SSNIP: How Small is Small But Significant?

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2 Introduction

Merger cases and abuse of dominance cases make up a large part of the work done by the Competition Bureau in Canada and the Department of Justice in the United States. The courts deciding these cases need to know the potential effects of a proposed merger or the current effects of a firm's actions. If it is possible to obtain good data about the case, a simulation can be performed to predict the effects of the merger or estimate the effects of a firm's actions. Unfortunately, most of the time it is not possible to find such data and, not only that, courts might find this approach to be confusing. As a result, it is often necessary to attempt to define the relevant antitrust market and then discuss the market power of the firm or firms in question.

Market delineation is therefore an important issue in both abuse of dominance cases and merger cases. Before the Competition Bureau or the Antitrust Division of the Department of Justice can start to analyze the potential effects of a merger, it must be determined whether the products concerned make up the entire market or only a small portion of it. Before the Competition Bureau or the Antitrust Division of the Department of Justice can start to analyze whether a firm is abusing its dominance, it must be determined whether the firm is dominant in the first place, and to do so requires market definition. An incorrect assessment of the size of the market can lead to the inefficiencies that result from allowing a merger that is anti-competitive or blocking a merger that would result in efficiencies of scale and scope. In abuse of dominance cases, an incorrect assessment of the size of the market can lead to an inefficient division of the firm into smaller pieces or it can lead to allowing a firm to stay intact despite large monopoly inefficiencies. Clearly, it is essential that the market be correctly defined.

A widely-used method of defining a market is the Hypothetical Monopolist Test. In performing this test, one begins with a narrow market—say, a single product or

a small geographic region. One then asks whether a firm with a monopoly in that market would find it profitable to raise prices a small amount and whether that price increase would be lasting. This idea is often referred to as a Small but Significant and Non-transitory Increase in Price (or SSNIP). If the monopolist would find it profitable to raise prices a small but significant amount, then the market is defined to be that single product or small geographic region. If on the other hand, the monopolist would not find it profitable to raise prices or the price increase would be non-transitory, then the market is widened by adding a second product or increasing the size of the geographic region and the test is performed again. This process is repeated until a market is found that is large enough that the monopolist would find it profitable to employ an SSNIP. This, then, is the relevant antitrust market.

The Hypothetical Monopolist Test and the SSNIP are very useful concepts in antitrust law enforcement. They help to minimize the amount of time spent in court arguing over the definition of the relevant market. However, they do have some drawbacks. For instance, the term "small but significant" is unspecific and confusing, and so is the term "non-transitory." It is unclear how big the price increase should be and how long it should last in order to be considered non-transitory. Common practice sets the required increase in price at five percent and the duration of the increase at one year. [9] It is unclear, however, that this five percent is the "correct" value for the required increase. How do we know that a 10 percent value would not be more effective? Could a 10 percent value ever result in defining a different market? Could this difference in market size affect an antitrust ruling and could this ruling be wrong due to using five percent instead of 10 percent? Does the type of demand system change these results? It is these questions that this paper seeks to address.

The next section reviews the previous literature on the subject of the hypothetical monopolist test, as well as the laws and guidelines in both Canada and the United States concerning market delineation and the hypothetical monopolist

test in particular. Following that, the methods used in this analysis are outlined. The analysis is broken into two main parts: linear demand systems and constant elasticity demand systems. Linear demand systems and constant elasticity demand systems are further separated into i) a simulation that tests whether different values for the SSNIP could result in different definitions of the market and ii) a simulation that tests whether different definitions of the market could result in an inefficient ruling. The next section provides relevant results from the simulations outlined in the methods section. Finally, the conclusion sums up what has been learned and provides suggestions for further topics of study.

3 Literature Review and Case Histories

3.1 Previous Cases

There have been several widely-publicized antitrust cases that hinged on market delineation. Perhaps the most famous case occurred in 1947 when the U.S. Department of Justice brought a monopolization case against DuPont. The Department of Justice argued that DuPont had a monopoly on cellophane because DuPont possessed a patent that protected their position as the sole domestic supplier of the product. Due to high tariffs, foreign suppliers were unable to compete. As a result, they were responsible for less than one percent of total sales. When the original patent expired, DuPont obtained a patent for a new product: moisture-proof cellophane. DuPont then cross-licensed with its only domestic competitor. Despite all these strong signals that DuPont was in a dominant position, the Department of Justice lost the monopolization case. The reason that the DOJ lost is known today as the Cellophane Fallacy. The Supreme Court stated in its ruling:

> The 'market' which one must study to determine when a producer has

> monopoly power will vary with the part of commerce under consideration. The tests are constant. That market is composed of products that have reasonable interchangeability for the purposes for which they are produced—price, use and qualities considered. While the application of the tests remain uncertain, it seems to us that du Pont should not be found to monopolize cellophane when that product has the competition and interchangeability with other wrappings that this record shows. [1]

The trouble with this ruling is that there is more than one possible explanation for the numerous substitutes available. The Supreme Court could have been correct in its assumption that the relevant market did in fact include many products, but it is also possible that the market was monopolized, resulting in a price on the elastic portion of the demand curve. In the presence of a high price, many products that would not be seen as good substitutes at a competitive price might be seen as reasonable substitutes. Most antitrust scholars today believe that the second explanation is the correct one and that the Supreme Court made a mistake. The example of the cellophane case illustrates how important market delineation can be to the final decision of an antitrust case. More importantly, it shows how hazardous it can be to define the market incorrectly.

In 1992, the Canadian Competition Commissioner brought a case against Southam Inc. under the merger sections of the Competition Act, due to a recent purchase of 11 community newspapers and one real estate publication. The Commissioner sought to force Southam to divest itself of two of the community newspapers as well as the real estate publication. The argument was that since Southam already owned two daily newspapers in the area, the latest acquisition would substantially lessen competition in the market for retail newsprint advertising. In reviewing the case, the Competition Tribunal needed to determine whether the market consisted of just community newspapers or whether it included daily newspapers as well. Southam argued that if community newspapers and daily newspapers were included in a single market, then other types of advertising (such as radio and television) should be included as well. The Tribunal was unable to obtain cross-elasticities as evidence of

substitutability due to the practical difficulty of measuring such a thing. Instead, they had to use indirect evidence such as buyer behavior. Using this evidence, they ruled that community newspapers were not in the same market as daily newspapers and, as a result, the acquisition of the two community newspapers did not substantially lessen competition. This ruling was appealed by the Commissioner on the grounds that the Tribunal had not followed its procedure for determining the market. In response the court stated:

> Products [are] in the same market if they are close substitutes. In turn, products are close substitutes if buyers are willing to switch from one product to another in response to a relative change in price ... Direct evidence of substitutability includes both statistical evidence of buyer price sensitivity and anecdotal evidence, such as the testimony of buyers on past or hypothetical responses to price changes. However, since direct evidence may be difficult to obtain, it is also possible to measure substitutability and thereby infer price sensitivity through indirect means. Such indirect evidence focuses on certain practical *indicia*, such as functional interchangeability and industry views/behaviour, to show that products are close substitutes. [11]

It is worth noting that the court did not explain the appropriate magnitudes of the relative change in price and lost sales. The Southam case is a good example of the difficulties involved in market definition.

The Canadian Director of Investigation and Research brought a case against Nielsen[1] in 1996 under section 79 (abuse of dominance) of the Competition Act. An interesting aspect of this case is that there were two markets in question. There was the upstream market for raw supermarket scanner data, and the downstream market for the information from processed scanner data. Nielsen argued that competition in the market for raw scanner data was fierce, but the Tribunal accepted the Director's assertion that the relevant market was in fact the downstream market and ruled that this was a well-defined market. Thanks in part to this definition of the market, the

[1] D&B Companies of Canada Ltd.

Tribunal ruled in favor of the Director of Investigation. [12]

A high-profile case occurred in 1997 when the Federal Trade Commission disputed the proposed merger between the office superstore chains Staples and Office Depot. The FTC argued that the market consisted of office supplies from office superstores, whereas Staples and Office Depot argued that the relevant market was the market for all office supplies. At the time of the case, office superstores were responsible for only six percent of total sales of office supplies. Thus, if the market was defined to be the market for all office supplies, the case would very likely be dismissed. However, there were only three office superstores[2] in that six percent. Consequently, if the market was defined as the market for office supplies from superstores, the merger would probably be blocked. Thanks to the availability of large amounts of data, the FTC was able analyze price differences between towns with one, two or all three types of office superstore. Their analysis found that towns with only one type of office superstore exhibited prices well over 5 percent higher than towns with three types of office superstores. The FTC also carried out an economic simulation and found that a merger to monopoly in the market for office supplies from superstores would raise prices by 8.49 percent. [2] This value satisfies the hypothetical monopolist test if the SSNIP uses a five percent increase but not if it uses a ten percent increase. The FTC used the five percent value for the SSNIP and the court accepted that the correct definition of the market was the market for office supplies from superstores. As a result, the merger was blocked.

These four cases illustrate some of the difficulties encountered when trying to define a market. They also clearly show how very important the definition of the market can be. Often, the outcome of a case may hinge on the definition of the market and, as can be seen from these cases, the authorities haven't always gotten it right.

[2]Staples, Office Depot and OfficeMax

3.2 Past and Current Law

In 1982, the United States Department of Justice released the first set of guidelines to suggest the use of the hypothetical monopolist test in market delineation.[3] Prior to the 1982 guidelines, the method for market definition was vague and confusing. The 1968 merger guidelines [8] state that:

> A market is any grouping of sales (or other commercial transactions) in which each of the firms whose sales are included enjoys some advantage in competing with those firms whose sales are not included. The advantage need not be great, for so long as it is significant it defines an area of effective competition among the included sellers in which the competition of the excluded sellers is, ex hypothesi, less effective. The process of market definition may result in identification of several appropriate markets in which to test the probable competitive effects of a particular merger.

It is easy to see that this definition would in practice be very difficult to implement.

The 1982 Guidelines [9] improved this definition as follows:

> In general, the Department will include in the product market a group of products such that a hypothetical firm that was the only present and future seller of those products (a 'monopolist') could profitably impose a 'small but significant and nontransitory' increase in price. That is, assuming that buyers could respond to an increase in price for a tentatively identified product group only by shifting to other products, what would happen? If readily available alternatives were, in the aggregate, sufficiently attractive to enough buyers, an attempt to raise price would not prove profitable, and the tentatively identified product group would prove to be too narrow.

This definition is much more useful than the one in the 1968 Guidelines due to the fact that it is a step-by-step procedure that can be understood by both economists

[3] These guidelines were revised slightly in 1984 and as a result the guidelines referenced here will be the 1984 Guidelines.

and lawyers. The 1982 Guidelines also state that:

> In attempting to determine objectively the effect of a 'small but significant and nontransitory' increase in price, the Department in most contexts will use a price increase of five percent lasting one year. However, what constitutes a 'small but significant and non-transitory' increase in price will depend on the nature of the industry, and the Department at times may use a price increase that is larger or smaller than five percent.

This section of the Guidelines specifies the magnitude of the increase in price required, but the Guidelines do not explain why five percent was chosen as the deciding price increase. They also concede that the five percent value is not rigid but, when they state that at times they will use an increase that is larger or smaller than five percent, the reference is to a relatively uncommon situation.[4]

The Competition Bureau in Canada uses the hypothetical monopolist test as well. The Merger Enforcement Guidelines updated in 2004 [7] outline the hypothetical monopolist test in much the same way as do the 1982 Department of Justice Guidelines. They too specify a five percent increase in price without providing a reason for the choice. Like the Department of Justice Guidelines, the Competition Bureau Guidelines allow the use of a different size price increase for unspecified special circumstances.

The European Commission's approach to market definition is similar to that of the United States and Canada. A notice released in 1997 by the European Commission on the definition of the relevant market states:

> The question to be answered is whether the parties' customers would switch to readily available substitutes or to suppliers located elsewhere in response to a hypothetical small (in the range 5 % to 10 %) but permanent relative price increase in the products and areas being considered. [3]

[4]The example that they give is of a price increase on a tariff or commission.

Notable differences between this definition and that of the United States is the fact that the European Commission's definition states that the price increase must be in the range of five percent to ten percent, and it defines non-transitory as permanent. These differences might cause difficulties during a case, as it may be more difficult to prove a permanent price increase and there may be disagreements about the exact magnitude of the price increase required.

The current guidelines from three different competition regulators all agree that the hypothetical monopolist test is the best method available with which to define a market. They also all agree on a value for the SSNIP that is around five percent, but none of them explain why the value was chosen. Clearly, the hypothetical monopolist test is an improvement over the previous methods, but it is not without its own drawbacks.

3.3 Literature Concerning SSNIP

Ten years after the 1982 Merger Guidelines were released, Gregory Werden, one of the authors of the Guidelines, conducted an analysis of the performance of the new market definition techniques during the previous ten years. [13] He asserts that the test has been quite successful and influential despite the fact that it was criticized almost as much as it was praised. He states that:

> Market shares never tell the whole story and must be supplemented with other information. Nevertheless, a structural merger policy—built on market delineation and market shares— finds support in economic theory and empirical research, and, in industries with relatively undifferentiated products, a structural approach to mergers is probably the best we can do given our current state of knowledge.

Werden also discusses the five percent value of the SSNIP. He mentions that in the rare case where a merger would be a merger to monopoly using a four percent SSNIP

but would not significantly reduce competition if a five percent SSNIP were used, then the Department of Justice will use the four percent SSNIP.

Werden addresses concerns that a five percent SSNIP allows too much market power by pointing out that a reduction in SSNIP might in fact transform some horizontal mergers into non-horizontal mergers which would not be contested at all. Imagine, for instance, that a potential "market" (not yet defined to be an antitrust market) consists of three products produced by three separate firms. Firms one and three propose a merger which would clearly be anti-competitive as long as the market is large enough to include both product one and three. A small SSNIP might define the market to include only products one and two. This definition of the market would be taken to imply that the merger will create no additional market power and thus would be allowed.

James F. Rill, Assistant Attorney General of the U.S. Department of Justice Antitrust Division from 1989 to 1992, gave an interview that was printed in the Antitrust Law Journal. [10] In the interview, he addresses some issues to do with the five percent test. He explains:

> While we will normally use five percent as our yardstick standard and we will not arbitrarily deviate from this standard, there are some circumstances in which we will depart from the use of the five percent figure. [...] There is no magic to five percent. Should it be the case that [three firms] together constitute the relevant market under say a seven percent test, then we would certainly be open to analyzing the merger as horizontal, while seeking confirmation from business evidence that the [firms] do compete head on for a significant amount of business.

Rill asserts that the Department of Justice does not rigidly adhere to the five percent test. Instead, the department judges each case on its own merits. Rill denies that this flexibility results in gerrymandered market definitions. This flexibility in the value of the SSNIP can be both an asset and a liability in that there is less chance

of a wrong decision due to rigid adherence to guidelines but, at the same time, there is greater leeway for the prosecution to unfairly influence the case.

Katz and Shapiro [5] discuss a variation on how to perform the hypothetical monopolist test called critical loss analysis. They explain:

> As a matter of arithmetic, the effect of a SSNIP on the hypothetical monopolist's profits depends upon the prevailing profit margin earned on each unit sold and on the percentage of unit sales that would be lost as a result of the price increase. We call the latter the 'actual loss.' The maximal percentage of unit sales that can be lost for the price increase to be profitable is know as the 'critical loss.' If the actual loss from a price increase would be greater than the critical loss, the price increase would be unprofitable.

After presenting a method for critical loss analysis that is different from the one that is commonly used, Katz and Shapiro state that if their interpretation of critical loss analysis creates markets that are judged to be "too narrow," to provide the correct antitrust conclusions, then a 10 percent SSNIP should be used instead of a five percent SSNIP. They do not, however, mention whether or not they believe five percent to be preferable to 10 percent.

4 Methods

4.1 Linear Demand

Linear demand is a demand structure that is often used because it is easy to visualize and simple to model. It is characterized by an own-price elasticity that grows in magnitude (becomes more elastic) as price rises.

4.1.1 Effect of Change in SSNIP

In order to test whether choosing a five percent SSNIP over a 10 percent SSNIP could make a difference in the size of the market eventually defined, I model a system with five inter-related products sold by five separate firms that compete with each other in price. I assume that the firms are profit-maximizing. I assume that they are not able to collude with each other, nor are they capable of price discrimination (firms are restricted to uniform pricing). I assume that demand for each product is linear and depends not only on own price but also on the prices of the other products. The demand system has the following structure:

$$
\begin{aligned}
q_1 &= a - bp_1 + dp_2 + dp_3 + dp_4 + dp_5 \\
q_2 &= a + dP_1 - bp_2 + dp_3 + dp_4 + dp_5 \\
q_3 &= a + dp_1 + dp_2 - bp_3 + dp_4 + dp_5 \\
q_4 &= a + dp_1 + dp_2 + dp_3 - bp_4 + dp_5 \\
q_5 &= a + dp_1 + dp_2 + dp_3 + dp_4 - bp_5
\end{aligned}
$$

where a is the intercept term, b represents own-price responsiveness and should be larger than the sum of the d terms which represent cross-price responsiveness.

Costs are assumed to be constant and each firm faces the same cost. As a result, each firm faces the maximization problem:

$$\max_{p_i} \quad (a - bp_i + d\sum_{j\neq i}^{n-1} p_j)(p_i - c) \tag{1}$$

where $n = 5$ in this case.

The first order conditions that solve equation 1 are the following equations:

$$
\begin{aligned}
-2bp_1 + dp_2 + dp_3 + dp_4 + dp_5 &= -bc - a \\
dp_1 - 2bp_2 + dp_3 + dp_4 + dp_5 &= -bc - a \\
dp_1 + dp_2 - 2bp_3 + dp_4 + dp_5 &= -bc - a \\
dp_1 + dp_2 + dp_3 - 2bp_4 + dp_5 &= -bc - a \\
dp_1 + dp_2 + dp_3 + dp_4 - 2bp_5 &= -bc - a
\end{aligned} \tag{2}
$$

These equations can be written in matrix form as $Ap = b$ where A represents the price coefficients:

$$
A = \begin{bmatrix}
-2b & d & d & d & d \\
d & -2b & d & d & d \\
d & d & -2b & d & d \\
d & d & d & -2b & d \\
d & d & d & d & -2b
\end{bmatrix}
$$

p is the vector of prices:

$$
p = \begin{bmatrix}
p_1 \\
p_2 \\
p_3 \\
p_4 \\
p_5
\end{bmatrix}
$$

and b is a vector of the constant terms:

$$
b = \begin{bmatrix}
-bc - a \\
-bc - a \\
-bc - a \\
-bc - a \\
-bc - a
\end{bmatrix}.
$$

To solve for the firms' optimal price choices, simply premultiply b by the inverse of the A matrix: $A^{-1}b = p$.

In order to test whether a change from a five percent SSNIP to a 10 percent SSNIP could significantly affect the size of the market defined, I first allow four of the five firms to merge. I assume that this merger is strictly anti-competitive and therefore does not affect costs. I then measure the size of the increase in price that this newly-created monopolist would profitably choose. If the percentage increase in price is larger than five percent (but not large enough that three products might conceivably make up the market), then the four products make up the relevant market when using a five percent SSNIP. If not, the market must include (at a minimum) the fifth product when using a five percent SSNIP. If the increase in price is larger than 10 percent, then the four products make up the relevant market when using a 10 percent SSNIP. If not, the market must include (at a minimum) the fifth product when using a ten percent SSNIP.

The four-product firm faces the maximization problem:

$$\max_{p_1,\ldots p_4} \quad \sum_{i=1}^{4}[q_i(p_i - c)] \tag{3}$$

The fifth firm faces the maximization problem outlined in equation 1.

The first-order conditions that solve these problems can be written in matrix form $Ap = b$ where A is now:

$$A^* = \begin{bmatrix} -2b & 2d & 2d & 2d & d \\ 2d & -2b & 2d & 2d & d \\ 2d & 2d & -2b & 2d & d \\ 2d & 2d & 2d & -2b & d \\ d & d & d & d & -2b \end{bmatrix}$$

and b is now:

$$b^* = \begin{bmatrix} -bc - a + 3dc \\ -bc - a + 3dc \\ -bc - a + 3dc \\ -bc - a + 3dc \\ -bc - a \end{bmatrix}.$$

Next, I allow all five firms to merge. Once again, I assume that this merger is strictly anti-competitive and therefore does not affect costs. I again measure the size of the increase in price that this newly-created monopolist would profitably choose. If the percentage increase in price is larger than five percent, then the five products make up the relevant market when using a five percent SSNIP. If the increase in price is larger than 10 percent, then the five products make up the relevant market when using a 10 percent SSNIP.

The five-product firm faces the maximization problem:

$$\max_{p_1,\ldots p_5} \quad \sum_{i=1}^{5} [q_i(p_i - c)] \tag{4}$$

The first-order conditions that solve this problem can be written in matrix form as $Ap = b$ where A is now:

$$A^{\dagger} = \begin{bmatrix} -2b & 2d & 2d & 2d & 2d \\ 2d & -2b & 2d & 2d & 2d \\ 2d & 2d & -2b & 2d & 2d \\ 2d & 2d & 2d & -2b & 2d \\ 2d & 2d & 2d & 2d & -2b \end{bmatrix}$$

and b is now:

$$b^{\dagger} = \begin{bmatrix} -bc - a + 4dc \\ -bc - a + 4dc \\ -bc - a + 4dc \\ -bc - a + 4dc \\ -bc - a + 4dc \end{bmatrix}.$$

If parameters can be found such that four products make up the market when using a five percent SSNIP but five products make up the market when using a 10 percent SSNIP, then we can reasonably conclude that increasing the SSNIP increases—at least sometimes—the size of the market.

4.1.2 Implication of Change in Market Size

A merger that results in a reduction in costs large enough to decrease the prices after the merger is one that is desirable judged by any of the conventional standards for evaluation welfare effects.[5] Even if the consumer surplus approach is preferred to a total surplus approach, a reduction in final price is an improvement. A merger that will cause prices to decrease should be allowed.

A merger that reduces the number of firms in the market from five to four is less likely to be challenged by competition authorities. If a situation can be found in which price is likely to decrease due to cost savings but the merger is likely to be challenged because the market only consists of four firms, a 10 percent SSNIP could be considered a better choice.

The other side of the coin is a situation where the market is defined as five firms and is therefore more likely to allow a merger that will cause price to increase.

[5]These include: the consumer surplus standard and the total surplus standard.

Thanks to Farrell and Shapiro's No Synergies Theorem[6][4], it is relatively easy to find a case where this is true.

First, I take the parameters used in the previous section which define the market to be four products when using a five percent SSNIP and five products when using a 10 percent SSNIP. I then ask the question: "What will happen if two firms merge under these conditions?"

The newly-merged two-product firm faces the following maximization problem:

$$\max_{p_i,p_j} \quad (a - bp_i + d\sum_{h\neq i}^{n-1} p_h)(p_i - c) + (a - bp_j + d\sum_{h\neq j}^{n-1} p_h)(p_j - c) \tag{5}$$

The first-order conditions that solve these problems can be written in matrix form as $Ap = b$ where A is now:

$$A^{\ddagger} = \begin{bmatrix} -2b & 2d & d & d & d \\ 2d & -2b & d & d & d \\ d & d & -2b & d & d \\ d & d & d & -2b & d \\ d & d & d & d & -2b \end{bmatrix}$$

and b is now:

$$b^{\ddagger} = \begin{bmatrix} -bc' - a + dc' \\ -bc' - a + dc' \\ -bc - a \\ -bc - a \\ -bc - a \end{bmatrix}.$$

It is important to note that c' represents the fact that costs after the merger

[6]If a merger generates no synergies, then it causes price to rise.

are now allowed to change.

For the price after the merger to show no change, the following condition must hold:[7]

$$b^{\ddagger} = \begin{bmatrix} -bc' - a + dc' \\ -bc' - a + dc' \\ -bc - a \\ -bc - a \\ -bc - a \end{bmatrix} = \begin{bmatrix} -2b & 2d & d & d & d \\ 2d & -2b & d & d & d \\ d & d & -2b & d & d \\ d & d & d & -2b & d \\ d & d & d & d & -2b \end{bmatrix} \begin{bmatrix} p_1 \\ p_2 \\ p_3 \\ p_4 \\ p_5 \end{bmatrix} = A^{\ddagger} p.$$

where p is the vector of competitive prices found in the previous section.

From this condition, we get a simple expression in the form $-bc' - a + dc' = x$ where x is just a number. It is then quite simple to substitute in the parameter values and solve for c'. Any post-merger cost less than c' will cause the post-merger price to decrease.

4.2 Constant Elasticity Demand

Constant Elasticity Demand is special because own-price elasticity does not vary with price. As a result, the elasticity will be the same at every point on the demand curve.

[7] $p = A^{-1}b$ must equal $p^{\ddagger} = A^{\ddagger -1} b^{\ddagger}$
$\therefore p = A^{\ddagger -1} b^{\ddagger}$
$\therefore A^{\ddagger} p = b^{\ddagger}$

4.2.1 Effect of Change in SSNIP

In order to test whether choosing a five percent SSNIP over a 10 percent SSNIP could make a difference in the size of the market eventually defined, I once again model a system with five inter-related products sold by five separate firms that compete with each other in price. Again, I assume that the firms are profit-maximizing. I assume that they are not able to collude with each other, nor are they capable of price discrimination (firms are restricted to uniform pricing). I assume that demand for each product has a constant own-price elasticity and depends not only on own price but also on the prices of the other products. The demand system has the following structure:

$$
\begin{aligned}
q_1 &= {p_1}^{-b}{p_2}^{d}{p_3}^{d}{p_4}^{d}{p_5}^{d} \\
q_2 &= {p_1}^{d}{p_2}^{-b}{p_3}^{d}{p_4}^{d}{p_5}^{d} \\
q_3 &= {p_1}^{d}{p_2}^{d}{p_3}^{-b}{p_4}^{d}{p_5}^{d} \\
q_4 &= {p_1}^{d}{p_2}^{d}{p_3}^{d}{p_4}^{-b}{p_5}^{d} \\
q_5 &= {p_1}^{d}{p_2}^{d}{p_3}^{d}{p_4}^{d}{p_5}^{-b}
\end{aligned}
$$

Again costs are assumed to be constant and each firm faces the same cost. As a result, each firm faces the maximization problem:

$$\max_{p_i} \quad ({p_i}^{-b}\prod_{j\neq i}^{n-1}{p_j}^{d})(p_i - c) \tag{6}$$

Where $n = 5$ in this case.

The first-order conditions can be solved to give the following expression for the Nash equilibrium price:

$$p_i = \frac{bc}{b-1} \tag{7}$$

Equation 7 gives the original prices for each product in this system. It is interesting to note that in this constant elasticity demand system, optimal price does not depend upon other prices.

As in the linear case, I next ask what would happen if four out of the five firms merge. The assumptions of profit-maximization, no collusion and no price discrimination still hold. The resulting four-product firm faces the maximization problem:

$$\max_{p_1,\ldots p_4} \quad \sum_{i=1}^{4}[q_i(p_i - c)]$$

In order to obtain a workable solution for this problem, I set b equal to kd where $k > n - 1$.[8] The result is the following expression for the equilibrium price:

$$p_i = \frac{dc(k-3)}{kd - 3d - 1} \tag{8}$$

To measure the size of the change in price, I subtract equation 7 from equation 8. Then, to obtain an expression for the percentage change in price, I divide the previous result by equation 7 and multiply by 100%. This produces the following expression:[9]

[8] Own-price elasticity b must be greater than the sum of the cross-price elasticities $(n-1)d$ to ensure the existence of profit-maximizing prices.

[9] Assuming costs do not change.

$$\text{percentage change} = \frac{3}{(kd - 3d - 1)k} \times 100\% \tag{9}$$

Equation 9 can easily be rearranged to find the value for d that results in a five percent increase in price:

$$\text{when } d = \frac{\frac{60}{k} + 1}{k - 3}, \text{the percentage change equals five percent.} \tag{10}$$

Next, I allow all five firms to merge. If a value for k can be found such that the value of d given by equation 10 causes an increase in price that is larger than 10 percent when five firms merge, this will mean that the market consists of four products if a five percent SSNIP is used and consists of five products when a ten percent SSNIP is used. The five firms face the following maximization problem:

$$\max_{p_1,\ldots p_5} \quad \sum_{i=1}^{5} [q_i(p_i - c)]$$

The solution to the first-order conditions is the following expression for price:

$$p_i = \frac{dc(k-4)}{kd - 4d - 1} \tag{11}$$

To obtain an expression for the size of the change in price, I subtract equation 7 from equation 11. Next, I divide the resulting expression by equation 7 and multiply by 100% to obtain an expression for percentage change:[10]

[10] Again assuming that costs do not change.

$$\text{percentage change} = \frac{4}{(kd - 4d - 1)k} \times 100\% \tag{12}$$

All that remains is to plug in the chosen value for k and the value for d obtained from equation 10. If the result is a value larger than five percent, then we can reasonably conclude that, in the context of constant elasticity demand, increasing the SSNIP still increases the size of the market.

4.2.2 Implication of Change in Market Size

In order to determine whether a change in the size of the SSNIP could result in a wrong decision in court, I again allow two of the five firms to merge. I use the parameters (k and d) chosen in the previous section that result in a four-product market when using a five percent SSNIP and a five-product market when using a 10 percent SSNIP. If a pre-merger cost and a post-merger cost can be found such that the merger should be allowed but might be challenged with a five percent SSNIP, then it will be clear that a wrong decision is possible. Again, Farrell and Shapiro's No Synergies Theorem makes it easy to find a contrasting case in which an inefficient merger might be allowed if using a 10 percent SSNIP.

The two-product firm faces the following maximization problem:

$$\max_{p_i, p_j} \quad ({p_i}^{-b} \prod_{h \neq i}^{n-1} {p_h}^{d})(p_i - c_1) + ({p_j}^{-b} \prod_{h \neq j}^{n-1} {p_h}^{d})(p_j - c_1)$$

Cost is now allowed to change post-merger. c is pre-merger cost and c' is post-merger cost. Once again, I set $b = kd$ where $k > n-1$. The solution to the first-order equations is the following expression:

$$p_i = \frac{dc'(k-1)}{kd-d-1} \tag{13}$$

Pre-merger and post-merger prices do not change when equation 7 is equal to equation 13:

$$\frac{kdc}{kd-1} = \frac{dc'(k-1)}{kd-d-1} \tag{14}$$

Equation 14 can be rearranged to obtain an expression for c'. This is the fraction of pre-merger cost that post-merger cost must be for the price to show no change after the merger:

$$c' = \frac{k(kd-d-1)}{(kd-1)(k-1)}c \tag{15}$$

Any value for c' that is lower than the cost required to satisfy equation 15 will cause prices to decrease post-merger.

If the parameters chosen for k and d result in a reasonable fraction in equation 15, then it is possible to find a situation in which a five percent SSNIP could result in a wrong decision.

5 Results

In this section, I provide numerical examples of the simulations outlined in the methods section. I also comment upon the significance of the examples.

5.1 Linear Demand

For the linear demand simulations, I choose the following parameters: $a = 100$; $b = 8$; $d = 0.6$ and $c = 5$. These parameters are chosen because they produce interesting results. They are however not unique in producing these results.

The demand system looks like this:

$$
\begin{aligned}
q_1 &= 100 - 8p_1 + 0.6p_2 + 0.6p_3 + 0.6p_4 + 0.6p_5 \\
q_2 &= 100 + 0.6P_1 - 8p_2 + 0.6p_3 + 0.6p_4 + 0.6p_5 \\
q_3 &= 100 + 0.6p_1 + 0.6p_2 - 8p_3 + 0.6p_4 + 0.6p_5 \\
q_4 &= 100 + 0.6p_1 + 0.6p_2 + 0.6p_3 - 8p_4 + 0.6p_5 \\
q_5 &= 100 + 0.6p_1 + 0.6p_2 + 0.6p_3 + 0.6p_4 - 8p_5
\end{aligned}
$$

5.1.1 Effect of Change in SSNIP

The pre-merger price in this example is found (using the process outlined in the methods) to be $p_i = 10.29$. This value will be referred to as p_0 to denote that it is the baseline price.

When four firms merge, the first-order conditions become:

$$
\begin{bmatrix}
-16 & 1.2 & 1.2 & 1.2 & 0.6 \\
1.2 & -16 & 1.2 & 1.2 & 0.6 \\
1.2 & 1.2 & -16 & 1.2 & 0.6 \\
1.2 & 1.2 & 1.2 & -16 & 0.6 \\
0.6 & 0.6 & 0.6 & 0.6 & -16
\end{bmatrix}
\begin{bmatrix} p_1 \\ p_2 \\ p_3 \\ p_4 \\ p_5 \end{bmatrix}
=
\begin{bmatrix} -131 \\ -131 \\ -131 \\ -131 \\ -140 \end{bmatrix}
$$

These conditions result in the following prices:

$$p_1 = p_2 = p_3 = p_4 = 11.07 \quad \text{and} \quad p_5 = 10.41$$

The new price for products one to four is approximately a 7.6 percent increase from the original price:

$$\text{percentage change} = \frac{p_1 - p_0}{p_0} \times 100\%$$
$$7.6\% \approx \frac{11.07 - 10.29}{10.29} \times 100\%$$

Clearly, in this situation the market would consist of four products[11] if a five percent SSNIP is used but not if a 10 percent SSNIP is used.

When all five firms merge, the first-order conditions become:

$$\begin{bmatrix} -16 & 1.2 & 1.2 & 1.2 & 1.2 \\ 1.2 & -16 & 1.2 & 1.2 & 1.2 \\ 1.2 & 1.2 & -16 & 1.2 & 1.2 \\ 1.2 & 1.2 & 1.2 & -16 & 1.2 \\ 1.2 & 1.2 & 1.2 & 1.2 & -16 \end{bmatrix} \begin{bmatrix} p_1 \\ p_2 \\ p_3 \\ p_4 \\ p_5 \end{bmatrix} = \begin{bmatrix} -128 \\ -128 \\ -128 \\ -128 \\ -128 \end{bmatrix}$$

These conditions result in the following prices:

$$p_1 = p_2 = p_3 = p_4 = p_5 = 11.43$$

The new price for every product is approximately an 11.1 percent increase from

[11] A hypothetical monopolist owning three products would raise price only 4.6 percent so the market does not consist of only three products.

the original price:

$$\text{percentage change} = \frac{p_1 - p_0}{p_0} \times 100\%$$
$$11.1\% \approx \frac{11.43 - 10.29}{10.29} \times 100\%$$

Thus, if a 10 percent SSNIP is used, the market consists of five products. If a five percent SSNIP is used, the market consists of four products. This example illustrates in a linear demand context that an increase in the SSNIP does indeed increase the size of the market under some conditions.

5.1.2 Implication of Change in Market Size

If two firms merge under the conditions outlined earlier: $a = 100$; $b = 8$; $d = 0.6$ and $c = 5$, and cost does not change post-merger, the post-merger prices of all the products will go up. The first order conditions from the two-product firm are:

$$\begin{bmatrix} -16 & 1.2 & 0.6 & 0.6 & 0.6 \\ 1.2 & -16 & 0.6 & 0.6 & 0.6 \\ 0.6 & 0.6 & -16 & 0.6 & 0.6 \\ 0.6 & 0.6 & 0.6 & -16 & 0.6 \\ 0.6 & 0.6 & 0.6 & 0.6 & -16 \end{bmatrix} \begin{bmatrix} p_1 \\ p_2 \\ p_3 \\ p_4 \\ p_5 \end{bmatrix} = \begin{bmatrix} -137 \\ -137 \\ -140 \\ -140 \\ -140 \end{bmatrix}$$

These conditions result in the following prices:

$$p_1 = p_2 = 10.51 \quad \text{and} \quad p_3 = p_4 = p_5 = 10.31$$

Compared to the original price (10.29), the prices of products 1 and 2 have increased by approximately 2.1 percent and the prices of the remaining products have increased by approximately 1.9 percent. These price increases cause a reduction in total amount of product sold of 2.8[12] units. The combined price increase and quantity decrease result in deadweight loss and therefore an inefficient merger.

Clearly, the merger outlined here should not be allowed to take place. If a five percent SSNIP is used, the market is defined to be four products, and this merger would be highly likely to be blocked. If, on the other hand, a 10 percent SSNIP is used, the market is defined to be five products and, as a result, this inefficient merger has an increased chance of being allowed. This is a case in which a five percent SSNIP is a better choice than a 10 percent SSNIP.

Next, I examine the more interesting case in which the merger results in cost savings. The initial parameters remain the same: $a = 100$; $b = 8$; $d = 0.6$ and $c = 5$. However, post-merger cost c' can be any number between zero and five.

Again, I suppose that two firms merge. The first-order conditions in this case are:

$$\begin{bmatrix} -16 & 1.2 & 0.6 & 0.6 & 0.6 \\ 1.2 & -16 & 0.6 & 0.6 & 0.6 \\ 0.6 & 0.6 & -16 & 0.6 & 0.6 \\ 0.6 & 0.6 & 0.6 & -16 & 0.6 \\ 0.6 & 0.6 & 0.6 & 0.6 & -16 \end{bmatrix} \begin{bmatrix} p_1 \\ p_2 \\ p_3 \\ p_4 \\ p_5 \end{bmatrix} = \begin{bmatrix} -100 - 8c' + 0.6c' \\ -100 - 8c' + 0.6c' \\ -140 \\ -140 \\ -140 \end{bmatrix}$$

As seen in the methods section, the condition under which prices do not change is the following:

[12] pre-merger, $q_1 + q_2 + q_3 + q_4 + q_5 = 211.88$
post-merger, $q_1 + q_2 + q_3 + q_4 + q_5 = 209.08$

$$\begin{bmatrix} -16 & 1.2 & 0.6 & 0.6 & 0.6 \\ 1.2 & -16 & 0.6 & 0.6 & 0.6 \\ 0.6 & 0.6 & -16 & 0.6 & 0.6 \\ 0.6 & 0.6 & 0.6 & -16 & 0.6 \\ 0.6 & 0.6 & 0.6 & 0.6 & -16 \end{bmatrix} \begin{bmatrix} 10.29 \\ 10.29 \\ 10.29 \\ 10.29 \\ 10.29 \end{bmatrix} = \begin{bmatrix} -100 - 8c' + 0.6c' \\ -100 - 8c' + 0.6c' \\ -140 \\ -140 \\ -140 \end{bmatrix}$$

This can be simplified to one equation:

$$-100 - 8c' + 0.6c' = -133.77$$

$$\therefore c' = 4.56$$

Any value of c' less than 4.56 will cause post-merger prices to decrease. If, for example, cost was reduced through synergies in the production process to 4 instead of the original 5, the merger would reduce prices and increase quantities. Such a merger should definitely be allowed.[13] If a five percent SSNIP is used, the market is defined to be four products and, as a result, this desirable merger might be blocked. If a 10 percent SSNIP is used, the market is defined to be five products and, as a result, this merger would have a better chance of being allowed. In this case, a five percent SSNIP might lead to a wrong decision, whereas a 10 percent would likely lead to a better decision.

The two examples seen in this section show that the choice of SSNIP might very well make an important difference in a linear demand scenario. On the one hand, a five percent SSNIP might lead to an inefficient merger being allowed and, on the other hand, a 10 percent SSNIP might lead to an efficient merger being blocked.

[13] I am implicitly following a consumer surplus standard here—the standard followed by United States antitrust law.

5.2 Constant Elasticity Demand

For the constant elasticity simulations, I choose the following parameters: $b = kd$; $k = 5$; $d = 6.5$; and $c = 5$. As in the linear case, these parameters are chosen because they produce interesting results. The d parameter is chosen by solving equation 10 when k is equal to 5.

The demand system looks like this:

$$
\begin{aligned}
q_1 &= {p_1}^{-32.5} {p_2}^{6.5} {p_3}^{6.5} {p_4}^{6.5} {p_5}^{6.5} \\
q_2 &= {p_1}^{6.5} {p_2}^{-32.5} {p_3}^{6.5} {p_4}^{6.5} {p_5}^{6.5} \\
q_3 &= {p_1}^{6.5} {p_2}^{6.5} {p_3}^{-32.5} {p_4}^{6.5} {p_5}^{6.5} \\
q_4 &= {p_1}^{6.5} {p_2}^{6.5} {p_3}^{6.5} {p_4}^{-32.5} {p_5}^{6.5} \\
q_5 &= {p_1}^{6.5} {p_2}^{6.5} {p_3}^{6.5} {p_4}^{6.5} {p_5}^{-32.5}
\end{aligned}
$$

5.2.1 Effect of Change in SSNIP

The pre-merger price in this example is found (using equation 7) to be $p_i = 5.16$. This value will be referred to as p_0 to denote that it is the baseline price.

When four firms merge the resultant prices for the merged products can be found from equation 8 to be:

$$p_1 = p_2 = p_3 = p_4 = 5.42.$$

The price of the remaining product does not change. Post merger, the price has increased by five percent—as it must, due to the fact that d was chosen from equation 10.

The result is that in this example, a five percent SSNIP would define the market to be four products whereas a 10 percent SSNIP would not.

Next, I consider the case in which five firms merge. The post-merger prices for all products can be found from equation 11 to be:

$$p_1 = p_2 = p_3 = p_4 = p_5 = 5.91.$$

This is a 14.5 percent increase in price due to the merger.

This shows that a five percent SSNIP would define the market to be four products, whereas a 10 percent SSNIP would define the market to be five products. This result holds for a constant elasticity demand system as well as a linear demand system. Clearly, circumstances exist under which an increase in the SSNIP noticeably increases the size of the market as well.

5.2.2 Implication of Change in Market Size

To test the potential results of a change in market size due to a change in SSNIP, I again start with a situation where a merger between two firms occurs and does not create any synergies.

The parameters in this situation are as before: $b = kd$; $k = 5$; $d = 6.5$; $c = 5$ and $c' = c$. Pre-merger price p_0 is equal to 5.16. Equation 13 solves the first-order conditions of the newly merged two-product firm's maximization problem. The post-merger prices are:

$$p_1 = p_2 = 5.2$$

The prices of the other three products do not change.

Clearly, this merger is inefficient. Although the price increase is not large, it

still exists and leads to deadweight loss. As a result, this merger should not be allowed. As was the case in the linear demand example, if a five percent SSNIP is used, the market is defined to be four products and this merger would be highly likely to be blocked. If, on the other hand, a 10 percent SSNIP is used, the market is defined to be five products and, as a result, this inefficient merger has an increased change of being allowed. This is a case in which demand has a constant elasticity structure and a five percent SSNIP is a better choice than a 10 percent SSNIP.

Next, I examine the more interesting case in which the merger results in cost savings in a constant elasticity demand context. The initial parameters remain the same: $b = kd$; $k = 5$; $d = 6.5$ and $c = 5$. However, post-merger cost c' can be any number between zero and five.

The post-merger cost that will cause prices to remain unchanged can be obtained from equation 15:

$$c' = \frac{5(5 \times 6.5 - 6.5 - 1)}{(5 \times 6.5 - 1)(5 - 1)}c$$

$$c' = 0.992c$$

$$\therefore c' = 4.96$$

Any merger between two firms that causes cost to decrease more than 0.8 percent will result in post-merger prices that are lower than pre-merger prices. For instance, if the merger resulted in synergies that made c' equal to 4.5, post-merger prices of the two goods would equal 4.68—a significant decrease.

An efficient merger such as this should definitely be allowed. If a five percent SSNIP is used, the market is defined to be four products and, as a result, this

desirable merger might be blocked. If a 10 percent SSNIP is used, the market is defined to be five products and, as a result, this merger would have a better chance of being allowed. In this case, a five percent SSNIP might lead to a wrong decision whereas a 10 percent would likely lead to a better decision.

The two examples seen in this section show that, as in the linear demand section, the choice of SSNIP might very well make an important difference in a constant elasticity demand situation. On one hand, a five percent SSNIP might lead to an inefficient merger being allowed and, on the other hand, a 10 percent SSNIP might lead to an efficient merger being blocked.

5.3 Abuse of Dominance Cases

The Nielsen case was an example of a firm being accused of abusing its dominant position. This accusation was the result of an exclusive dealing contract that Nielsen had signed with the upstream seller of raw scanner data. This contract prohibited the upstream seller from dealing with any of Nielsen's competitors.

Exclusive dealing is a type of vertical integration that uses contracts instead of a merger of the upstream and downstream firms. The practice is not illegal per se, because as Mathewson and Winter [6] showed, exclusive dealing may either increase total surplus or decrease it. Exclusive dealing might increase total surplus in several ways, for example: through vertical synergies; the need for the upstream firm to "bribe" the downstream firm into accepting the contract; or by encouraging upstream firms to safely invest in the downstream firms with the purpose of attracting customers. On the other hand, exclusive dealing might decrease total surplus due to the usual mechanics of increased market power and barriers to entry.

We have seen that an increase in the SSNIP will lead to a widening of the

market. It is conceivable that a situation could exist whereby a firm is practicing surplus-decreasing exclusive dealing and an SSNIP of five percent would be much more likely to result in a cessation order than an SSNIP of 10 percent. Since in this case, the exclusive dealing contract results in inefficiencies, a five percent SSNIP would be the better choice.

Conversely, it is possible that a situation could exist whereby a firm is practicing surplus-increasing exclusive dealing and an SSNIP of five percent would be likely to bring a court-ordered end to the practice while a 10 percent SSNIP would be much less likely to do so. In this situation, the exclusive dealing contract results in efficiencies and, as a result, a ten percent SSNIP would be the better choice.

This discussion is intended to show that the choice of SSNIP is vital in not only merger cases but in abuse of dominance cases as well. Unfortunately, an in-depth analysis of such a situation is beyond the scope of this paper.

6 Conclusion

In the course of this paper, I have shown the importance of market definition to antitrust cases. From the mishandled cellophane case to the widely-researched and well-informed Staples case, market definition can have widespread and lasting results. We have seen that the current laws of Canada, the United States and the European Union deem market definition best accomplished by means of the hypothetical monopolist test. Furthermore, all three authorities consider that the hypothetical monopolist test should use a five percent value as the Small but Significant and Non-transitory Increase in Price, but not one of these authorities adequately explains the reasoning behind choosing this specific value.

I have also shown that an increase in the value of the SSNIP from five percent

to 10 percent does increase the size of the market. This result holds both in cases where demand is linear and cases where demand has a constant elasticity structure. Not only does the size of the market depend on the size of the SSNIP, but also the wrong value for the SSNIP can lead to an inefficient decision in an antitrust case. A too-low SSNIP can lead to blocking a merger which would result in efficiencies large enough to outweigh the negative consequences of increased market power. A too-high SSNIP can lead to allowing a merger which would result in inefficiencies through increased market power. Again, these results hold for both linear demand and constant elasticity demand systems.

The implication of these results is that competition and antitrust agencies should put careful thought into determining the value they plan to use for the SSNIP. It is not enough for the United States or Canada to pick a seemingly arbitrary value and the rest of the world to follow suit. More study is required to determine whether the SSNIP should be set at a particular value and, if so, what that level should be, or whether different values should be used depending on the circumstances. Another interesting area of research would be to attempt to determine whether an increase in the SSNIP widens the market regardless of the original value. It may be that there is a value for the SSNIP that is more robust to small changes.

In the past, the attempts at market definition were not as successful as they are today with the help of the hypothetical monopolist test. Continuing analysis will further improve our ability to define the relevant antitrust market. A clearer understanding of the SSNIP is a step towards that result.

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