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Quantitative Closeness of Rivalry Assessment – Price Co-movement and Diversion Ratios

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Section 1: Introduction

1. Competition in a market can, and usually does, take the form of both price and non-price competition. Non-price competition typically involves differentiation by a firm of its products and services from those offered by its competitors.

2. Economic theory informs us that firms engage in differentiation to establish market niches and to retain some pricing power over its customers.[1] This allows the firm to charge a higher price than it would have without differentiation and still retain part of its customer base. In other words, a firm can enhance its market power[2] through product differentiation.[3]

3. A central question of interest, for the purposes of competition assessment, is whether the firm has sufficient market power to act unilaterally without being constrained by competitive forces. In this regard, an examination of the closeness of rivalry between firms can provide insight into the competitive dynamics at play in a market with differentiated products.

4. In this paper, we will explore two price-based quantitative tools[4], namely (i) the price co-movement analysis and (ii) the diversion ratio analysis, which can be used to assess the extent of the closeness of rivalry between firms. These tools have gained traction in the field of competition law enforcement, possibly due to their ease of implementation. We will also explore how these tools apply to the Competition and Consumer Commission of Singapore ("CCCS")'s competition assessment framework and how CCCS has been incorporating such tools into its casework.

5. The rest of this paper is organised as follows:
    a. Section 2 discusses the rationale for closeness of rivalry assessment;
    b. Section 3 elaborates on the two quantitative methods, namely the price co-movement analysis and diversion ratio analysis, that can be used to assess closeness of rivalry;
    c. Section 4 explores possible applications in CCCS's competition assessment framework; and
    d. Section 5 sets out the conclusion.

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[1] Differentiation softens price competition, though there may be limits to the extent of differentiation. For further information, see Jean Tirole, *The Theory of Industrial Organisation* (United States: Massachusetts Institute of Technology Press, 1988), Chapter 7.

[2] Market power is defined in this paper as the ability to profitably sustain prices above competitive levels.

[3] Given this incentive, product homogeneity is usually the exception rather than the norm. Even in seemingly homogeneous product markets (e.g. cola, water), it is observed that a firm charging more than its competitors does not lose all of its customers. In such seemingly homogeneous markets, some form of differentiation still exists, such as in the branding of the products.

[4] While differentiation softens price competition, firms are not completely shielded from competing on prices. Although two competing firms producing differentiated products are able to charge different prices due to (perceived) quality differences, there is a limit to how far each firm can raise its prices before a significant number of customers stop purchasing its products altogether. Prices are not totally delinked from the non-price characteristics of the products, and hence can provide an indication of how closely the products compete with one another.

Section 2: Rationale for closeness of rivalry assessment

2.1 An aid in market definition

6. Market definition is generally considered to be a first and important step in performing a competition assessment.[5] The goal of market definition is to determine the boundaries in which competition takes place. This allows the identification of competitors in the relevant market and the measurement of their market shares to assess whether potential competition concerns could arise.[6]

7. The Hypothetical Monopolist Test ("HMT") is the conceptual framework used for market definition in most jurisdictions today. Essentially, the HMT asks whether a hypothetical monopolist can profitably impose a small but significant and non-transitory increase in price ("SSNIP")[7] on the products in the relevant market defined.[8]

8. The HMT is carried out by way of an iterative process. The analysis begins with a narrow definition of the product market. The analysis then proceeds by asking the question of whether a significant number of customers would switch to other products[9], that are the next best substitutes, if the price of the focal product is raised by a SSNIP. If the answer is "yes", the substitute products are included into the candidate market as these other products potentially constrain the exercise of market power. The question is repeated and substitute products are added until the answer becomes a "no". The relevant product market[10] is therefore the smallest product group such that a hypothetical monopolist controlling that product group could profitably sustain "supra competitive" prices, i.e. prices that are at least a small but significant amount above competitive levels.[11]

9. While the HMT provides a useful conceptual framework for market definition, applying the HMT can be a challenging task in the context of differentiated products. The HMT requires the classification of potential substitutes as either 'in' or 'out' of the relevant market. In homogeneous product markets, the HMT can be applied and the relevant market can be defined with relative conceptual ease, as a price increase in the focal product may mean that almost all demand would shift to the near perfect substitutes of the focal product. However, when it comes to differentiated products, the boundaries of the relevant market are often blurred and it may not always be clear whether products are 'in' or 'out' of the market. Depending on the extent of differentiation, different

[5] While the *US Horizontal Merger Guidelines 2010* explicitly states that market definition need not be the first step in a merger review, we are of the view that the concept of market definition still remains useful in most cases to the extent that it helps to provide the framework to analyse a merger's likely competitive effects.
[6] OECD, "Background note", OECD Roundtable on Market Definition, 2012. Retrieved from http://www.oecd.org/daf/competition/Marketdefinition2012.pdf
[7] Usually 5 or 10%.
[8] The HMT can be applied to define both the relevant product and geographic market.
[9] While the word 'products' is used in this paper, it should be noted that the concepts are applicable to services as well.
[10] The relevant geographic market is defined in the same manner.
[11] Paragraph 2.4 of the *CCCS Guidelines on Market Definition*.

products are substitutes to the focal product to different extents and hence exert differing competitive constraints on the focal product.

10. A closeness of rivalry assessment can be used to indicate the extent of substitutability of the competing products and to rank them in order of their closeness of competition to the focal product.[12] This will provide a useful sense-check on the application of the HMT in a differentiated product context.

11. A closeness of rivalry assessment can provide further evidence to aid the market definition process. Qualitative evidence (e.g. internal documents, comparison of product characteristics, consumer questionnaires and surveys) is typically presented by merger parties to support their market definition. However, there may be times when there is conflicting qualitative evidence, or when there is uncertainty with regard to the boundaries of the relevant market based on available qualitative evidence. In such scenarios, a quantitative closeness of rivalry assessment provides further evidence that can indicate whether two products are close enough substitutes to warrant being considered in the same relevant market.

2.2 A direct look at merger effects

12. In the context of a merger between firms selling differentiated products, the assessment of the closeness of rivalry between the products can also provide insights into the direct competitive constraints that each merger party imposes on the other. This allows the competition authority to reach a more robust conclusion on the competitive effects of the merger. For instance, a competition assessment based solely on market shares may not reveal any anti-competitive effects when one of the merging parties has a significantly smaller market share than the other merging party, while other competitors in the same market have market shares that lie in between those of the two merging parties. This however may fail to capture the point that the merging parties are in fact each other's closest competitor, which results in a false negative finding[13], given that the merger will eliminate the intense rivalry between the merging parties.

13. A direct assessment of the closeness of rivalry also enables authorities to zoom in on the competitive interactions between the merger parties, which can be helpful given the short timeframes involved in merger reviews. Indeed, it has been advocated that such assessment (which is part of price pressure tests) is more solidly grounded in economics and simpler to utilise, as compared to the traditional framework[14] of competition assessment, in screening for unilateral effects of a merger in markets for differentiated

[12] Willem H. Boshoff, "Limits and Uses of Price Tests for Market Definition", Stellenbosch Economic Working Papers: 01/11, 2013. Retrieved from: https://www.ekon.sun.ac.za/wpapers/2011/wp012011/wp-01-2011_revised.pdf .

[13] A false negative is also known as a Type II error, where we fail to reject the null hypothesis, which in this context is that the merger will not result in a substantial lessening of competition.

[14] The traditional competition assessment framework usually involves defining the relevant market, identifying market shares and concentration, then assessing the unilateral and coordinated effects that may arise from the merger.

products.[15] In this regard, it is also our view that the quantitative tools described in this paper can be used to perform a direct closeness of rivalry assessment where relevant, which undertaken together with a review of other evidence, can improve the quality of a competition assessment.

14. In the next section, we explore in greater detail the two quantitative tools, namely the price co-movement analysis and the diversion ratio analysis, that can be used to assess the closeness of rivalry between products.

Section 3: Quantitative methods to assess closeness of rivalry

3.1 Price co-movement analysis

15. The intuition behind price co-movement analysis is the law of one price ("LOOP"), which suggests that goods that are identical should sell at identical prices (absent any transport costs). Otherwise, market participants may be able to profit through arbitrage by exploiting the price differential between the two identical products (i.e. buying the identical good at the lower price and re-selling it at the higher price). The LOOP's intuition can be applied to assess the closeness of rivalry between two products. Where two products are close substitutes, the incentive and ability to arbitrage should imply that there is a limit to how far the prices of the two products which are good substitutes can diverge. The more substitutable the products are for each other, the greater the expected profit from arbitraging when a price change in one of the products widens the price differential between the two products. The implication is that the prices of products which are good substitutes should not diverge beyond a certain magnitude.

16. In a differentiated product market, the price levels of products can be different due to different product characteristics.[16] Nevertheless, the relative price movements of the products can still be measured to give an indication of the closeness of rivalry between the two products. In this regard, both the similarities in the price levels or co-movements in prices can indicate that the two products are close substitutes, which may suggest that they are in the same relevant market.[17] This same analysis can also be undertaken to see if two regions may be in the same geographic market.[18]

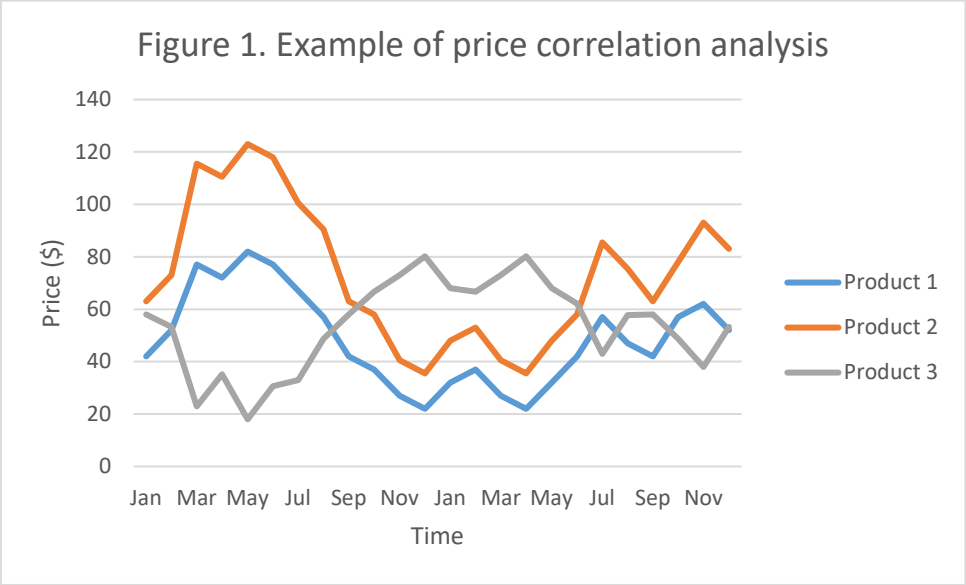
17. It is important to note here that the price co-movement analysis is based on the economic market concept of the LOOP which may not necessarily coincide with the concept of an antitrust market.[19] Nevertheless, it is our view that price co-movement

[15] Joseph Farrell and Carl Shapiro, "Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition", *The B.E. Journal of Theoretical Economics* 10, no. 1, Article 9 (2010).
[16] These product characteristics arise from product differentiation and include factors such as quality, brand, reputation and advertising.
[17] Peter Davis and Eliana Garcés, *Quantitative Techniques for Competition and Antitrust Analysis* (United Kingdom: Princeton University Press, 2010), 170.
[18] Lexecon Ltd., "An Introduction to Quantitative Techniques in Competition Analysis".
[19] The differences between antitrust and economic markets are not discussed in this paper. For further information on this, please see Gregory J. Werden and Luke M. Froeb, "Correlation, Causality, and All that Jazz: The Inherent shortcomings of Price Tests for Antitrust Market Delineation", *Review of Industrial Organisation* 8, no. 3 (1993).

analysis can be a quick and useful quantitative tool (if data is readily available) for assessing the closeness of rivalry between two products in an antitrust context, as long as we understand its limitations and caveats. In this regard, the results of a price co-movement analysis should be regarded as a supplementary piece of evidence that is used in conjunction with other evidence to provide a robust competition assessment, and not as conclusive or confirmatory on its own.

3.1.1 Price correlation and stationarity assessment

18. The price correlation and stationarity tests are two of the typical tests that can be performed to conduct a price co-movement analysis. The price correlation test is a relatively simple tool that is used to test the strength of co-movement of two price series. The strength of the co-movement of prices is based on the correlation coefficient that is obtained from the correlation test.



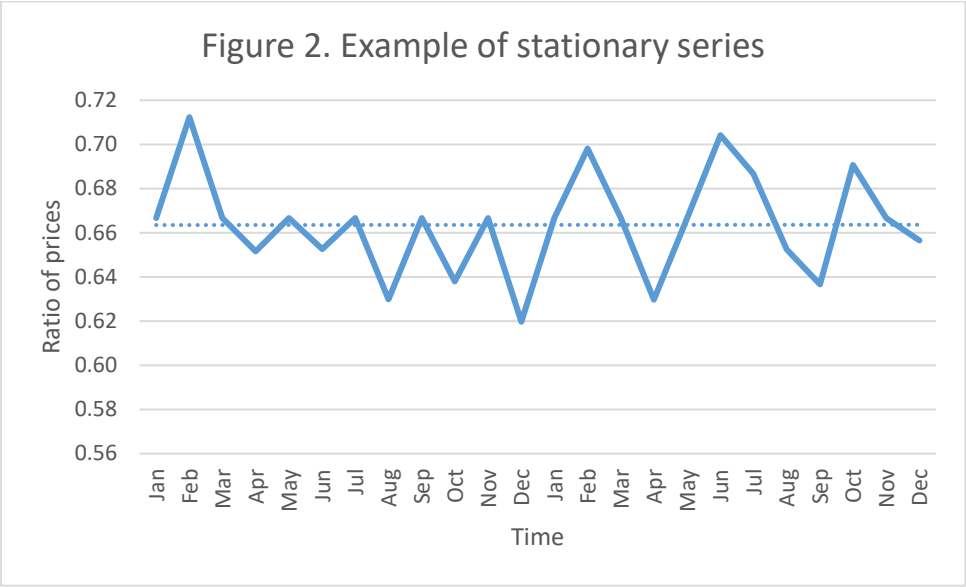
19. Figure 1 above shows an example of a price correlation analysis. The correlation coefficient of the prices of products 1 and 2 is 0.99 (i.e. almost perfectly positively correlated). As can be seen, the prices of products 1 and 2 tend to move in tandem with each other. Conversely, the correlation coefficient between the prices of products 1 and 3 is -0.99 (i.e. almost perfectly negatively correlated), and as can be seen, the prices of products 1 and 3 tend to move in opposite directions to each other.

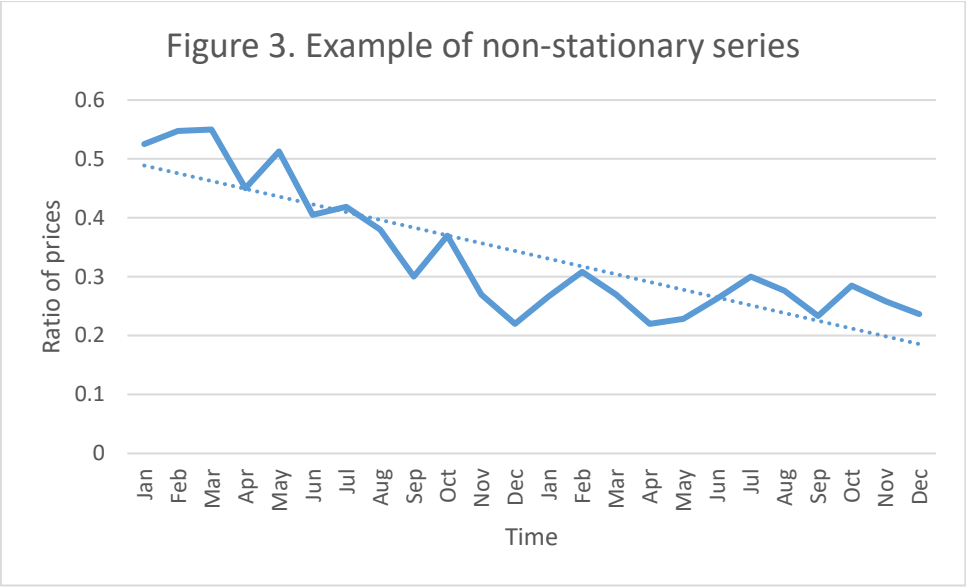
20. It should be noted that price correlation can be used to test the relative movements in prices, and does not require that absolute levels of prices to be similar between two products.[20] As seen in Figure 1 above, it is possible that the price of one product lies above that of another because of differences in quality (real or merely perceived) between the two products. Nevertheless, the price correlation test can allow us to identify whether the prices of these two products move in tandem, and considered

[20] George J. Stigler and Robert A. Sherwin, "The Extent of the Market", *The Journal of Law & Economics* 28, no. 3 (1985): 558-559.

together with other evidence, can strengthen the finding of whether the two products are in the same relevant market.

21. The stationarity test is a related tool that is often used to supplement the price correlation test. The stationarity test is more complex in nature, but is arguably more versatile than the price correlation test when it comes to examining the long-run relationship between two price series. This is important as the price of a substitute product may not immediately adjust (i.e. in the same period) to the change in price of the other product in question.[21]





[21] Charles River Associates, "Market Definition: How Stationarity Tests Can Improve Accuracy", 2001.

22. The stationarity test can be conducted in various forms.[22] Figures 2 and 3 above show a graphical representation of a stationarity test. The stationarity test examines whether the relative price ratio of two products tend to return to a stable value over time. If the ratio of the prices of two products tend to return to a stable value, as shown in Figure 2, it can be said that the ratio is stationary. However. if the ratio of the prices is found to increase or decrease over the long run, as seen in Figure 3, the ratio is said to be non-stationary. This suggests that the prices of the two products tend to diverge in the long run and the two products are not close enough substitutes such that the suppliers of these products competitively constrain each other.

23. It should be noted that the data requirements for performing the two price co-movement tests are the historical prices of the two products being tested, which may not be difficult nor complicated to obtain.

3.1.2 Limitations

24. There are several limitations that one should take note of when interpreting the results from the price co-movement tests. First, the correlation coefficient obtained in the price correlation test only indicates the direction and strength of the co-movement of the price series, but there is no benchmark figure to compare against to determine whether the coefficient is sufficiently high to suggest that the two products being tested are close rivals. A workaround would be to compare the correlation coefficient obtained against other coefficients of products that have previously been established to be good substitutes and in the same relevant market.[23]

25. The price correlation test can also suffer from spurious correlation, possibly due to common influences[24] (e.g. common costs) or because the price series contains a time trend.[25] In these situations, the cause of the spurious correlation should be removed from the price series in order to obtain a meaningful result from the price correlation test. Conversely, there is also the possibility of non-spurious but insufficient correlation, where price levels are close to each other due to strong substitutability of the products, but price movements are limited and largely caused by noise rather than underlying competitive forces.[26]

26. While common influences do not affect the result of a stationarity test (because the effects of the common influence on the two price series will cancel each other out when taking the price ratio), care must be taken to check that the two price series are not

[22] See Mario Forni, "Using stationarity tests in antitrust market definition", *American Law and Economics Review* 6, no. 2 (2004), for an example of the use of stationarity analysis in competition law.
[23] Peter Davis and Eliana Garcés, *Quantitative Techniques for Competition and Antitrust Analysis* (United Kingdom: Princeton University Press, 2010), 173.
[24] Peter Davis and Eliana Garcés, *Quantitative Techniques for Competition and Antitrust Analysis* (United Kingdom: Princeton University Press, 2010), 176.
[25] For example, see George J. Stigler and Robert A. Sherwin, "The Extent of the Market", *The Journal of Law & Economics* 28, no. 3 (1985).
[26] Patrick D. Smith, "Economic quantification within the black letter of the law", Fourth Annual Competition Conference, September, 2010. Retrieved from: http://www.compcom.co.za/wp-content/uploads/2014/09/100812-PS-Paper-for-SACC-conference-DRAFT.pdf

stationary in the first place.[27] In addition, both the price correlation and stationarity tests are sensitive to changes in the structure of the market that causes the price of one product to be permanently changed.[28]

27. In this regard, before performing any price co-movement analysis, it may be prudent to always consider, based on economic theory and other qualitative evidence, the nature and state of competition between the two products being tested and the inherent characteristics of the corresponding price series. For example, one should consider whether the various price series to be assessed are stationary[29] and whether there were any previous changes in the market structure that may have led to a permanent change in the price levels of the products being tested. This will help in appropriately interpreting and weighing the subsequent results of the price co-movement analysis (and any anomalies).

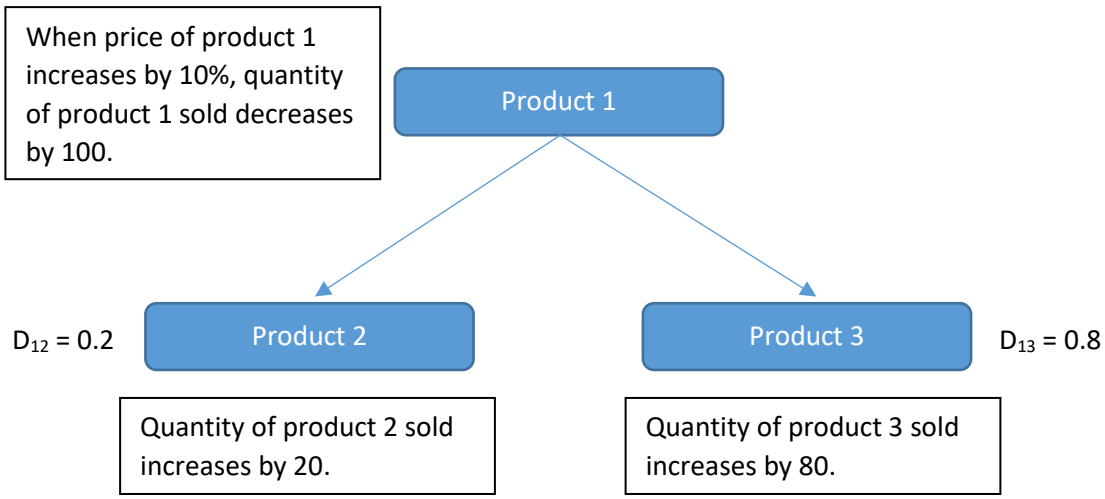
3.2 Diversion ratio analysis

28. We now turn to look at diversion ratio analysis – a more direct method of assessing the closeness of rivalry between two products. A diversion ratio analysis is based on two simple economic assumptions. First, given that all other factors remain the same, when the price of a product is increased, the sales (or quantity demanded) of that product will fall as some customers stop purchasing the product.[30] The second assumption is that the same customers that no longer purchase the original product would instead purchase substitute products or buy other unrelated economic transactions.

29. Taken together, the diversion ratio measures the proportion of sales (e.g. in quantity)[31] lost by the original product that is diverted to the substitute product when the price of the focal product is raised.[32] The greater the proportion of sales diverted to the substitute product (i.e. the higher the diversion ratio), the closer the substitute product is to the focal product and the stronger the constraint exerted by the substitute product on the focal product.

[27] Lexecon Ltd., "An Introduction to Quantitative Techniques in Competition Analysis".
[28] Charles River Associates, "Market Definition: How Stationarity Tests Can Improve Accuracy", 2001.
[29] In statistics, a stationary time series is one whose statistical properties such as mean, variance and autocorrelation are all constant over time.
[30] This is commonly known as the law of demand.
[31] In practice, the diversion ratio could be calculated using other indicators, such as number of customers, volumes or revenues diverted.
[32] There are several variants of a diversion ratio that can be estimated for different purposes. If the diversion ratio is to be used to simulate the price effects of a merger, or for the HMT, the 'capture ratios' should be used. Capture ratios are the ratio of sales captured by the substitute product in relation to the sales lost by the focal product. For more information, see Gunnar Niels, Helen Jenkins and James Kavanagh, *Economics for Competition Lawyers 2nd Edition* (United Kingdom: Oxford University Press, 2016), 312-314.

Figure 4. Example of diversion ratio analysis



30. Figure 4 above shows an example of a diversion ratio analysis. When the price of product 1 increases by 10%, the quantity of product 1 sold decreases by 100, and the quantity of products 2 and 3 sold increase by 20 and 80 respectively. The diversion ratio from product 1 to product 2 (i.e. proportion of sales lost by product 1 that is diverted to product 2), D_{12} is 0.2, while the diversion ratio from product 1 to product 3 (i.e. proportion of sales lost by product 1 that is diverted to product 3), D_{13} is 0.8. This suggests that product 3 is a closer substitute to product 1 than product 2 is. While diversion ratios are usually calculated in the context of price pressure tests[33] in merger assessments, they can be used on a standalone basis to provide an indication of the closeness of rivalry between two differentiated products.

31. In practice, diversion ratios can be estimated through multiple methods, such as through the analysis of data (both qualitative and quantitative) collected over the course of daily business activities[34], through the use of consumer surveys[35], in the context of a natural experiment when the effects of previous shocks to the market can be observed[36], or through the use of market shares as a proxy[37]. A point to note here is that while consumer surveys are commonly used to address the issue of insufficient data often faced in the course of using other methods, consumer surveys usually capture reported behaviour (i.e. what consumers say they will do) instead of actual behaviour (i.e. what

[33] See section 3.2.1 below on price pressure tests.
[34] Oxera, "Diversion ratios: why does it matter where customers go if a shop is closed?", 2009.
[35] *Ibid.*
[36] David Parker, "Illustrative Price Rises from Mergers in Differentiated Product Markets", *GCP: The online magazine for global competition policy*, April, 2009. Retrieved from https://www.competitionpolicyinternational.com/assets/0d358061e11f2708ad9d62634c6c40ad/Parker-Apr-09_2_.pdf
[37] One of the impetus of assessing closeness of rivalry using diversion ratio analysis is to overcome the limitation of assessing the state of competition in differentiated product markets using conventional market concentration analysis. In this regard, using market shares as a proxy for diversion ratios seems to defeat the purpose of conducting a diversion ratio analysis in the first place. For further information, see Jan M. Rybnicek and Laura C. Onken, "A Hedgehog in Fox's Clothing? The Misapplication of GUPPI Analysis", *George Mason Law Review* 23, no. 5 (2016): 1195-1197.

consumers actually do), the latter being the more accurate and reliable type of information.[38] While theoretically simpler to execute, results gathered from consumer surveys may be flawed as responses are easily influenced by the way questions in the survey are framed, phrased and sequenced. Consumer surveys may also suffer from a limited sample pool. Careful thought needs to be put into designing and implementing the consumer survey in order to elicit accurate and reliable results.[39]

32. Diversion ratios can provide insights to how closely two differentiated products compete with each other, as it is measured by the extent of demand substitution following the increase in the price of one product.[40] In this regard, diversion ratio analysis can be used to rank how close the substitute products (or geographic areas) are to the focal product (area) before performing a HMT. This provides a systematic way of including the closest substitute products (i.e. substitute products with the largest diversion ratios) first into the relevant market when applying the HMT.[41]

3.2.1 Price pressure tests

33. In assessing mergers involving differentiated products, unilateral effects are usually the main cause for concern.[42] Price pressure tests have generally been developed to assess the unilateral effects arising from mergers in the context of price competition in a differentiated product market (i.e. differentiated Bertrand competition).[43] The three most widely discussed price pressure tests are the Gross Upward Pricing Pressure Index ("GUPPI"), the Upward Pricing Pressure ("UPP"), and the Illustrative Price Rise ("IPR").[44]

34. In general, the three aforementioned price pressure tests aim to estimate the change in incentives of the merged entity to unilaterally raise prices post-merger. Pre-merger, if a company tried to increase the prices of its products[45], it would lose a certain quantity of sales to substitute products while earning a higher margin on the remaining sales it makes. This means that a profit-maximizing firm that is already producing at the profit-maximizing quantity will have no incentive to further increase the prices of its products. However, if the merger is between two firms that are close competitors, some of these lost sales might be recaptured by the other firm post-merger. This in turn implies that post-merger, the merged firm will have an increased incentive to increase prices since some of the lost sales from a price increase can now be captured by the other merging

[38] Oxera, "Diversion ratios: why does it matter where customers go if a shop is closed?", 2009.
[39] For some good practices on consumer survey design, see Gunnar Niels, Helen Jenkins and James Kavanagh, *Economics for Competition Lawyers 2nd Edition* (United Kingdom: Oxford University Press, 2016), 316-317.
[40] The diversion ratio from product y to product x (i.e. D_{yx}) may not be symmetric and hence may be different from D_{xy}.
[41] Oxera, "Diversion ratios: why does it matter where customers go if a shop is closed?", 2009.
[42] Joseph Farrell and Carl Shapiro, "Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition", *The B.E. Journal of Theoretical Economics* 10, no. 1, Article 9 (2010).
[43] OECD, "Background note", OECD Roundtable on Market Definition, 2012. Retrieved from http://www.oecd.org/daf/competition/Marketdefinition2012.pdf
[44] The literature on pricing pressure tests is vast and deserves a separate section on its own. We do not however attempt to cover in depth the various tests in this paper, but instead seek to provide an overview of how diversion ratios are used in these tests.
[45] Assuming the products or services follow a downward sloping demand curve.

firm (instead of losing it to other firms in the market). The diversion ratio is used to measure the proportion of lost sales that are captured by the other merging firm. Taken together with the price-cost margin of the substitute product that the lost sales are diverted to, one can perform the price pressure tests and estimate the incentive of the merged firm to raise prices unilaterally post-merger. The higher the diversion ratio (i.e. the more sales that can be recaptured by the other merging firm), and the higher the price-cost margin, the larger the incentive for the merged firm to raise prices after the merger.

35. The three aforementioned pricing pressure tests all require the estimation of diversion ratios. There are also other input requirements and assumptions that are required depending on each test, which is further elaborated upon below.

36. The GUPPI appears to be the simplest test as it is a measure of the upward pricing pressure that arises solely from the closeness of substitution between the products of the merging firms. The GUPPI is derived by multiplying the diversion ratio to and the percentage price-cost margin of one of the products in question. Given the simplicity of the GUPPI, it has been proposed that the GUPPI could be used as a threshold to screen for potential anti-competitive mergers.[46]

37. The UPP is essentially an extension of the GUPPI, such that it takes into account efficiencies generated from the merger. While the concept of upward pricing pressure in the UPP test is similar to that of the GUPPI, the UPP also considers the possibility of downward pricing pressure due to merger-specific cost savings. The UPP essentially asks the question of whether there is any *net* upward pricing pressure arising from the merger.[47] A point to note here is that merger efficiencies are often very difficult to estimate, even for the merging parties. In this regard, it has been proposed that a default efficiency value be used if UPP is used at the initial screening stage, while leaving the detailed estimation of the efficiency gains to a later stage if and when a full analysis is conducted.[48]

38. Finally, the IPR is a form of simplified merger simulation. While the IPR also utilises diversion ratios as one of its inputs, there are several other assumptions that need to be made when performing the IPR test. These include the shape of the demand curve, the definition of margins, that firms price differently in their different stores, that there are no merger efficiencies, that all firms are identical, and that rivals would not respond to the merger.[49] The IPR can be interpreted as a percentage price increase arising from the

[46] Steven C. Salop and Serge Moresi, "Updating the Merger Guidelines: Comments", 2009.
[47] Joseph Farrell and Carl Shapiro, "Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition", *The B.E. Journal of Theoretical Economics* 10, no. 1, Article 9 (2010).
[48] Joseph Farrell and Carl Shapiro, "Upward Pricing Pressure and Critical Loss Analysis: Response", *The CPI Antitrust Journal*, February 2010.
[49] David Parker, "Illustrative Price Rises from Mergers in Differentiated Product Markets", *GCP: The online magazine for global competition policy*, April, 2009. Retrieved from https://www.competitionpolicyinternational.com/assets/0d358061e11f2708ad9d62634c6c40ad/Parker-Apr-09_2_.pdf

merger, and hence can be compared against a threshold percentage for price increases when assessing the unilateral effects of a merger.[50]

3.2.2 Limitations

39. Estimating diversion ratios requires sufficient and accurate price and volume data, which competition authorities may not always possess.[51]. Even if the required raw data is available, it may not be in a form that is easily usable for the estimation of diversion ratios. A significant amount of time may be required to prepare the data in order to derive an estimate of the diversion ratio. The estimation of the diversion ratio is more suited for a process involving an in-depth merger assessment.

40. There are no clear, well established benchmarks of what is considered a "close competitor" when performing a diversion ratio analysis. In this regard, as with the case of the price correlation test, a similar approach would be to compare the estimated diversion ratio with the diversion ratio of products that have been previously established as close substitutes, or with a proxy.[52]

41. Furthermore, price pressure tests are static and do not consider the supply-side responses of rivals to the price changes initiated.[53] The results obtained from price pressure tests would have to be considered together with other forms of qualitative evidence in order to reach a robust conclusion.

42. Finally, the application of diversion ratios (and price pressure tests) have generally been developed for use in situations where firms compete on prices in a differentiated product market and where there are sufficient excess capacities. While diversion ratios (and price pressure tests) can theoretically be applied to assess the unilateral effects arising in situations involving other forms of competition (e.g. firms compete on quantity in a differentiated product market and there are capacity constraints[54]), the

[50] Lear, "Merger screen and the use of price pressure tests", *Lear Competition Note*, February 2013. Retrieved from http://www.learlab.com/wp-content/uploads/2016/03/lcn_merger_screen_price_pressure_test_1360694100.pdf

[51] Jan M. Rybnicek and Laura C. Onken, "A Hedgehog in Fox's Clothing? The Misapplication of GUPPI Analysis", *George Mason Law Review* 23, no. 5 (2016): 1194. In addition to price and volume data, cost data is also required for price pressure tests.

[52] For example, see Case No. COMP/M.6497 – *Hutchinson/Orange*, at paragraphs 188 – 189. In this scenario, the proxy used was the diversion ratio predicted based on the market share of the parties.

[53] Lear, "Merger screen and the use of price pressure tests", *Lear Competition Note*, February 2013. Retrieved from http://www.learlab.com/wp-content/uploads/2016/03/lcn_merger_screen_price_pressure_test_1360694100.pdf; OECD, "Background note", OECD Roundtable on Market Definition, 2012. Retrieved from http://www.oecd.org/daf/competition/Marketdefinition2012.pdf

[54] In the case of quantity competition with homogeneous products, there is a positive relationship between market power (as measured by the Lerner index) and market shares. For a given price elasticity of demand, market shares and concentration-based tools are useful to provide an indication of the extent of competition in the market. Where there is the presence of excess capacity, a closer examination of which firms have excess capacity is also necessary to accurately assess the competitive dynamics of the market. See further OECD, "Background note", OECD Roundtable on Market Definition, 2012. Retrieved from http://www.oecd.org/daf/competition/Marketdefinition2012.pdf

methodology would have to be modified to take into account the price diversion ratios instead of quantity diversion ratios.[55]

43. In this regard, akin to the price co-movement analysis, it may be prudent to consider the market structure and state of competition in the market so that the diversion ratio or price pressure analysis can be applied appropriately.

Section 4: Application to CCCS's competition assessment framework

44. In this section, we turn to look at how the above quantitative closeness of rivaly analyses can be applied to CCCS's competition assessment framework.

4.1 Market definition

45. Like many other competition authorities, CCCS considers market definition, which is carried out using the HMT[56], to be a key step in its framework for competition assessment.[57] In defining the relevant product market, CCCS takes into account both demand-side and supply-side substitutability to determine which products are considered to be close substitutes to the focal product.

46. On the demand-side, one specific type of evidence that may be considered by CCCS is the pattern in price changes.[58] CCCS recognises that the prices need not be similar for products to be considered in the same market, as quality differences may render differences in prices.[59] In this regard, both the price correlation and stationarity tests, as discussed in the previous sections, appear to be relevant and applicable tools in examining whether two products are close substitutes and whether they may belong in the same relevant market.

47. The *CCCS Guidelines on Market Definition* also indicate that evidence on substitution could be in the form of how buyers rank particular products.[60] As noted previously, both the price co-movement analysis and diversion ratio analysis can be used to rank the closeness of substitute products, although diversion ratios may be more suitable and accurate (from the buyers' perspective) in ranking substitute products.

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[55] See Serge Moresi, "The Use of Upward Price Pressure Indices in Merger Analysis", The Antitrust Source, American Bar Association, February 2010. Retrieved from https://www.americanbar.org/content/dam/aba/publishing/antitrust_source/Feb10_Moresi2_25f.authcheckdam.pdf; and "Cournot Competition and The UPP Test", HMG Review Project, Comment, Project No. P092900. Retrieved from https://www.ftc.gov/sites/default/files/documents/public_comments/horizontal -merger-guidelines-review-project-545095-00036/545095-00036.pdf.
[56] Paragraph 2.2 of the *CCCS Guidelines on Market Definition*.
[57] Paragraph 1.6 of the *CCCS Guidelines on Market Definition*.
[58] Paragraph 3.9 of the *CCCS Guidelines on Market Definition.*
[59] Paragraph 3.5 of the *CCCS Guidelines on Market Definition.*
[60] Paragraph 3.7 of the *CCCS Guidelines on Market Definition.*

48. In addition, own or cross price elasticities of demand, which are closely related to diversion ratios, could also inform an assessment of the extent of demand substitution.[61] With specific information (e.g. quantity demanded of products in question), the own or cross price elasticities of the products can be derived from the diversion ratio between two products, and vice versa.[62]

49. Price co-movement analysis and diversion ratio analysis can also be used to explore the strength of the chains of substitution, if any. This can provide a better indication of whether the products in the chain are close enough substitutes to be considered in the same relevant product market.

50. Finally, CCCS uses the same competition assessment framework in determining the relevant geographic market, and as such, the price co-movement analysis and diversion ratio analysis can also be applied when CCCS is defining the relevant geographic market.[63]

4.1.1 Assessment of market power

51. It should be noted that market definition, though crucial, is only an intermediate step in CCCS's competition assessment framework. Market definition sets out the perimeters within which further analysis can be conducted on the competitive constraints acting on a seller of a given product. Market definition is usually followed by an assessment of market shares to provide a quick indication of whether an agreement will likely have an appreciable adverse effect on competition or whether an undertaking has substantial market power.[64]

52. Where the relevant market comprises products that are differentiated, undertakings with relatively low market shares can have market power because other products in the markets are not close substitutes.[65] In this regard, price co-movement analysis and diversion ratio analysis can be used to measure whether other products are close substitutes to the focal product. This in turn provides a sense of the extent to which the supplier of the focal product is competitively constrained in the market.

4.2 Merger assessment

53. In merger assessments, CCCS is concerned with whether the merger would result in a substantial lessening of competition ("SLC") in a market in Singapore. In essence, the

[61] Paragraph 3.9 of the *CCCS Guidelines on Market Definition*. For further information on the application of demand elasticities in antitrust analysis, see Gregory J. Werden, "Demand elasticities in Antitrust Analysis", *Antitrust Law Journal* 66, no. 2 (1998): 363-414.
[62] For a formula of diversion ratios containing own and cross price elasticities, see Oxera, "Diversion ratios: why does it matter where customers go if a shop is closed?", 2009.
[63] Paragraph 4 of the *CCCS Guidelines on Market Definition.*
[64] Paragraph 1.7 of the *CCCS Guidelines on Market Definition.*
[65] Paragraph 9.4 of Annex B of the *CCCS Guidelines on the Section 34 Prohibition 2016;* and paragraph 9.4 of Annex A of the *CCCS Guidelines on the Section 47 Prohibition 2016.*

focus of CCCS's assessment is on how the competitive constraints on the merger parties and their competitors might change as a result of the merger.[66]

4.2.1 Market definition

54. The market definition exercise in merger assessments focuses attention on the areas of overlap in the merger parties' activities and is helpful in identifying the extent of immediate competitive interaction between the merging parties' products.[67] In this context, price co-movement analysis and diversion ratio analysis fine tune the market definition process as they can provide an indication of the extent to which the overlapping products are close substitutes and whether other products are close substitutes to the overlapping products provided by the merging parties. The use of the price co-movement analysis and diversion ratio analysis for market definition is similar to that as described in section 4.1 above.

4.2.2 Addressing the shortcomings of market shares and concentration based assessment

55. Market definition and market concentrations may not portray a full picture of the state and dynamics of competition in a differentiated products market. In such situations, diversion ratios[68] can be estimated to directly assess the competitive dynamics between the merging parties and other competitors in the market.

56. For instance, the diversion ratios between the two merging parties' products may be significantly higher than the diversion ratios to competitors' products despite the merged entity having a small post-merger market share. This would imply that the merging parties are each other's closest competitor and that post-merger, none of the others competitors' products may be able to act as an effective competitive constraint on the merged entity's products. In this case, there could be competition concerns even though the merged entity does not have a high market share.

57. Conversely, if the diversion ratios to competitors' products are significantly higher than the diversion ratios between the merging parties' products, it may mean that the merged entity will still face significant competitive constraints post-merger, even if it has a high market share.

4.2.3 Assessment of non-coordinated and coordinated effects

58. CCCS takes into account the closeness of competition when assessing non-coordinated effects.[69] Both price co-movement analysis and diversion ratio analysis can provide an indication of the extent that the merging parties are close rivals. In particular, diversion ratios can provide an indication of whether the merging parties' products are each other's next best substitute, which can be especially illuminating in the context of a market with differentiated products.

[66] Paragraph 5.1 of the *CCCS Guidelines on the Substantive Assessment of Mergers 2016.*
[67] Paragraph 5.5 of the *CCCS Guidelines on the Substantive Assessment of Mergers 2016.*
[68] Diversion ratios may not be symmetric, therefore we should calculate the diversion ratio for both directions (i.e. from product 1 to product 2, and a separate one for product 2 to product 1).
[69] Paragraphs 5.19 to 5.21 of the *CCCS Guidelines on the Substantive Assessment of Mergers 2016.*

59. The diversion ratios can then be further used in price pressure tests (as described in paragraphs 33 to 38) to provide insight into the incentives of the merging firms to increase prices post-merger.[70]

60. In the context of coordinated effects, the removal of a particularly aggressive or destabilising competitor may make coordinated behaviour more likely.[71] In this regard, diversion ratio analysis can similarly provide insight into the intensity of competition between merging parties, and whether the merger may result in the removal of an aggressive competitor.

4.3 Case examples

61. There are also recent case examples which further shed light on how these tools may be used by CCCS in its assessment. In assessing the proposed acquisition by Wilhelmsen Maritime Services ("WMS") of Drew Marine Technical Solutions ("DMTS"), CCCS reviewed a diversion analysis that was submitted by WMS to support its view that the merger parties were not close competitors. CCCS assessed the analysis, including the methodology and assumptions used, and did not find the analysis to be compelling evidence to support WMS's claims. In this regard, the diversion analysis submitted was based on sales to individual vessels that were lost by one merger party, and the percentage of such lost sales that were won by the other.[72] However, CCCS assessed that there were gaps and limitations in the diversion analysis. For example, the analysis likely over-included certain vessels amongst the "lost sales", when demand from these vessels may have been removed from the market. Further, CCCS also assessed that the methodology in respect of when a sale is regarded as "won" by the other party (i.e. only if the other Party has sales in the subsequent year(s) of the analysis) is also limited, as it inherently would not pick up sales that are lost by one party and won by the other party within the span of the same calendar year. CCCS made a provisional finding that WMS and DMTS were each other's closest competitor based on other evidence, including CCCS's analysis of win/loss data based on the Parties' contemporaneous internal records of customer sales opportunities won and lost.[73]

62. CCCS also assessed the use of the diversion ratios and price pressure test in the investigation into the unnotified merger between Grab and Uber.[74] A variant of the GUPPI test was submitted by the merger parties as evidence that it was unlikely that Grab and Uber would have the level of margins required for there to be a GUPPI of

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[70] Paragraph 5.26 of the *CCCS Guidelines on the Substantive Assessment of Mergers 2016.*

[71] Paragraph 5.36 of the *CCCS Guidelines on the Substantive Assessment of Mergers 2016.*

[72] In the analysis submitted by WMS, a sale is regarded as lost if there were sales made by only one of the merger parties to a vessel in the first year, but no sales made at all in the subsequent year(s) considered in the analysis. A sale is regarded as won by the other merger party if that party has sales in the subsequent year(s) of the analysis to a vessel that the first merger party lost entirely.

[73] CCCS's media release in relation to the proposed acquisition by WMS of DMTS dated 25 May 2018. The Media Release can be accessed here: https://www.cccs.gov.sg/media-and-consultation/newsroom/media-releases/wms-dmts-proposed-merger-provisional-decision-issued

[74] CCCS's Infingement Decision against Grab and Uber dated 24 September 2018. The Infringement Decision can be retrieved from CCCS's public register page here: https://www.cccs.gov.sg/public-register-and-consultation/public-consultation-items/uber-grab-merger?type=public_register

10%.[75] In CCCS's decision, CCCS highlighted that the GUPPI test was more relevant for estimating the effects of an anticipated merger, as compared to a completed merger (which was the case between Grab and Uber) where actual evidence of the effects would carry more weight in its assessment. CCCS also considered that the diversion ratios that were used in the GUPPI test were not likely to be accurate[76], which could have skewed the results of the GUPPI test. In addition, CCCS considered the dynamics of the market that Grab and Uber operated in (i.e. a platform market), and assessed that the GUPPI analysis understated the extent of the upward pricing pressure as it did not sufficiently take into account the indirect network effects in such markets.

Section 5: Conclusion

63. In this paper, we have explored how price co-movement analysis and diversion ratio analysis can be used to assess the closeness of rivalry between two firms offering differentiated products. While useful, we recognise that evidence resulting from use of quantitative analysis should not be taken as conclusive. Rather, these quantitative tools can be used, where appropriate, to strengthen and improve the competition assessment undertaken by competition authorities.

64. As discussed above, the price co-movement and diversion ratio analyses bear direct relevance to market definition and the assessment of mergers, and the usage of these tools are in line with CCCS's guidelines and assessment framework. Recent case examples also highlight the increasing relevance of such quantitative tools, and how they can be appropriately utilised in CCCS's competition assessment.

[75] The parties' historical negative margins prevented them from using the conventional GUPPI test. The variant of the GUPPI test estimated how high margins would have to be over the long run, given the estimated diversion ratios, for the GUPPI to reach a level of concern.

[76] The diversion ratios were obtained from a consumer survey commissioned by Uber. CCCS was of the view that the survey suffers from consistency/design issues and is likely to have understated the true degree of substitution between Uber and Grab.