19 *FTC v Swedish Match* 131 F. Supp. 2d 151 (D.D.C. 2001).  
20 *US v SunGard and Comdisco* 172 F. Supp. 2d 172, 182, 186-92 and n.21 (D.D.C. 2001).

## Collective dominance

Critical loss analysis can also be used to analyse market power issues. A critical loss estimate provides evidence when the exercise of market power has been or will be profitable. When sufficient alternatives exist, an attempted exercise of market power will not be profitable and, is therefore unlikely to be exercised and to harm competition.

One particularly important use is to assist in identifying collusive, cartel-like or collective dominance. Collective dominance in particular has become a confused area because of the European Commission's decision in *Airtours/First Choice*<sup>21</sup> which adopted a structural approach to collective dominance without the need to show a high likelihood of tacit collusion between the firms. On appeal the European Court of First Instance (CFI) annulled the decision, reinstating tacit collusion as an essential requirement.<sup>22</sup> The court said that the parties must be able to monitor the behaviour of the other firms adopting a common policy, which must be sustainable in the sense that "there must be an incentive not to depart from the common policy on the market", and there must be "adequate deterrence to ensure a long term incentive of the members not to depart from the common policy". In short, tacit collusion must be sustainable, and can be effectively monitored and effectively policed by its members. The CFI used particularly ferocious language attacking the Commission for its lack of empirical rigour, failure to examine the facts and poor analysis.

Critical loss analysis can assist in examining the conditions set out by the court. Firms in an oligopolistic market may be able to co-ordinate their activities (tacit collusion) but face two conflicting incentives. The first is that if they co-ordinate by reducing the quantity supplied to the market they can raise price and their profits. On the other hand each firm in the group has an incentive to cheat, since if it lowers its price while the others do not, it can increase its sales and profits. Significant cheating will undermine the ability to maintain "tacit collusion" and cause prices to fall to the competitive level.

A firm's incentive to cheat is significantly influenced by the contribution margin and thus the level of its individual critical loss. The extent of this incentive is measured by the level of sales an individual firm can afford to lose before the price increase becomes unprofitable. The calculation is identical to that for market

definition except the single firm must also consider any sales that would be lost to other firms in the provisional market. That is, in contemplating raising its price the member must take into account the sales lost to substitute products and the likelihood that other firms in the group will cheat by pricing below the agreed level. If a firm expects to lose more sales than the critical loss associated with its contribution margin, it will not adhere to the price agreement. Similarly, if a firm expects that cheating will increase sales by more than its critical loss, it will cheat on the price agreement.

The European Commission has, in common with other jurisdictions, sought to identify tacit collusion using a "checklist" of factors. For example, collusion is more likely when firms are of similar size, have similar cost structures, and face similar demand conditions. On the other hand, large infrequent transactions can have a constraining impact on the ability to co-ordinate activities. How large and infrequent can be determined using critical loss analysis as was shown in the 1990 case of *US v Baker Hughes*.<sup>23</sup> In that case the DoJ identified four suppliers of drilling rigs in the relevant product market. However, there were only a small number of drilling rigs sold each year. The critical loss formula showed that an attempt to hypothetically raise prices by 5 per cent in 1988 would have been unprofitable for most firms in the market if the firm lost only a single unit of sales. Under these circumstances joining a group attempting to exercise market power would have been very risky for each individual firm.

Differences in demand and costs also affect the likelihood of tacit collusion by causing some of the firms to lose more sales than their critical loss even though the group could collectively raise its profits. For example, suppose there are five firms in a well-defined market, two on the fringe facing stronger competition from those outside the group. The firms located on the fringe are more likely to lose sales in excess of their critical loss, and hence they have less incentive to join the group seeking to raise prices. Similarly, a firm with a higher contribution margin has a lower critical loss, and is less likely to participate in a group attempt to exercise market power.

## Concluding remarks

There is growing concern over the lack of rigour and factual analysis by the European Commission and national competition authorities when defining markets

21 *Airtours/First Choice* (2000/276/EC), September 22, 1999 [2000] O.J. L93/1; [2000] 5 C.M.L.R. 494.

22 Case T-342/99 *Airtours v Commission* [2002] 5 C.M.L.R. 7.

23 *US v Baker Hughes* 908 F.2d.981 (D.C. Cir. 1990).

and assessing market power. This has culminated in several recent successful appeals,<sup>24</sup> which have reiterated that competition authorities must maintain and satisfy

*24 Aberdeen Journals Ltd v Director General of Fair Trading and Aberdeen and District Independent Ltd (intervenor)* [2002] Comp.A.R. 1.

high evidentiary standards and burden of proofs. Critical loss analysis provides a simple technique which can add more rigour to the assessment of market definition and market power. It only requires data on price and average variable costs to determine how much substitution is needed for a product to be in its own relevant product market or a wider one.