Market Definition in Industries with Dynamic Demand

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1. Introduction

Competition authorities often employ the *hypothetical monopolist test* to evaluate whether groups of products in candidate markets are sufficiently broad to constitute relevant antitrust markets.[1] This paper focuses on young and growing industries where consumer demand is *dynamic* and firms engage in *penetration pricing*. It discusses the implications of dynamic demand and penetration pricing for market definition analysis and the hypothetical monopolist test.[2]

Industries with dynamic demand typically exhibit several key features. Firms supply relatively new products, earn relatively small contribution margins, and compete both within the industry and, at least to some degree, against firms that supply traditional products. For example, when Sirius and XM merged in 2008, satellite radio was a relatively new service. Sirius and XM were the only suppliers of satellite radio services, and neither company had ever earned a profit. They were competing against each other and also against traditional AM/FM radio stations.[3] In addition to these features, a driving competitive dynamic is a vision by the firms supplying the new products that the demand for their products is still very much in a growth phase and far from being saturated, with a very large "addressable market" which needs to be developed and grown into. Fostering growth (rather than maximizing short-term profits) is typically the main incentive for firms selling new products.

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[1] See, e.g., U.S. Department of Justice and the Federal Trade Commission, *Horizontal Merger Guidelines* (2010), section 4.1.1; European Commission, *Notice on the definition of relevant market for the purposes of Community competition law* (1997), paragraphs 15-18.

[2] The implications for competitive effects analysis of horizontal mergers are discussed briefly in the Appendix.

[3] Listeners had other choices beside AM/FM and satellite radio, such as iPods, mobile phones, and Internet radio. See Serge Moresi and Steven C. Salop, *Sirius-XM Satellite Radio Merger (2008)*, in: THE ANTITRUST REVOLUTION: ECONOMICS, COMPETITION, AND POLICY (2014).

In this type of industries, market definition can be an important and complex issue. Should the relevant antitrust market be limited to just the new products or should it be expanded to include traditional products? In the Sirius-XM case, if the proper relevant market were limited to satellite radio, then the merger would be a merger to monopoly and therefore likely to be found to be anticompetitive; if instead the market also included traditional AM/FM radio, then the merger would have a small effect on market concentration and thus would be more likely to be permitted. Market definition analysis however is more complex when demand is dynamic than in mature industries with static demand.

Another key feature of industries with dynamic demand is that firms engage in penetration pricing—that is, each firm has an incentive to price low to stimulate future demand from existing and future potential customers. Penetration pricing can explain the relatively low prices and small contribution margins observed in this type of industries. For example, the small margins of Sirius and XM could in principle be the result of cut-throat competition between the two firms, but they also could instead be explained by penetration pricing in a highly dynamic industry.

The presence of dynamic demand and penetration pricing has important implications for market definition and the hypothetical monopolist test. A proper market definition analysis must begin by asking *why* contribution margins are relatively low, sometime near zero or even negative. The analyst must review the available evidence (industry data, company documents, etc.) and determine whether margins are low because of intense competition or because the industry is still young and growing, and firms are seeking to expand into a larger addressable market.

Consequently, a properly conducted hypothetical monopolist test must consider the effects of a price increase on the industry dynamics and analyze inter-temporal substitution patterns, in addition to the standard, static ones. For example, a price increase by XM would have diverted some business to Sirius in the short term (the standard, static effect), but that might also have reduced the growth and expansion of the entire category (satellite radio) into the addressable market, and hence reduced the business of Sirius in the medium term and beyond. That is, while intra-temporally the new services offered by XM and Sirius were substitutes, inter-temporally they were complements.

In turn, this complementarity between current demand for new products and future demand mitigates the incentives of a hypothetical monopolist of the new products to raise prices. In fact, the standard presumption encountered in mature and static industries that the hypothetical monopolist would have an incentive to raise prices (the only question being by *how much*), does not exist here: the hypothetical monopolist may have an incentive to *reduce* prices because it internalizes the effect of low

current prices on future demand, and more so than the individual firms do. This is an essential consideration that competition authorities need to account for when defining relevant markets in young and growing industries. Failing to account for dynamic demand and penetration pricing tends to introduce a bias toward defining relevant markets that are too narrow.

Section 2 discusses dynamic demand and penetration pricing a bit further. Section 3 explains how to modify the hypothetical monopolist test (used by antitrust economists to define relevant markets) so that it accounts for dynamic demand and penetration pricing. The Appendix contains all the derivations, presents additional results, and briefly discusses the close relationship between market definition and competitive effects analysis of horizontal mergers.

2. Dynamic Demand and Penetration Pricing

In young and growing industries, firms generally expect that demand will grow faster in the future, if current prices are lower or current sales are higher. The faster growth occurs because increasing sales today or providing more value to customers today can be the first step toward converting non-users into future users: that is, demand is *dynamic*. By increasing its customer base and providing customers with more value, for example through price discounts and increased quality of service, each firm is effectively *investing* in its own growth as well as the growth of the market and the industry.[4]

Demand for new products is dynamic because increasing demand in the current period, say, through a price discount campaign, has a positive *spillover effect* on demand in future periods, even if the price discount campaign is short-lived. There are several factors that contribute to this positive relationship between current and future demand for new products.

Dynamic demand spillovers arise mainly as the result of the *information diffusion* process for new and growing products.[5] In particular, word-of-mouth diffusion of information from early adopters to potential adopters raises awareness for new products in the population of potential users. Word-of-mouth occurs when customers share information with one another about products or services. It

[4] Similarly, entry of a new firm can expand the market and benefit incumbent firms. See, e.g., Oren Reshef, *Smaller Slices of a Growing Pie: The Effects of Entry in Platform Markets*, Haas School of Business, UC Berkeley, mimeo (2019). This study considers competition between providers on the Yelp! Transactions Platform and finds that entry of new firms increases incumbent performance, especially for high-quality incumbents.

[5] See, e.g., Everett M. Rogers, DIFFUSION OF INNOVATIONS (1983).

includes online word-of-mouth, where one-to-many communication occurs via the Internet (e.g., in a Tweet, a Yelp review, a forum, or a blog).[6] In effect, current customers act as "marketing agents" on behalf of the firms that supply the new products. Offering low prices and high quality of service incentivizes customers to spread positive word-of-mouth to other potential customers.[7]

Dynamic demand spillovers also arise because of *consumer inertia or other switching costs*. Some consumers will be more willing to use new products in future periods if they begin to use them (or use them more often) in the current period. This effect also implies that future demand for new products will be increased if current sales rise.[8]

In this context, when a supplier of new products chooses the current prices for its products, it does not consider only its short-term profits, but instead it considers how its current prices will affect both its current and future profits. In other words, the supplier of new products does not maximize its current, static profits, but instead maximizes the net present value of its current and future profit streams. In a mature and static industry, it does not matter much whether the firms focus on the short-term or long-term profitability of a price change, because the two profitability measures are similar and largely independent of one another. However, in a young and growing industry where firms sell new products, a price reduction in the current period increases demand both in the current period and in future periods (even if the price reduction occurs only in the current period).

Such intertemporal and dynamic effects play the same role as a higher price elasticity of demand. That, in turn, provides each firm with an incentive to price low to stimulate future demand from existing customers and from future potential customers, a practice referred to in the marketing

[6] For a survey of the literature on word-of-mouth, see, e.g., Sarah Moore and Katherine Lafreniere, *How Online Word-of-Mouth Impacts Receivers*, CONSUMER PSYCHOLOGY REVIEW (2020).

[7] There are several factors that can motivate customers to use new products and spread word-of-mouth ("WOM") information about them among other potential customers. See, e.g., Daniel Belanche, Marta Flavián, and Alfredo Pérez-Rueda, *Mobile Apps Use and WOM in the Food Delivery Sector: The Role of Planned Behavior, Perceived Security and Customer Lifestyle Compatibility*, SUSTAINABILITY (2020).

[8] This consumer inertia could be psychological. It could involve habituation, as in the case of addictive substances, such as cigarettes. Alternatively, the inertia could arise if consumers must invest time or experience a product to learn their preferences or learn how to use it, as in the case of consumer software. In that latter type of situation, when the product wears out or is replaced by an upgrade, the consumer is more likely to purchase the product already being used. Again, this would lead to higher current sales driving higher future sales too.

literature as *penetration pricing*.[9] This is a key feature of many young and growing industries that can explain the relatively low contribution margins earned by the firms.

In industries with dynamic demand, firms earn variable contribution margins (that is, price net of variable costs) that are often small and sometime even negative. One can think of two possible explanations for such low margins. First, low margins may be the result of intense competition among the firms selling the products in the candidate market. If so, those products likely constitute a relevant antitrust market. Second, low margins may reflect the fact that the firms in the industry at hand obtain other, indirect benefits from not increasing prices. As discussed earlier, firms selling new products may be seeking to grow into a large addressable market, consisting of customers that are not currently using the new products. Because demand is dynamic, a price reduction increases demand and sales both in the current period and in future periods. When growing demand in the future at a fast pace is a main strategic objective, firms have an additional incentive to keep prices low, because low prices boost adoption of the new products and hence future sales. This penetration pricing strategy has important implications for market definition analysis and the hypothetical monopolist test. Failing to account for dynamic demand and penetration pricing tends to introduce a bias toward defining relevant markets that are too narrow.

3. Market Definition and the Hypothetical Monopolist Test

Consider a young and growing industry where firms supply new products (or services) and where consumer demand is dynamic. Firms compete against each other within the industry and, to some extent, also against other firms that supply traditional products. The key question is whether the relevant antitrust market should be limited to just the new products or should be expanded to include also traditional products.

For the relevant market to be limited to just the new products, the hypothetical monopolist test requires that a hypothetical profit-maximizing firm, not subject to price regulation, that was the only present and future seller of those products ("hypothetical monopolist") likely would impose at least a

[9] Penetration pricing is a pricing strategy where the price of a product is initially set low to reach rapidly a wide fraction of the market and initiate WOM. *See, e.g.*, Joel Dean, *Pricing Policies for New Products*, HARVARD BUSINESS REVIEW (1976).

small but significant and non-transitory increase in price ("SSNIP") on those products.[10] Accordingly, if a hypothetical monopolist of the new products would raise prices by *less* than the SSNIP threshold (typically, 5% or 10%), then the products outside the candidate market—which include the traditional products and other outside goods—exert a sufficiently strong constraint on the hypothetical monopolist, and hence the relevant market should be broadened to include one or more of the traditional products. Conversely, if the hypothetical monopolist would raise prices by more than the SSNIP threshold, then traditional products and other outside goods do not exert a sufficiently strong constraint, and hence the new products alone constitute a relevant market for antitrust purposes.

In the standard case of a mature industry with static demand, when the products under the umbrella of the hypothetical monopolist are substitutes to one another, there is a presumption that the hypothetical monopolist would find it profit-maximizing to increase prices by at least a small amount. This is because the hypothetical monopolist internalizes the fact that a fraction of the sales of any one product that will be lost following a price increase of that product will be recaptured by other products under the umbrella of the hypothetical monopolist. Hence, a small price increase that would be unprofitable from the perspective of each individual firm becomes profitable from the perspective of the hypothetical monopolist. Because a small price increase is always profitable in the standard case, the hypothetical monopolist test turns into whether that small price increase is significant (typically, more than 5% or 10%) or not significant.

When demand is dynamic, however, the hypothetical monopolist will internalize an additional offsetting effect. When that additional effect is present, it will mitigate the hypothetical monopolist's incentive to impose a SSNIP. In fact, if that effect is sufficiently pronounced, no price increase is profitable and thus the hypothetical monopolist would actually *reduce* (not raise) prices.

This point can be explained as follows. When demand is dynamic, the hypothetical monopolist of the new products needs to consider how a price increase on one of the new products will affect the demand for the other new products, both in the current period and in future periods. The price increase generally leads to an increase in the demand for the other products in the current period, because the products are substitutes within the current period. However, the price increase of one of the new

[10] For simplicity, the analysis here assumes a uniform SSNIP, i.e., the same percentage price increase is imposed on each product in the candidate market. For a discussion of asymmetric SSNIPs (with static demand), see, e.g., Serge Moresi, Steven C. Salop, and John R. Woodbury, *Market Definition in Merger Analysis*, in: ANTITRUST ECONOMICS FOR LAWYERS (2017).

products can lead to a reduction in the demand for the other new products in future periods. This is because the price increase will slow down that product's growth into the addressable market and reduce generally the amount of positive word-of-mouth (WOM), and thus slow down the overall market expansion, which indirectly may also slow down the growth of the other new products into the addressable market.

For instance, this may occur if there are strong WOM effects or demonstration effects. Consumers who are already using one of the new products may praise and recommend to their friends and acquaintances that one product in particular or, more generally, all the new products as being a better deal than traditional products. Their friends may then decide to try that new product or some other one. Such WOM effects are stronger and more effective if the firms supplying the new products offer low prices and high quality. Similarly, consumers who are not currently using the new products may indirectly learn about the benefits from using the new products, simply by observing increased usage by others. In this case, existing users effectively act as "advertising agents" for the new products.

These WOM and demonstration effects may operate within a single brand and across brands. WOM and demonstration effects within a single brand refer to cases where, for example, a user of brand A advertises brand A to other potential users, thus increasing the future demand for brand A. WOM and demonstration effects across brands refer to cases where a user of brand A advertises the new products in general, thereby increasing the future demand for all the brands; or advertises brand A but, as users churn, this again increases (albeit indirectly) the future demand for all brands of the new products.

These across-brand effects, whereby a lower price of a new product (brand A) increases the future demand for other new products (brand B, etc.) are *dynamic external spillover effects*.[11] They are different from dynamic *internal* spillover effects, whereby a lower price of brand A boosts the future demand for brand A. While the individual firms internalize only dynamic internal spillover effects, the hypothetical monopolist also internalizes the external effects. For example, the firm selling brand A

[11] A recent study shows evidence of dynamic external spillover effects in the video game industry. Avery Haviv, Yufeng Huang, and Nan Li, *Intertemporal Demand Spillover Effects on Video Game Platforms*, MANAGEMENT SCIENCE (2020). While most studies focus on indirect network effects through platform expansion, this article focuses on complementarity on the same side of the platform. It studies how the presence and sales of video games expand consumer demand in the next period, thus creating a positive spillover effect to competing products. The study suggests this demand spillover effect is reminiscent of habit formation on the consumer side.

does not internalize the fact that a lower price of brand A may boost the future demand for brand B, brand C, etc. However, the hypothetical monopolist would.[12] For this reason, the hypothetical monopolist will have an additional incentive to lower prices relative to the individual firms.

To summarize, with dynamic demand spillovers, there is not an automatic presumption that a hypothetical monopolist of the new products would find it profit-maximizing to impose even a small price increase. Instead, the hypothetical monopolist may find it profit-maximizing to decrease prices. In any event, ignoring the presence of dynamic demand spillovers tends to overstate the profitability of a SSNIP and hence to bias the market definition exercise towards defining markets that are too narrow.

Section 3.1 discusses the original SSNIP test of Harris and Simons.[13] It explains that their test is based on static demand and that it is biased toward defining relevant markets that are too narrow. It also explains how to modify the test to account for dynamic demand and eliminate the bias. Section 3.2 is very similar, except that it discusses the more recent SSNIP test of Katz and Shapiro, and O'Brien and Wickelgren (KSOW).[14]

3.1 Original SSNIP Test

The SSNIP test of Harris and Simons can be modified to account for dynamic demand effects as follows:[15]

$$\textbf{Critical Loss} = (S - G) / (M + S)$$

where S denotes the SSNIP threshold (e.g., 10%), M denotes the percentage margin, and G denotes the loss in future profits (expressed as a percentage of current revenue) that would occur as a result of the SSNIP in the current period. When demand is not dynamic, G = 0 and the above formula reduces to the original critical loss formula of Harris and Simons.

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[12] If brand A and brand B were to merge, the merged firm would also internalize a similar dynamic external spillover effect. For this reason, the logic set out here also matters for unilateral competitive effects analysis.

[13] Barry C. Harris and Joseph J. Simons, *Focusing Market Definition: How Much Substitution is Necessary?* RESEARCH IN LAW AND ECONOMICS (1989).

[14] Michael Katz and Carl Shapiro, *Critical Loss: Let's Tell the Whole Story*, ANTITRUST (2003); Daniel O'Brien and Abraham Wickelgren, *A Critical Analysis of Critical Loss Analysis*, ANTITRUST LAW JOURNAL (2003).

[15] The derivation is explained in the Appendix. For simplicity, I assume that the firms supplying the new products earn the same percentage margin. The test can be extended to the case where each firm earns a different margin.

For example, suppose the SSNIP threshold is S=10% and the margin is M=5%. Then, if one ignores dynamic demand effects and thus sets G=0, the critical loss is equal to 67%.[16] Accordingly, in this example, one would conclude that the new products constitute a relevant market if a 10% price increase of the new products would reduce the current sales of the new products by less than 67%. Suppose however that the loss in future profits of the new products (due to a 10% price increase in the current period) is G=8% of current revenues. Then, the critical loss is equal to 20%.[17] Accordingly, in this example, the correct SSNIP test implies that the new products do *not* constitute a relevant market if a 10% price increase of the new products would reduce their current sales by *more* than 20%. To see the bias and potential error that can occur if one ignores dynamic demand effects, suppose that there is empirical evidence that a 10% price increase of the new products would lead to a likely reduction in their current sales of 30%. Since 30% is less than 67%, ignoring dynamic demand effects would lead to the conclusion that the new products constitute a relevant market. However, since 30% is more than 20%, accounting for dynamic demand would instead lead to the conclusion that the new products do not constitute a relevant market, which is the correct conclusion in this example.

3.2 More Recent SSNIP Test

The more recent SSNIP test of KSOW also ignores dynamic demand effects and tends to be biased toward finding a narrow market. To eliminate the bias, one should use the following formula for the critical aggregate diversion ratio:

Critical Aggregate Diversion Ratio = (S + X) / (M + S)

where again S denotes the SSNIP threshold and M denotes the percentage margin. Here, X denotes the *dynamic external spillover effect* and is measured as follows. Suppose that one of the firms supplying the new products were to increase price unilaterally in the current period. The external spillover effect, X, is the amount of future profits lost by the other suppliers of new products, expressed as a percentage of current revenue. When demand is not dynamic, X = 0 and the above formula reduces to the standard critical aggregate diversion ratio formula of KSOW.

For example, suppose again that the SSNIP threshold is S=10% and the margin is M=5%. Then, if one ignores dynamic demand effects and thus sets X=0, the critical aggregate diversion ratio is equal to

[16] That is, 10/(5 + 10) = 67%.

[17] That is, (10 – 7)/(5 + 10) = 20%.

67%.[18] Accordingly, in this example, one would conclude that the new products constitute a relevant market if the aggregate diversion ratio from a new product to the other new products is higher than 67% or, equivalently, if the diversion ratio to traditional products and other outside goods is smaller than 33%.[19] Suppose however that the dynamic external spillover effect is X=4% of a firm's current revenue. Then, the critical aggregate diversion ratio is equal to 93%.[20] Accordingly, in this example, the correct SSNIP test implies that new products do *not* constitute a relevant market if the diversion ratio to traditional products and other outside goods is higher than 7%.[21] As with the original SSNIP test, ignoring dynamic demand effects can lead to an incorrect relevant market. To illustrate, suppose that there is evidence that the diversion ratio from a new product to the traditional products is 15%. Since 15% is less than 33%, ignoring dynamic demand effects would lead to the conclusion that the new products constitute a relevant market. However, since 15% is more than 7%, accounting for dynamic demand would instead lead to the conclusion that the new products do not constitute a relevant market, which is the correct conclusion in this example.

Appendix

[18] That is, 10/(5 + 10) = 67%.

[19] That is, 100 – 67 = 33.

[20] That is, (10 + 4) / (5 + 10) = 93%.

[21] That is, 100 – 93 = 7.

The Appendix shows the derivation of the modified SSNIP tests. In addition, it recasts the SSNIP tests into the corresponding implied profit-maximizing SSNIPs, which are useful when estimates of the aggregate elasticity or aggregate diversion ratio are available. The Appendix also briefly discusses the close relationship between competitive effects analysis and the KSOW approach to market definition.

1. Derivation of the SSNIP Tests

For simplicity, assume that the firms in the candidate market are symmetric and single-product firms. The question is whether the products sold by those firms constitute a relevant antitrust market.

a. Original SSNIP test (Harris and Simons)

Consider first the original SSNIP test of Harris and Simons, when demand is static.[22] The products in the candidate market constitute a relevant market if $L < S / (M + S)$, where S denotes the SSNIP threshold (e.g., 10%) and M denotes the percentage margin; the expression $S / (M + S)$ is the *critical* loss of output for the SSNIP to be just profitable, while L denotes the *actual* loss of output that would occur if the prices of the products in the candidate market increased by the SSNIP. Both the critical loss and actual loss are expressed in percentage terms.

Proof: With no loss of generality, assume that total output of the products in the candidate market is equal to 1 and their price is equal to 1. Total profits are equal to M before the SSNIP and $(M + S)(1 – L)$ after the SSNIP. Thus, the SSNIP is profitable if $M < (M + S)(1 – L)$ or equivalently if $L < S / (M + S)$. ■

If one assumes linear demand, one can calculate the profit-maximizing SSNIP that the hypothetical monopolist would choose:

Profit-maximizing SSNIP = (1/E – M) / 2

where E is the group elasticity (in absolute value) of the total demand for the products in the candidate market with respect to a uniform price increase of those products.

Proof: With linear demand, L = SE, Thus, the break-even SSNIP is the solution of SE = S/(M + S), that is, S = 1/E – M. With linear demand, the profit-maximizing SSNIP is one-half of the break-even SSNIP. ■

[22] See *supra* note 13.

For example, if M = 5% and E = 2, then the profit-maximizing SSNIP is 22.5%,[23] and thus the analyst would conclude that the products in the candidate market constitute a relevant market.

Suppose now that the products in the candidate market are new products and the analyst accounts for dynamic demand effects. The new products constitute a relevant market if $L < (S - G) / (M + S)$, where G denotes the loss in future profits (expressed as a percentage of current revenues) that is caused by a SSNIP in the current period.

Proof: Using the same normalization as before, the total profits of the new products are equal to M + F, where M and F denote the profits obtained in the current period and future periods, respectively (in net present value). After a SSNIP in the current period, their profits are equal to $(M + S)(1 - L)$ in the current period, plus $(1 - L')F$ in future periods, where L' denotes the fraction of future profits lost as a result of the SSNIP in the current period (holding prices in future periods constant). Thus, the SSNIP increases their total profits if $M + F < (M + S)(1 - L) + (1-L')F$ or equivalently if $L < (S - G)/(M + S)$, where $G = FL'$.■

Again, it is convenient to assume linear demand and estimate the profit-maximizing SSNIP that the hypothetical monopolist would choose:

$$\textbf{Profit-maximizing SSNIP} = [(1-g)/E - M]/2$$

where g = G/S is the loss in future profits caused by a 1% price increase in the current period.[24]

Proof: With linear demand, L = SE and thus the break-even SSNIP is the solution of $SE = (1 - g)S / (M + S)$, that is, $S = (1-g)/E - M$. The profit-maximizing SSNIP is one-half of the break-even SSNIP.■

Consider again the above example with M = 5% and E = 2, where the profit-maximizing SSNIP is 22.5% if one ignores dynamic demand effects. Suppose that a 10% SSNIP in the current period would cause a loss in future profits equal to 8% of current revenue, that is, S = 0.1, G = 0.08, and hence g = G/S = 0.8. Then, the profit-maximizing SSNIP is equal to 2.5%,[25] and thus the analyst would conclude that the new products do *not* constitute a relevant market (assuming a typical SSNIP threshold of 5%).

[23] That is, $(1/2 - 0.05) / 2 = 0.225$.

[24] I am implicitly assuming that G = gS where g is a constant. When demand is not dynamic, g = 0.

[25] That is, $((1-0.8)/2 - 0.05) / 2 = 0.025$.

b. More Recent SSNIP Test (Katz and Shapiro, O'Brien and Wickelgren)

Consider now the more recent SSNIP test developed by KSOW when demand is static.[26] The main difference with respect to the original SSNIP test discussed in the previous section is that KSOW assume that firms engage in Bertrand price competition with differentiated products and no binding capacity constraints, which allows them to use information contained in the firms' contribution margin, M.

Assuming linear demand, the new products constitute a relevant market if $A > S / (M + S)$, where A denotes the aggregate diversion ratio from any product in the candidate market to the other products in the candidate market.

Proof: With no loss of generality, assume that the output of each product in the candidate market is equal to 1 and its price is equal to 1. Suppose the price of all the products in the candidate market increases by a SSNIP. It is convenient to trace out the effects of a single price increase on the combined total profits of all the products in the candidate market, because the effects of the other price increases are identical since demand is linear. By raising price, a firm loses S/M units, where 1/M is the own-price elasticity, while the other firms recapture AS/M units. Thus, since all firms in the candidate market raise price, each firm loses a total of $(1 – A)S / M$ units, which corresponds to a profit reduction of $(1-A)S$ dollars. However, each firm gains S dollars on each of the $1 – (1 – A)S/M$ units that it does not lose, which corresponds to a profit increase of $[1 – (1 – A)S/M]S$ dollars. It follows that the SSNIP is profitable on balance if $(1 – A)S < [1 – (1 – A)S/M]S$ or equivalently if $A > S / (M+S)$. ■

As before, it is convenient to calculate the profit-maximizing SSNIP that the hypothetical monopolist would choose:

Profit-maximizing SSNIP = AM / [2 (1 – A)]

Proof: The break-even SSNIP is the solution of the equation $A = S / (M+S)$, that is, $S = AM/(1 – A)$, and the profit-maximizing SSNIP is one-half of the break-even SSNIP. ■

For example, if M = 5% and A = 90%, then the profit-maximizing SSNIP is 22.5%,[27] and thus the analyst would conclude that the candidate market is a relevant antitrust market.

[26] See *supra* note 14.

[27] That is, 0.9 x 0.05 / (2 x (1 - 0.9)) = 0.225.

Suppose now that the products in the candidate market are new products and the analyst accounts for dynamic demand effects. The new products constitute a relevant market if $A > (S + X) / (M + S)$, where X denotes the external spillover effect—that is, the future profits lost by the other suppliers of new products following a price increase of S by one of the suppliers (expressed as a percentage of a firm's current revenue).

Proof: Let us adopt the same normalization as before, assume that all suppliers of the new products raise price by a SSNIP in the current period, and trace out the effects of one of those price increases. By raising price in the current period, a firm loses S/(M+V) units in the current period, where V denotes the internal spillover effect and 1/(M+V) is the own-price elasticity of the firm's current sales with respect to the firm's current price.[28] That corresponds to a profit reduction of MS/(M+V) dollars in the current period, but the firm earns S additional dollars on each of the 1 - S/(M+V) units that it does not lose. In future periods, the firm incurs a profit reduction of VS/(M+V) dollars (in net present value) and thus the total profit reduction for that firm is equal to $S^2/(M+V)$.[29] The other suppliers of new products recapture a total of AS/(M+V) units in the current period, which corresponds to a profit increase of AS(M+S)/(M+V) dollars. However, in future periods, these other suppliers incur a profit reduction of XS/(M+V) dollars, where X denotes the dynamic external spillover effect. Thus, the net total profit increase obtained by the other suppliers of new products is equal to AS(M+S)/(M+V) – XS/(M+V). The SSNIP is profitable if $S^2/(M+V) < AS(M+S)/(M+V) – XS/(M+V)$ or equivalently if $A > (S + X) / (M + S)$.■

As before, it is convenient to calculate the profit-maximizing SSNIP of the hypothetical monopolist:

Profit-maximizing SSNIP = AM / [2 (1 – A + x)]

where x = X/S is the reduction in future profits of other suppliers of new products when a supplier of new products raises price by 1% in the current period.[30]

Proof: The break-even SSNIP is the solution of $A = (1 + x)S/(M + S)$, that is, $S = AM / (1 – A + x)$, and the profit-maximizing SSNIP is one-half of the break-even SSNIP.■

[28] The margin M + V is the "dynamic margin" in the sense that an additional sale in the current period generates a margin M in the current period and a margin V (in net present value) in future periods.

[29] That is, $MS/(M+V) – [1 - S/(M+V)]S + VS/(M+V) = S^2/(M+V)$.

[30] I am implicitly assuming that X = xS where x is a constant. When demand is not dynamic, x = 0.

Consider again the above example with M = 5% and A = 90%, where the profit-maximizing SSNIP is 22.5% if one ignores dynamic demand effects. Suppose that if a supplier of the new products raises price by 10% in the current period then the other suppliers of the new products would incur a reduction in their total future profits equal to 6% of a firm's current revenue, that is, S = 0.1, X = 0.06, and therefore x = X/S = 0.6. Then, the profit-maximizing SSNIP is equal to about 3.2%,[31] and thus the analyst would conclude that the new products do *not* constitute a relevant market (assuming a typical SSNIP threshold of 5% or higher).

Finally, the KSOW approach to critical loss analysis can be applied not only to market definition but also to competitive effects analysis of horizontal mergers when firms engage in Bertrand price competition. Indeed, one can calculate the profit-maximizing SSNIP for a "candidate market" that would comprise only the products of the two merging firms. That amounts to replacing the aggregate diversion ratio, A, with the diversion ratio between the merging firms, say, D < A, and replacing the total dynamic external spillover ratio, x, with the dynamic external spillover ratio to the merger partner only, say, z < x. Under these and the other assumptions used above, the profit-maximizing price increase of the merged firm is equal to DM/[2 (1 – D + z)].

[31] That is, 0.9 x 0.05 / (2 x (1 - 0.9 + 0.6)) = 0.032 (after rounding).