



## **COULD POLITICIANS BE MORE RIGHT THAN ECONOMISTS? A THEORY OF MERGER STANDARDS**

**by**

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### *Abstract*

Most large competition authorities are required to appraise a merger proposal on the basis of its impact on consumer welfare. This is in opposition to the economist's classic recommendation to include profits in the social evaluation. This paper shows that the latter total welfare standard is generally sub-optimal because firms have an advantage in proposing mergers. Where alternative merger opportunities are available, the consumer welfare standard can achieve higher total welfare. The conditions for this are more likely to be satisfied in large, complex or internationally integrated economies.

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## 1. Introduction

By what standard should a competition authority judge a horizontal merger? Most economists naturally adopt the criterion of total welfare, which weights the welfare of all members of society equally, including both producers and consumers.<sup>1</sup> The important implication is that a loss of consumer surplus due to higher prices or lower quality can be compensated by a bigger increase in producer profits. The classic statement of this potential trade-off is set out in Williamson (1968). We refer to this as the *total welfare standard (TWS)*. Yet most major competition authorities operate under legislation and guidelines that reject this standard, and no major competition authority seems to apply it consistently. Instead, they overwhelmingly focus on consumers, including industrial customers, to the exclusion of the welfare of merging firms.

Efficiency gains are crucial for horizontal merger appraisal. In their absence, any expected increase in market power reduces both consumer welfare and total welfare. Under the TWS, efficiency gains benefit firms and, insofar as they are passed on in lower prices or higher quality, also their customers. Both are equally valued. Under the *consumer welfare standard (CWS)*, the competition authority takes into account only those benefits passed on to consumers. For example, marginal costs must fall sufficiently for equilibrium prices to be no higher than before the merger. The treatment of efficiency gains is, therefore, an acid test in understanding the welfare standard being applied by a competition authority.

The USA prohibits any acquisition, the effect of which “may be substantially to lessen competition, or to tend to create a monopoly” (Clayton Act #7, 1914). This is referred to as the SLC test, and interpreted as “whether the merger is likely to create or enhance market power or to facilitate its exercise” (US Merger Guidelines, 1997). The efficiencies section of the Guidelines has been changed repeatedly. The 1992 version states ‘Some mergers that the

Agency otherwise might challenge may be reasonably necessary to achieve significant net efficiencies' [section 4]. This seems to suggest that producer benefits may be set against consumer losses from a merger. However, this clause found resistance in the courts (see Posner for a sceptical view as early as 1976, and White (1989) for an example), and the Guidelines were revised in 1997. This latest version is a clear statement of the CWS: 'the Agency considers whether cognizable efficiencies likely would be sufficient to reverse the merger's potential to harm consumers in the relevant market, e.g., by preventing price increases in that market'.

The European Communities Merger Regulation (1989) prohibits the creation of a dominant position. The latter is not defined, but the European Court has interpreted it as 'the power to behave to an appreciable extent independently of its competitors, customers and ultimately of consumers' (Case 27/76, *United Brands v EC Commission*, 1978). For a merger to be allowed, efficiencies generated by the merger must be at least sufficient to offset any threat of market dominance. The Commission is required to take into account 'the development of technical and economic progress *provided that it is to consumers' advantage* and does not form an obstacle to competition' [Art.2.1(b), italics added]. In practice, this is interpreted as a requirement to apply the CWS.<sup>2,3</sup>

Thus, the world's two largest economies both apply the CWS to merger appraisal, and they are not alone. Japan's Act Concerning the Prohibition of Private Monopolization and Maintenance of Fair Trade (1947) follows the US SLC wording, and its 1998 Merger

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<sup>1</sup> Consumers are individuals who also hold shares in firms, possibly indirectly through pension funds, etc. Furthermore, any undesirable income distributions can be dealt with by the tax system, independent of a particular merger decision.

<sup>2</sup> The treatment of mergers echoes a similar principle applied to agreements between firms. The EU's Article 81(3) allows agreements which generate efficiencies *provided* consumers receive 'a fair share of the resulting benefits'. A 'fair share' is not made precise, but this must surely be at least non-negative, and it is a clear statement of the consumer welfare standard.

<sup>3</sup> There is also an important matter of the interpretation of 'does not form an obstacle to competition', and whether or not this includes the welfare of non-merging firms in the industry. Neven, Nuttall and Seabright (1993) highlight some of the confusion in the early years of the Merger Regulation, when there were even signs

Guidelines suggest a similar treatment of efficiencies.<sup>4</sup> The UK currently appraises mergers against a ‘public interest’ test, which in principle could be interpreted as a TWS. In practice, however, at least since the early 1980s, the focus has been on maintaining competition. The 2002 Enterprise Bill currently before Parliament formalises the CWS by adopting the SLC test with an override clause that mergers are acceptable if they bring relevant consumer benefits (i.e. lower prices, higher quality, greater choice or greater innovation).

Only competition authorities in smaller countries have sometimes adopted a less consumer-oriented standard. Canada applies the SLC test unless the merger ‘is likely to bring about gains in efficiency that will be greater than, and will offset, the effects of any prevention or lessening of competition’. At least until recently, this has been interpreted as allowing the possibility of weighing gains against losses, at least approximating the TWS.<sup>5</sup> Australia and New Zealand in principle allow a similar trade-off.<sup>6</sup> We return to international differences later, but meanwhile focus on existing literature analysing the empirical bias in favour of consumer welfare.

There are, of course, many reasons why the political process might have resulted in a consumer standard. These include: voter preference under majority rule (if more people think of themselves as consumers than as recipients of profits); evolution of legislation originally

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of an efficiency offence that low costs will increase the market share of the new entity and so ‘harm’ rival firms. Analysis of this goes beyond the concerns of the present paper.

<sup>4</sup> ‘When improvement of efficiency is deemed likely to stimulate competition (for example, a low-ranking company increase its cost competitiveness, financing capability, raw material procurement ability and other fundamentals through a merger, which leads to lower product prices and higher quality of the goods, and in turn promotes competition with high-ranking companies), these positive impacts are considered’ (p.20).

<sup>5</sup> However, the Propane case (appealed in 2001) has substantially undermined this claim. At least when the threat to competition is large, it appears that an efficiencies trade-off will not be allowed.

<sup>6</sup> Australia applies the SLC test (#50 Trade Practices Act 1974), except that an authorisation may be granted if it ‘would be likely to result in such a benefit to the public that the acquisition should be allowed to take place’ (#90.9). Benefits explicitly include competitiveness and trade, but could be anything and so this might be interpreted as a TWS. The authorisation procedure switches the onus of proof from the competition authority (ACCC) onto the merging firms who must formally apply for an authorisation. It also makes the trade-off explicit and public (and is rarely taken up by firms). New Zealand has a similar approach to mergers. It is also interesting to note that smaller European countries, such as Sweden and Finland, have complained about the EU’s DG Competition blocking domestic mergers which an individual member state considers important for international competitiveness, even though the merger could well harm its own domestic consumers. I return to the significance of nation size in the concluding section.

targeting different goals (e.g. conserving small firms for social reasons); national indifference to foreign owners; second-best counter-balance to trade protection lobbyists; imposition by a foreign power; and random historical events. However, although they may explain how some countries arrived at the CWS, they are not compelling reasons to maintain it.

The economic literature on the consumer welfare ‘bias’ in merger policy is quite small, and has focused on three issues: information advantages of firms; lobbying advantages of firms; and ease of investigation. Besanko and Spulber (1993) suggest that greater weight should be attached to consumer welfare to counter-balance the asymmetric information advantages of merging firms vis-à-vis the regulator with respect to cost savings.<sup>7</sup> Neven and Roller (2000) take into account lobbying by merging firms, and the personal benefits this may bring to regulators; they show that raising the weight on consumer surplus can be an appropriate counter-balance to such lobbying. Werden (1996) argues that even with symmetric information, the assessment of a differentiated product merger by the competition authority is made very much easier if there is no trade-off requirement; in particular, a focus on what efficiencies are necessary to preserve current prices eliminates the need to make any strong assumptions about the functional form of demand. Each of these papers provides a strategic economic justification that potentially narrows the gap between the positions of economists and legislators.<sup>8</sup> However, I am not convinced that they provide the most compelling justifications.<sup>9</sup>

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<sup>7</sup> Practitioners are well aware of the difficulties of verifying claims which of their essence must be speculative (see the guidance notes published by almost any competition authority). Also, the authorities require that efficiencies between the merging firms cannot be achieved without the merger. This raises some issues addressed in transaction cost economics and incomplete contract theory relating to the efficient boundaries of the firm, and what can and cannot be achieved by market contracts.

<sup>8</sup> Another possibility is that there needs to be a counterweight to the burden of proof lying with the competition authority.

<sup>9</sup> The simulations in Besanko and Spulber require a very high degree of uncertainty on the part of the authority in order for even a modest bias in favour of consumer surplus to be optimal. Neven and Roller are insufficiently clear about the personal benefits that lobbyists are able to give regulators (e.g. it seems plausible that a regulator who has a reputation for being tough on firms may attract the highest wage offers when he or she chooses to leave the regulator and enter the private sector). Werden’s argument is uncomfortably close to the justification for looking for lost keys under a lamppost because that is the only place where there is any light.

The aim of this paper is to show that the TWS is quite generally a sub-optimal rule and, in plausible cases, the CWS can indirectly result in higher total welfare.<sup>10</sup> This is because the TWS provides a threshold rule, so mergers acceptable to the competition authority need not be the most socially desirable. The essential elements of the argument are as follows. First, mergers generally can have both market power and efficiency effects. A competition authority (CA) can say ‘yes’ or ‘no’ to a merger proposal, but it cannot say who should merge with whom, and it cannot reject an otherwise acceptable merger on the speculation that there might be a socially better alternative that has not yet been proposed. It cannot impose a first best market structure. This gives the firms an advantage when consumer and producer interests are opposed – they will propose only those mergers that maximise the increase in joint profits, subject to the merger being allowed under the regulatory rules. Second, a firm thwarted in its attempt to make its most preferred merger will not abandon its merger ambitions if another partner would still be profitable.<sup>11</sup> While an alternative will be privately inferior, it may be socially superior. This paper investigates the circumstances under which a tough merger standard will lead to a more desirable equilibrium market structure. Is it reasonable to expect that the extreme CWS could be superior to the TWS? And should different countries adopt different standards?

Section 2 introduces the model as a four-stage game, with the final stage being a simple model of spatial price competition. Product differentiation on a circle allows a simple representation of some features that are common in numerous mergers. In particular, there is often the opportunity for mergers to take place between firms operating in either the same or in closely related markets. For example, banks may merge with rivals that have branches on

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<sup>10</sup> Fridolfsson (2001) has independently developed a related idea for capital transfers between two Cournot duopolists, when marginal costs are inversely proportional to capital.

<sup>11</sup> There are plenty of examples where a merger that has been challenged by the CA is dropped by one of the parties, who soon find another partner where the competitive overlap is smaller; e.g. in the UK, when the Lloyds bid for Midland Bank was challenged, HSBC came in with a successful bid for Midland that was not challenged by the OFT.

the same high street or with those with stronger presence in different locations; potential acquisitions by paper manufacturers may have strengths in facial tissue or toilet tissue; targets for efficiencies in the beer industry may have strengths in premium lagers or basic bitters. Section 3 derives the conditions under which the CWS is a better standard than the TWS. This is done first for a single merger, then for a full equilibrium market structure. Section 4 discusses the implications for the choice of merger standard in different economies, and how our results might generalise. Section 5 concludes.

## **2. The Model**

The key ideas of legislative choice, merger proposal, regulatory assessment and competitive effect can be modelled naturally as a four stage game:

1. Legislature (or nature) chooses the assessment standard to be applied by the competition authority
  2. Firm A proposes a merger, possibly also offering some divestiture
  3. Competition authority accepts or rejects the merger according to the legislated standard
- ...Stages 2 and 3 may be repeated until there are no more merger proposals
4. Firms compete in the market

*Stage one* can be interpreted in two ways. Either, legislators are cunning rule setters, who understand the full consequences of their actions, and use this knowledge strategically to credibly bind their competition authority. Alternatively, adopting a more sceptical view of legislative abilities and realities, nothing in the analysis changes if we view stage one as random, with the chosen standard resulting from an accident of history, or a consequence of random political pressures. The remaining model then describes each rule's implications.

On either interpretation, it is assumed infeasible to legislate for a complex standard such as a weighted average of consumer surplus and profits. Also, we assume a lightly

regulated economy so the competition authority is required to consider only mergers brought before them by firms. It cannot attempt an activist industrial policy, and each merger must be appraised independently on its own merits.<sup>12</sup> Although a complex standard would not affect the basic argument in this paper, the examples we examine simply compare the TWS with the CWS. Beyond justifying this on the grounds of empirical practice, it is probably neither feasible nor credible to give a weighted objective to the administrators of a competition policy. Legislated weights would inevitably have to be vague, and this invites controversy and apparently random decisions. The result is likely to be extensive use of appeal courts or other forms of judicial review, and may bring merger policy into disrepute. Such arguments favour a simple rule. Furthermore, even if such a rule is not legislated, it is more likely to evolve by the creation of legal precedence than is some complex weight of producer benefits and consumer detriment.

Whether or not we choose to think of legislators as rational optimisers, our evaluation of the alternative rules delegated to the competition authority is based on a social optimum of equal weighted aggregation of consumer surplus and profits. It is important not to confuse this social optimum appraisal of rules that lead to alternative market structures, with the TWS applied to a single merger.

At *stage two*, merging firms are only concerned for their profits, but they must anticipate *stage three* regulatory intervention. This means that, given any costs of being under investigation, there will be no challenge to merger proposals in sub-game perfect equilibrium.<sup>13</sup> A common empirical feature of merger policy is that merging firms with product overlaps will offer the competition authority a divestiture to remedy consequent market power problems, and we allow for this in section 3.2.

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<sup>12</sup> Even without political constraints, while the competition authority may be able to audit efficiency claims proposed by firms, they could not do the initial calculations without the cooperation of the firms (and firms have no incentive to cooperate unless they want to merge).

A detailed specification of product space is necessary in order to derive specific results about competition in *stage four*. We require a product space that provides opportunities for profitable mergers with different welfare impacts, and some mergers should be acceptable under the CWS. These realistic elements are essential to our argument, but are missing from standard, symmetric models of market competition.<sup>14</sup> The following price-setting spatial product differentiation model captures them in a simple way. It also permits the possibility of divestiture as a remedy.

We assume that products are located symmetrically on a circle with a uniform distribution of consumers. Consumers are identical except for location, and a particular customer buys the product  $k^*$  with the lowest delivered price,  $p^k + tx^k$ , where  $p^k$  is price,  $x^k$  is the ‘psychic’ distance between the consumer and product  $k$ , and  $t > 0$  is a ‘transport cost’ parameter measuring the degree of product differentiation. For the product they prefer to buy, consumers have elastic individual demands:  $f(p + tx)$ , with  $f(0) > 0$ ,  $f(v) = 0$ , and  $f'(p + tx) < 0$  for  $0 \leq p + tx < v$ . Elastic individual demand means that total surplus falls if prices rise, so for given product locations and complete market coverage, high prices have an adverse effect on total welfare (unlike in the unit demand model of Salop, 1979). It will sometimes be convenient to illustrate further assumptions with reference to the linear individual demand curve:  $f(.) = v - p - tx$ , where  $v > 0$  is a common preference parameter.

Product specifications are fixed, and there is no entry or exit of products. We fix the number of products at four (labelled A, B, C and D) and allow no product entry or exit.<sup>15</sup> See Figure 1. Firms are owners of products, and can exit or enter by merger or divestiture. Price

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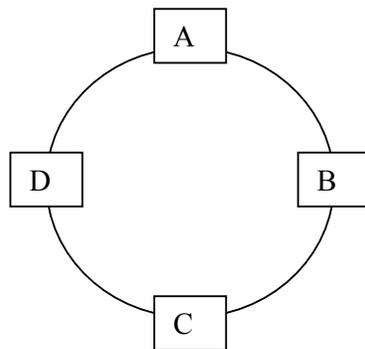
<sup>13</sup> In practice, of course, investigations will be necessary to establish the facts, and there will be uncertainties that result in occasional rejected proposals. These are not considered in this paper.

<sup>14</sup> The homogeneous product model has well known limitations in merger analysis (see Salant et al (1983), Perry and Porter (1985), Farrell and Shapiro (1990) and Kamien and Zhang (1990)). There are strict conditions for mergers to be profitable in Cournot oligopoly. Strategic substitution encourages the expansion of non-merging firms, to the detriment of those who merge. Also, very substantial synergies are necessary if mergers are to pass the CWS, and alternative merger opportunities can only relate to the different capacities or efficiencies of potential partners, not their product range.

discrimination is not possible. There are sufficient products, and low enough transport costs, such that a monopolist would serve all potential consumers. Firms coordinate the pricing of the products they own, and competition between firms is non-cooperative in prices.<sup>16</sup> Each product has an identical cost structure including a fixed cost and constant marginal cost,  $c$ . Cost and demand conditions are common knowledge. Prices are strategic complements.<sup>17</sup> Finally, our comparative statics approach requires a unique equilibrium in prices.

For simplicity, merger efficiencies are assumed only to allow fixed cost savings. Neighbouring product ownership saves  $F > 0$ , and non-neighbouring product ownership saves  $[1-\lambda]F$ , with  $0 < \lambda < 1$ .  $\lambda$  measures the efficiency advantage of a merger with a neighbouring product.<sup>18</sup> Ownership of a third or fourth product saves nothing more.<sup>19</sup> We also assume that transaction costs are such that merger efficiencies cannot be achieved by contract between independent firms. The initial market structure is fragmented into single product firms.

**Figure 1: Simple Product Market on a Circle**



<sup>15</sup> Four is the smallest number necessary to allow alternative mergers in terms of market power. The general results are robust to increasing the number of products.

<sup>16</sup> Levy and Reitzes (1992) argue that there may be a collusion gain from non-neighbouring common ownership (i.e. in our terms, defined below, ‘competitive oligopoly’ or ‘competitive duopoly’), but the balance of arguments is not unambiguous.

<sup>17</sup> This assumption is further discussed in Appendix 1 and section 4. Strategic complementarity is not guaranteed by our earlier assumptions, and if individual demand is linear, neighbouring products become strategic substitutes for sufficiently high  $t$ . For example, if  $v = 10$  and  $c = 4$ , neighbouring products are strategic complements around the competitive equilibrium for all  $t < 23$ , and strategic substitutes for higher  $t$ . The absence of gaps in the monopolised market requires  $t \leq 32$  (this also means there is no kinked equilibrium à la Salop, 1979). The low  $t$  case is the more appropriate for merger analysis because the price raising potential of joint ownership is greater.

<sup>18</sup> Thus, we assume a positive correlation between market power and efficiency savings. A zero or negative correlation ( $\lambda \leq 0$ ) would only sharpen our argument. See Propositions 1 and 2, which continue to apply.

<sup>19</sup> Except that a merger of, say,  $\{A, C\}$  with  $\{B\}$  or  $\{D\}$  would allow an extra  $\lambda F$  savings to be attained.

### 3. Impact of the Welfare Standard on Merger Selection

Section 3.1 considers a single merger proposal by firm A to acquire no more than one other firm. We compare merger  $\{A, B\}$  with  $\{A, C\}$ , and also prices and welfare in more concentrated market structures. Section 3.2 develops the implications of a sequence of mergers that results in an equilibrium market structure.

#### 3.1 *Single Merger*

##### *Stage 4 Price competition*

The price effect of mergers depends on the change in market structure. There are fifteen possible ownership patterns of four products. Eight of these are distinguished only by product labelling, leaving seven substantive market structures which we call: fragmented; oligopoly; competitive oligopoly; duopoly; competitive duopoly; dominant firm; and monopoly. We denote common ownership of products by curly brackets  $\{\}$ . The following lemma shows that Nash equilibrium prices are the same (i.e. monopolistically competitive) in three of these market structures, resulting in five possible price vectors (labelled 1 to 5):

1. Competitive prices result from the following three market structures:

Fragmented structure [1F]:  $\{A\} \{B\} \{C\} \{D\}$ .

Competitive oligopoly [1CO]:  $\{A, C\} \{B\} \{D\}$ ; or  $\{B, D\} \{A\} \{C\}$ .

Competitive duopoly [1CD]:  $\{A, C\} \{B, D\}$ .

2. Oligopoly prices and structure [2O]:  $\{A, B\} \{C\} \{D\}$ ;  $\{A, D\} \{B\} \{C\}$ ;  $\{B, C\} \{A\} \{D\}$ ;  
or  $\{C, D\} \{A\} \{B\}$ .

3. Duopoly prices and structure [3D]:  $\{A, B\} \{C, D\}$ ; or  $\{A, D\} \{B, C\}$ .

4. Dominant firm prices and structure [4DF]:  $\{A, B, C\} \{D\}$ ;  $\{B, C, D\} \{A\}$ ;  $\{A, C, D\} \{B\}$ ;  
 $\{A, B, D\} \{C\}$ .

5. Monopoly prices and structure [5M]: {A, B, C, D}.

Price vectors 1, 3 and 5, are symmetric, with all four products setting the same equilibrium prices. Oligopoly and dominant firm market structures result in asymmetric product price vectors 2 and 4. We adopt the following notation, where brackets are used to denote the number of co-owned products in asymmetric markets:  $p_1$  is the common price for all products in the competitive price vector 1;  $p_2(1)$  is the price charged by single product firms in the oligopolistic price vector;  $p_2(2)$  is the price charged by the two-product oligopolist;  $p_3$  is the duopoly price; and  $p_5$  is the monopoly price. Lemma 1 shows there is a clear and natural ranking of product prices for all the market structures we need to consider.<sup>20</sup>

**Lemma 1:**

- a) If no neighbouring products are co-owned, prices are independent of market structure.
- b)  $p_1 < p_2(1) < p_2(2) < p_3 < p_5$ .

*Proof:* See Appendix 1.

*Stage 3 Assessment by Competition Authority*

The welfare ranking of most market structures follows directly from Lemma 1. Write  $CS_i$  as the consumer surplus resulting from price vector  $i$ , and  $W_i$  as the *gross* welfare (consumer surplus plus profits *exclusive* of any fixed cost savings) resulting from price vector  $i$ .

**Corollary 1:**  $CS_1 > CS_2 > CS_3 > CS_5$  and  $W_1 > W_2 > W_3 > W_5$

Standards for merger appraisal apply to *changes* in welfare expected post-merger. Suppose there were no efficiencies following a merger. Then, the only acceptable mergers would be competitively neutral (e.g. {A, C}). The merger of neighbouring products would not be allowed. The same assessment applies under the TWS and CWS.

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<sup>20</sup> We later make a sufficient assumption to rule out a dominant firm equilibrium.

In the presence of efficiencies, both standards allow  $\{A, C\}$ .  $\{A, B\}$  is never allowed under the CWS because prices rise. Under the TWS, the efficiency defence is invoked if cost savings and higher profits outweigh the loss of consumer surplus. Define  $\Delta_{ij}W$  as the change in total welfare if the vector of product prices changes from  $i$  to  $j$  (so  $\Delta_{ij}W < 0$  for  $j > i$ ). The TWS allows  $\{A, B\}$  if and only if  $F \geq -\Delta_{12}W$ .<sup>21</sup>

*Stage 2 Merger proposal*

Lemma 2 shows that the  $\{A, B\}$  merger is always profitable, despite losing market share and even in the absence of cost savings. The independent firms gain even more, at least before efficiencies are taken into account.<sup>22</sup> This result follows closely on Deneckere and Davidson (1985). Define  $\pi_i(n)$  as the gross profit (excluding fixed costs) of a firm with  $n$  products when the price vector is  $i$ .

**Lemma 2:**  $2\pi_1(1) = \pi_1(2) < \pi_2(2) < 2\pi_2(1) < \pi_3(2) < \frac{1}{2}\pi_5(4)$

*Proof:* see Appendix 1.

Firms *always* prefer  $\{A, B\}$  to  $\{A, C\}$  because of both higher prices and higher cost savings; and they prefer  $\{A, C\}$  to no merger because of some cost savings. Under the CWS, therefore, A proposes  $\{A, C\}$ . If proposals are subject to the TWS, A proposes  $\{A, B\}$  if  $F \geq -\Delta_{12}W$ , and  $\{A, C\}$  otherwise.

*Stage 1 Optimal standard*

Neither standard achieves unambiguously higher total welfare, because  $\{A, C\}$  is socially preferable if  $\lambda$  is sufficiently small. More precisely:

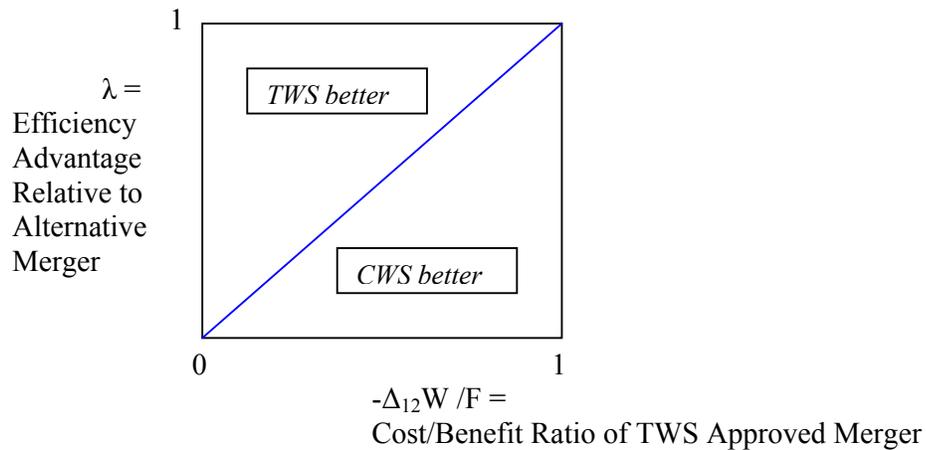
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<sup>21</sup> Under neither standard does the authority have to estimate  $\lambda$ . This is fortunate, because it might be an almost impossible task, given the hypothetical nature of the alternative merger at the time of appraisal, and the incentive for the firms to claim  $\lambda$  is large in order for the more profitable  $\{A, B\}$  merger to be allowed.

<sup>22</sup> This does not matter at this stage since we are only comparing alternative mergers.

**Proposition 1:** Define  $\lambda^* = -\Delta_{12}W / F$ . Both standards rightly reject merger  $\{A, B\}$  when  $\lambda^* > 1$ . The TWS sub-optimally allows  $\{A, B\}$  when  $1 > \lambda^* > \lambda$ . The CWS sub-optimally rejects  $\{A, B\}$  when  $\lambda > \lambda^*$ .

**Figure 2**      **Relative Merits of Alternative Standards With a Single Merger**



Proposition 1 is summarized in a simple diagram, Figure 2, which will be useful to develop in the next section. The unit square represents all parameter values for which the TWS would accept a merger to oligopoly. The CWS rejects all such mergers, in which case A merges to competitive oligopoly.  $\lambda^*$  is the diagonal. The CWS is ‘better’ below the diagonal, which is to say it achieves higher total welfare than under the TWS. This is where the alternative merger sacrifices fewer efficiencies and the welfare cost of oligopoly is higher relative to efficiencies.

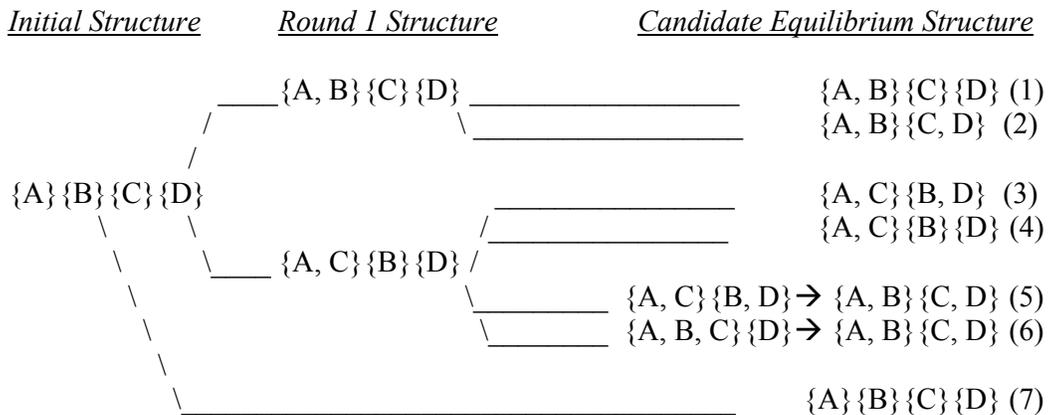
### **3.2 Equilibrium Market Structure**

Next, allow stages 2 and 3 of the game to be repeated until no more proposals are made. An equilibrium market structure is constrained only by the profit motive and the intervention of competition policy. Even with just four products, there are numerous sequences of potential

mergers once we allow divestiture. We take a number of steps to focus on the most interesting of these. We assume there are transaction costs associated with merger and divestiture. To focus on the central issues, we assume these are not sufficient to reverse any welfare or profit rankings, but are relevant in otherwise equivalent cases. Transaction costs allow us immediately to eliminate ‘circular’ mergers that would recreate an earlier market structure. We also rule out merger paths that are obviously unprofitable (i.e. lead to a less profitable market structure). To avoid repetition, we do not consider merger paths that differ only in the labelling of products. Mergers are proposed sequentially, with the first proposal being made by A. Finally, for simplicity we assume  $\lambda < -\Delta_{14}W / F$ , which is sufficient to eliminate a dominant firm market structure as an equilibrium.

In Appendix 2, we show that the remaining set of candidate equilibrium merger paths that might be allowed under the TWS can be restricted to those in Figure 3. These are numbered for future reference. Arrows signify divestitures as part of a merger proposal. Table 1 summarises the relevant considerations for which mergers would be allowed, and their ultimate welfare consequences.

**Figure 3 Mergers That Might Be Allowed Under the TWS**



**Table 1: Potential Merger Paths Under the TWS**

	<i>Structure Following Second Merger</i>	<i>Mergers Allowed Under TWS If</i>	<i>Welfare Change Due to Mergers</i>
1	{A, B} {C} {D}	$-\Delta_{12}W / F < 1$	$F + \Delta_{12}W$
2	{A, B} {C, D}	$-\Delta_{12}W / F < 1$ and $-\Delta_{23}W / F < 1$	$2F + \Delta_{13}W$
3	{A, C} {B, D}	<i>always</i>	$2(1 - \lambda)F$
4	{A, C} {B} {D}	<i>always</i>	$(1 - \lambda)F$
5	{A, C} {B, D} → {A, B} {C, D}	$-\Delta_{13}W / F < (1+\lambda)$	$2F + \Delta_{13}W$
6	{A, B, C} {D} → {A, B} {C, D}	$-\Delta_{13}W / F < (1+\lambda)$	$2F + \Delta_{13}W$
7	{A} {B} {C} {D}	<i>always</i>	0

Merger paths (5) and (6) indicate indirect paths to duopoly. The interest in these product swap and divestiture sequences is that they might allow a merger to duopoly that would be disallowed if the first merger were directly {A, B}. Merger path (2) requires two regulatory hurdles:  $F \geq -\Delta_{12}W$ ; and  $F \geq -\Delta_{23}W$ . While the sum of these is easier to satisfy than for the indirect path (5), there may be a strategic advantage in the latter. This holds: if  $-\Delta_{12}W$  is much larger than  $-\Delta_{23}W$  or *vice versa*, so that one step in the sequential strategy falls at the regulatory assessment; and  $[1+\lambda]F \geq -\Delta_{13}W$ , so that the indirect route clears the regulatory hurdle.

The equilibrium market structure subject to CWS scrutiny is always a competitive duopoly: {A, C} and {B, D}. These are the only allowable mergers, and both are profitable. As compared with the initial structure, there are social gains of  $2[1-\lambda]F$ .

The TWS permits a wider range of potential equilibrium structures, depending on the underlying parameters that determine the deadweight welfare costs of higher prices. Which of the TWS acceptable paths will be chosen depends on the profit of the firm proposing the merger. To determine this, we adopt the following two principles:

1. Firms always agree privately profitable mergers (i.e. where joint profits increase), and propose the most profitable mergers that are allowed.
2. If two or more parties are essential to a merger path, possibly including being partners in a divestment deal, then all parties get shares of the gains from that merger path proportional to the products they contribute.

Principle 1 means that only privately profitable mergers are agreed, and if there is a profitable opportunity, it will be agreed even if non-merging firms gain more from the deal (i.e. there is no holdout). Principle 2 imposes a particular form of symmetry. Merger proposals are sequential and, without loss of generality, we assume firm A (the original owner of product A) can make the first merger proposal. For the structures identified in Figure 3, applying these principles of bargaining gives us Lemma 3 (proof in Appendix 2).<sup>23</sup>

***Lemma 3:***

- a) Firm A ranks the alternative merger paths in Figure 3 in the following order of preference:  $(2) > (5) = (6) > (1) > (3) > (7)$
- b) All firms involved in later mergers rank the alternative merger paths in the following order:  $(2) > (1)$  and  $(5) = (6) > (3) > (4) = (7)$

It remains to find the subgame perfect equilibrium of the merger game, which depends on: the details of welfare and efficiency effects, which restrict the set of feasible paths; and relative profits, which affect merger choice in the feasible set. Only merger paths (4) and (7) are dominated, and could never be an equilibrium. The following proposition follows directly from Table 1 and Lemma 3.

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<sup>23</sup> More general assumptions about merger agreements would not result in such a clear ranking of the private profitability of alternative merger paths. This would lead to additional profit restrictions in Proposition 2, and would complicate matters without adding new insights. Also, at least for  $\pi_2(2) - 2\pi_2(1) + F > 0$ , Lemma 3 holds for a range of strategic bargaining models.

**Proposition 2:**

1. Under the CWS, the equilibrium market structure is always *competitive duopoly*.
2. If  $-\Delta_{12}W / F > 1$  and  $-\Delta_{13}W / F > 1 + \lambda$ , the TWS equilibrium market structure is *competitive duopoly*; and the two merger standards are equivalent.

If  $-\Delta_{12}W / F < 1$ ,  $-\Delta_{23}W / F > 1$ , and  $-\Delta_{13}W / F > 1 + \lambda$ , the TWS equilibrium is *oligopoly*; and the CWS achieves higher total welfare than the TWS if and only if  $2\lambda - 1 < -\Delta_{12}W / F$ .

If  $-\Delta_{12}W / F < 1$  and  $-\Delta_{23}W / F < 1$ , the TWS equilibrium is *direct merger to duopoly*; and the CWS achieves higher welfare if and only if  $\lambda < -\Delta_{13}W / 2F$ .

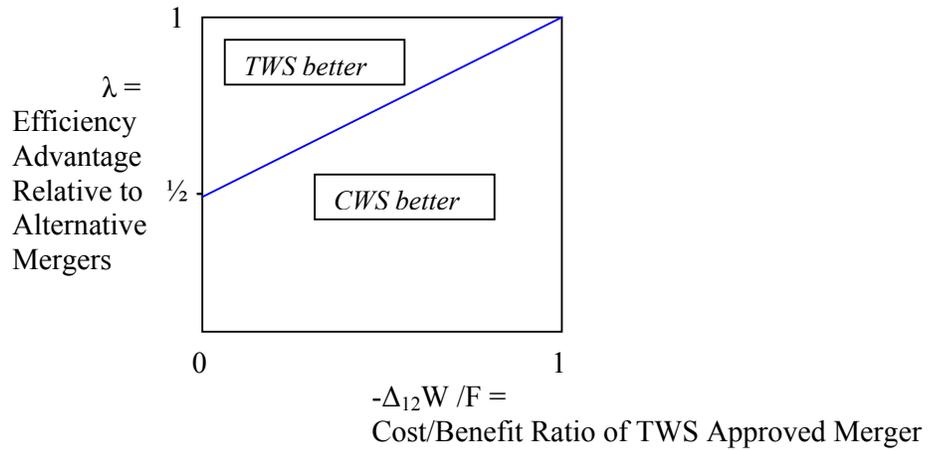
If  $-\Delta_{13}W / F < 1 + \lambda$ , and either  $-\Delta_{12}W / F < 1$  and  $-\Delta_{23}W / F > 1$ , or the latter two inequalities are reversed, the TWS equilibrium is merger to *duopoly by an indirect path*; the CWS achieves higher welfare if and only if  $\lambda < -\Delta_{13}W / 2F$ .

Figures 4, 5 and 6 illustrate the welfare implications of the second part of Proposition 2. Figure 4 shows how ‘long-term’ equilibrium market structure considerations can extend the range of parameter values for which the CWS is better than the TWS. The TWS works badly when the equilibrium structure is oligopoly because an early merger blocks a competitive duopoly that would have more firms achieving economies. In effect, the first merger ‘buys’ the maximum allowable market power in the industry, and thwarts other firms from achieving efficiency through merger. Note that the market is less concentrated as well as less competitive in this oligopoly case than in the CWS equilibrium structure.

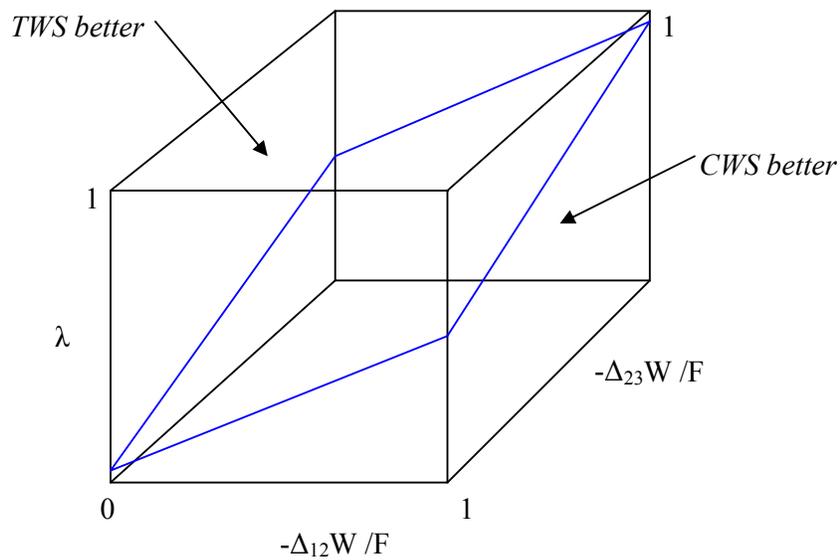
The direct sequence of mergers to duopoly (path 2) is shown in Figure 5, which is a three-dimensional, two-merger version of Figure 2. The unit cube represents the set of TWS acceptable mergers, and the TWS performs better than the CWS above the diagonal plane. If the welfare impact of the second merger is small (i.e.  $-\Delta_{23}W / F$  is close to zero), then the nearest face of the cube shows that the TWS is more likely to be better than under the single merger case. However, if the second merger would only marginally pass the TWS (i.e. –

$\Delta_{23}W / F$  is close to one), then the far face of the cube shows that the range of parameters for which the TWS is superior is much compressed. This is a natural continuation of the oligopoly case in Figure 4 (which arises when  $-\Delta_{23}W / F$  exceeds one).

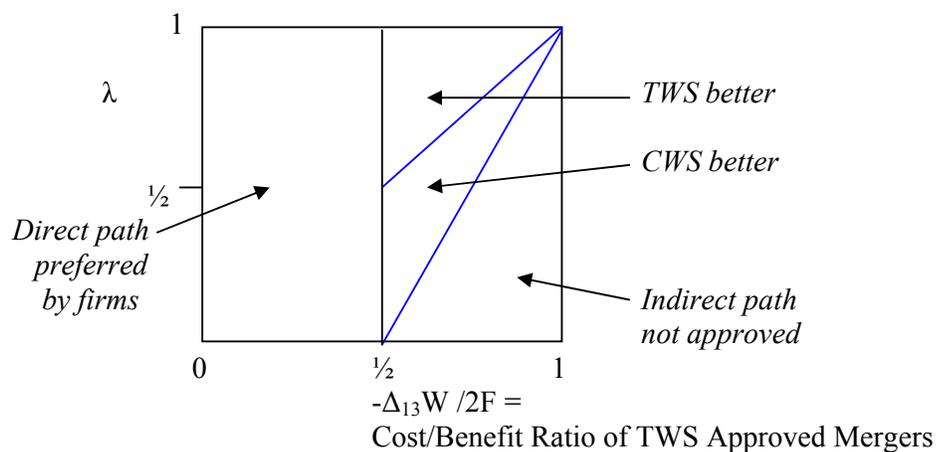
**Figure 4** Relative Merits of Alternative Standards When TWS Equilibrium Structure is Oligopoly



**Figure 5** Relative Merits of Alternative Standards When TWS Equilibrium Structure is Duopoly By Merger Path (2)



**Figure 6** Relative Merits of Alternative Standards When TWS Equilibrium Structure is Duopoly By Merger Path (5) or (6)



The indirect paths to duopoly (5 or 6) differ from the direct sequence in that there is a single regulatory hurdle. The set of TWS acceptable mergers is no longer the entire square: the bottom right triangle in Figure 6 does not satisfy the TWS merger criterion, so these parameter configurations do not allow an indirect path to duopoly. Also,  $-\Delta_{13}W / 2F > 1/2$  because  $-\Delta_{13}W / 2F = 1/2 (-\Delta_{12}W / F) + 1/2 (-\Delta_{23}W / F)$  and one of the terms in brackets must exceed one for the indirect path to be preferred by the firms (the direct path to duopoly avoids extra transaction costs). Consequently, the set of parameter values that might support the indirect route is relatively limited. Although the indirect path is an equilibrium only when the cost-benefit ratio is high, the TWS compares reasonably well with the CWS because the opportunity cost of one alternative merger is taken into account in this appraisal – only the marginal efficiency gains from {A, C} enter the competition authority’s assessment. Note, however, that the welfare attractions of this strategy are undermined by the transaction costs associated with divestiture.

## 4. Discussion

### *4.1 Implications For When The CWS Is Better Than The TWS*

Given the requirement that an economy must adopt a universal standard for merger appraisal, this very simple model suggests a number of conditions that would have to be widespread in an economy before the CWS could be considered the better standard to maximize total welfare. In general, there needs to be a range of alternative merger opportunities, some of which can attain a significant part of the efficiencies but without the market power side effects associated with privately preferred mergers. This is most likely in large, complex economies, or in sectors that allow efficiencies to be achieved through international (national) ownership while markets remain national (local).

More specific results are that the CWS is better for total welfare when:

- The most profitable mergers are also those with a high cost/benefit ratio,  $-\Delta W_{ij}/F$ , which is not quite large enough for the TWS to block the merger.
- There is a low efficiency advantage of privately most profitable mergers over alternatives with lesser market power implications,  $\lambda$ .<sup>24</sup>
- The second merger has a more adverse effect on market power than the first,  $-\Delta_{23}W > -\Delta_{12}W$ , because this can result in an oligopoly or a marginally acceptable duopoly, both of which block a greater number of socially preferred mergers. This condition seems natural for two reasons. Firstly, moving outside the present model, more market power generally arises when moving from 3 to 2 firms than from 4 to 3, so a bigger average price rise is likely to result when moving from price vector 2 to 3 than from price vector 1 to 2. Secondly, for any

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<sup>24</sup> If  $\lambda < 0$ , so neighbouring products have less efficiency gains than non-neighbours, firms may still prefer the low efficiency merger with higher market power. The CWS would dominate in achieving higher total welfare because a doubly inefficient merger could still pass the TWS.

given slope of demand curve and price increment, the deadweight loss is greater the higher the initial wedge between price and marginal cost.<sup>25</sup>

- There are more firms in the market. If there are only two firms, the TWS is always superior because the proposed merger has no alternatives. Where there are four firms, as in our simple model, there are more opportunities for socially preferable, though privately less profitable, mergers.
- Merger assessment is early in the evolution of market structure, so that alternative opportunities to achieve efficiencies still exist and are not blocked by privately preferred earlier mergers.<sup>26</sup>

#### ***4.2 Alternative Product Spaces***

In markets where all products are substitutes to some extent, any positive cross-price elasticity between products controlled by merging firms would fail the strict CWS (in the absence of a merger-specific reduction in marginal costs). However, in practical competition policy, the wording and application of the CWS is not as absolute as is modelled here: a merger should not lessen competition ‘substantially’ or ‘significantly’. This leaves room for some mergers that would not pass a literal CWS; for example, mergers between small firms in a homogeneous product market even when marginal costs are not expected to change, or between larger firms whose products are only marginal substitutes.<sup>27</sup> The courts are not likely to disapprove of a price rise that is predicted to be no more than, say 1%. In practice,

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<sup>25</sup> Individual demand curves have to be very convex to outweigh this.

<sup>26</sup> Suppose the legislators were introducing a merger standard only after the first merger in our section 3 example. If that first merger was {A, B}, the TWS would be appropriate for appraising {C, D}. Starting from {A, C}, the considerations in Figure 6 apply. These are exactly the two situations where the TWS compares best with the CWS.

<sup>27</sup> The SSNIP test is the yardstick for market definition by CAs all over the world. This involves asking the conceptual question of whether a monopolist of all products in a proposed market would find it profitable to impose a small but significant non-transitory increase in price over the current level. ‘Small but significant’ is usually interpreted as 5-10%. Although not a tolerance level for price increases, it does mean that marginally substitutable products are unlikely to be defined as in the same market, and so mergers between such products will be allowed under the CWS.

therefore, the gap between the CWS and the TWS is less than is characterised by the analytical model in this paper. This softens the edge of the CWS and widens the range of situations for which it serves social welfare better than the TWS. The essential ingredient of the argument presented in this paper is that firms often have alternative merger opportunities, with differential effects on market power.

Analytically, recent econometric models of merger in differentiated product industries allow for asymmetric products, and would provide a useful basis for testing the robustness of the strategic advantage of the CWS.<sup>28</sup> Asymmetries in merger opportunities can also be introduced on the cost side. For example, Fridolfsson (2001) develops the Perry-Porter (1985) cost structure where two firms producing homogeneous products have different marginal costs due to different endowments of transferable capital. He finds that if the smaller firm starts with assets in a well defined range, the CWS can induce unequal sized firms to transfer assets to become a symmetric duopoly. Total welfare can then be higher than under the TWS, which would allow monopoly in the same parameter range. Thus, cost asymmetries complement our analysis of product competition asymmetries. In both cases, the CWS can direct firms towards a less profitable, but socially preferable merger.

The assumption of strategic complementarity simplifies the analysis and presentation of the basic argument. First, it provides the price ranking in Lemma 1b, from which the unambiguous welfare corollary is derived. With strategic substitution, neither ranking is guaranteed in the asymmetric oligopoly market structure, though the rankings are preserved in symmetric structures. Second, Lemma 2 would not necessarily hold for oligopoly, and the incentive to merge is much reduced, because independent products free ride to a greater extent. This might be thought to limit the value of the CWS in flushing out the most socially desirable mergers, because the incentives to merge could already be suboptimal. However,

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<sup>28</sup> e.g. Baker and Breshahan (1985), Hausman and Leonard (1997), Nevo (2000).

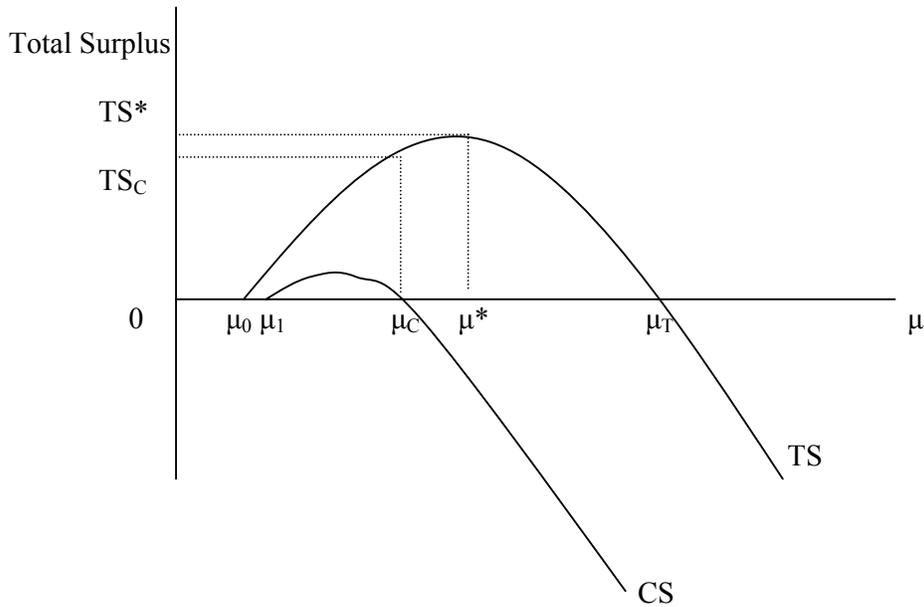
privately unprofitable mergers will not be proposed under either standard, so it is not obvious that this should undermine the relative merits of the CWS and TWS. The next section presents a simple heuristic model designed to bring out the effect of externalities between firms.

### ***4.3 A Heuristic Model***

Mergers are naturally discrete choices, but the intuition behind why the TWS is fundamentally sub-optimal can be brought out with a simple heuristic model in which mergers are represented as a continuum of possibilities. In what follows, profits, consumer welfare and total welfare are all measured relative to the pre-merger status quo. Consider a single merger event, but that merger may include more than two firms in the industry. Suppose mergers can be ranked in terms of the market power they create. Mergers with higher market power, as measured by the increase in *industry* profits, are indexed by  $\mu$  (with higher  $\mu$  representing higher market power). For example, in a homogeneous product market,  $\mu$  may represent the number of firms involved in the merger; and with differentiated products, it may rank the cross-elasticity between products, and/or the number of products subject to the merger. Merger-specific efficiencies include marginal as well as fixed costs, but we assume they preserve the same ranking of industry profits.

Assume that the function relating consumer surplus and  $\mu > \mu_1$  is initially increasing then decreasing.  $\mu_1$  is the lowest  $\mu$  for which consumer surplus is affected, and mergers are bad for consumers for all  $\mu > \mu_C$ . In between, marginal cost efficiencies allow some mergers to benefit consumers. Total welfare is the sum of industry profits and consumer surplus, and is also assumed to increase for  $\mu > \mu_0$ , then to decrease and eventually to become negative after  $\mu_T > \mu_C$  (e.g. merger to monopoly is always bad). These consumer surplus and total surplus functions are represented in Figure 7.

**Figure 7** Heuristic Comparison of the CWS and TWS When There is a Continuum of Possible Mergers



Although industry profits are increasing in  $\mu$ , the externalities associated with merger mean that the profits of the merging firms may either rise or fall with  $\mu$ . We illustrate the implications of alternative standards by reference to three plausible patterns for the relation between  $\mu$  and the profits of merging firms inclusive of efficiency savings,  $\Pi_M$ . We assume that holdout problems can be solved, so firms always merge if it is profitable to do so, even if it is more profitable to remain an outsider.

First, suppose  $\Pi_M$  is monotonically increasing in  $\mu$ . Under the CWS, firms merge up to  $\mu_C$ , and the economy achieves total surplus of  $TS_C > 0$ . Under the TWS, firms merge up to  $\mu_T$ , where total surplus is zero. *The CWS is always superior because firms exploit the TWS up to the point where social benefits are completely eroded by the maximum acceptable increment to market power.*

Next, suppose profit externalities between firms result in  $\Pi_M$  first decreasing in  $\mu$ , before rising and becoming positive only for  $\mu > \mu_M$ .<sup>29</sup> If  $\mu_C < \mu_M$ , the CWS will not allow any merger that firms want to propose (so  $TS = 0$ ); and if  $\mu_C > \mu_M$ , firms will merge up to  $\mu_C$ , to achieve  $TS_C > 0$ . Under the TWS, if  $\mu_T < \mu_M$ , there will be no merger, and if  $\mu_T > \mu_M$ , firms will merge up to  $\mu_M$ . Either way,  $TS = 0$ , so the CWS is at least as good as the TWS, and strictly better if  $\mu_C > \mu_M$ .

Finally, suppose  $\Pi_M$  is first increasing in  $\mu$ , as economies are achieved without a significant output switch to outsiders, before decreasing as the externality between firms becomes large. The local maximum  $\Pi_M$  is at  $\mu_{M0}$ . Define  $TS_{M0} > 0$  as the total welfare for this merger. Eventually, the externality is internalised and  $\Pi_M$  must be increasing in  $\mu$ , achieving higher profits than at  $\mu_{M0}$  for all  $\mu > \mu_{M1}$ . Under the CWS: if  $\mu_C < \mu_{M0}$ , or if  $\mu_{M1} < \mu_C$ , firms merge up to  $\mu_C$  (achieving  $TS_C > 0$ ); and if  $\mu_{M0} < \mu_C < \mu_{M1}$ , firms merge to  $\mu_{M0}$  (achieving  $TS_{M0} > 0$ ). Under the TWS: if  $\mu_T < \mu_{M0}$ , or if  $\mu_{M1} < \mu_T$ , firms merge up to  $\mu_T$  (where  $TS = 0$ ); and if  $\mu_{M0} < \mu_T < \mu_{M1}$ , firms merge to  $\mu_{M0}$  (achieving  $TS_{M0} > 0$ ). Thus, the TWS is superior only if  $\mu_C < \mu_{M0} < \mu_T < \mu_{M1}$ , *and*  $TS_C < TS_{M0}$ . In all other cases, the CWS is at least as good, and strictly superior in many cases.

The core intuition of this heuristic model is that because firms want to merge until the total surplus gains from merger are eroded, almost any tougher standard is an improvement. Although the empirical lumpiness of mergers undermines this stylisation of merger possibilities as a continuum, and externalities between insiders and outsiders to a merger can disrupt the core intuition, the heuristic model confirms a deep problem with the TWS.

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<sup>29</sup> For example, this applies in the Salant et al (1983) example of symmetric, homogeneous Cournot oligopoly,

## 5. Conclusions

Economists are almost unanimous in favouring total welfare as the yardstick for appraising economic policy. However, this does not mean that the same yardstick is appropriate for case-by-case implementation of that policy. The TWS appraisal of individual mergers is unlikely to maximize total welfare. This is because firms have the right to propose any merger they wish, and a competition authority can only appraise mergers proposed by firms. This gives the firms an advantage, and the mergers they propose can block a more desirable market structure that would evolve under a more restrictive standard. This paper has compared an apparently extreme alternative, the CWS, and found reasonable conditions where this alternative is superior. The major motivation for investigating the CWS is that it is the standard applied by the largest competition authorities in the world, including the USA and EU.

The CWS is not always better than the TWS, but it does have advantages in large, complex economies where there are socially preferable but privately less profitable merger opportunities. In this way, the applicability of the argument developed in this paper depends on the size of the economy. It is therefore interesting to observe that legislation and formal acceptance of the efficiency trade-off is largely restricted to competition authorities operating in smaller economies such as Canada and Australia.

Taken together with other reasons for weighting consumer welfare more highly, such as informational advantages of the firms, the effect of lobbying activities, and the burden of proof, it is far from obvious that economists are right in their widely held belief that the TWS provides a better policy implementation rule than the CWS. Both undoubtedly fall short of being optimal, but given the need for a simple universal rule, their relative merit is an

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where merger is only profitable if it covers at least 80% of the industry.

empirical matter, depending on the prevalent market opportunities in merger intensive sectors.

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## *Appendix 1: Market Structure, Prices, Profits and Welfare With Spatial Demand*

[EXTENDED VERSION FOR REFEREES]

Assume that individuals have tastes that can be represented by a unit circle. Consumers are uniformly distributed with density  $D$  round the circle, and are otherwise identical. They buy the product with the lowest ‘delivered price’,  $p^k + tx^k$ , where  $p^k$  is price of product  $k$ ,  $t$  is ‘transport cost’ and  $x^k$  is psychic distance to  $k$ . Individual demand is elastic and is given by  $f(p^k + tx^k)$ .  $N$  products are at fixed locations, and equally spaced around the circle. There are sufficient products such that a non-discriminating monopolist would choose to serve all consumers; so  $f(p^k + tx^k) > 0$  and  $f'(p^k + tx^k) < 0$  in the relevant range of prices.

We assume constant marginal costs, equal for all products, and the usual properties of well behaved demand curves, including marginal revenue increasing with price. Firms compete in prices. Where firms are competitively symmetric, we look for the symmetric equilibrium. We assume there is no ‘mill-price undercutting’, so no firm ever expects to be able to obtain market share by leaving a neighbouring product with zero demand.<sup>30</sup>

Define a ‘half-market’ as the demand generated by consumers on one side of a product’s location. A consumer located at  $\bar{x}$  between products A and B, respectively located at 0 and  $1/N$ , is indifferent between them if  $p_A + t\bar{x} = p_B + t[N^{-1} - \bar{x}]$ . This defines the limit of product A’s market area:

$$(1) \quad \bar{x} = N^{-1}/2 + [p_B - p_A]/2t$$

Thus, given  $p_B$ ,

$$(2) \quad \frac{d\bar{x}}{dp_A} = -1/2t$$

Each product has two half-markets, one on each side of its location. Consider one of these half-markets (say, between products A and B). Demand is given by

$$(3) \quad \frac{1}{2}q_A = D \int_0^{\bar{x}} f(p_A + tx) dx$$

The slope of the *competitive half-market demand curve* (i.e. holding  $p_B$  constant) is:

$$(4) \quad \frac{d \frac{1}{2}q_A^C}{dp_A} = D \left[ \int_0^{\bar{x}} f'(p_A + tx) dx + f(p_A + t\bar{x}) \frac{d\bar{x}}{dp_A} \right]$$

It is convenient to develop price comparisons by using perceived elasticities. From (2), (3) and (4), the *competitive elasticity of demand* is:

$$(5) \quad -\frac{d \frac{1}{2}q_A^C}{dp_A} \frac{p_A}{\frac{1}{2}q_A^C} = \eta_C(p_A, p_B, t, N) = \frac{-p_A \left[ \int_0^{\bar{x}} f'(p_A + tx) dx - f(p_A + t\bar{x}) / 2t \right]}{\int_0^{\bar{x}} f(p_A + tx) dx}$$

We assume that neighbouring products are strategic complements, which is equivalent to  $\partial \eta_C / \partial p_B < 0$ . Write product A's gross profit as  $\pi_A = [p_A - c] q_A$ . Then the first order condition is:

$$\frac{\partial \pi_A}{\partial p_A} = q_A + [p_A - c] \frac{\partial q_A}{\partial p_A} = q_A \left( 1 - \left[ \frac{p_A - c}{p_A} \right] \eta_C \right) = 0$$

The definition of strategic complementarity is:

$$\frac{\partial^2 \pi_A}{\partial p_A \partial p_B} = \frac{\partial q_A}{\partial p_B} + [p_A - c] \frac{\partial^2 q_A}{\partial p_A \partial p_B} = -q_A \left[ \frac{p_A - c}{p_A} \right] \frac{\partial \eta_C}{\partial p_B} > 0$$

The second expression uses the first order condition (envelope theorem). Using the more familiar, non-elasticity definition, the first term is always positive because the products are gross substitutes and the marginal consumer has strictly positive demand. The profit margin is also positive, but a higher  $p_B$  raises A's market area, drawing in more marginal consumers who might have more elastic demand. For linear individual demand curves, which aggregate to a quadratic product demand curve, this term is always negative:  $\partial^2 q_A / \partial p_A \partial p_B = -1/4t < 0$ .

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<sup>30</sup> Salop (1979) has shown, for inelastic individual demands, that mill price undercutting is not an equilibrium strategy in this product space when products are competitive. It can be shown that this property also holds for linear individual demand curves.

Although the absolute size of this last term is decreasing in  $t$ , the price-cost margin is increasing in  $t$ , which tends to counteract this. Also,  $\partial q_A / \partial p_B$  is decreasing in  $t$ , because the marginal consumer becomes less important. Overall, strategic complementarity is probably most appropriate when products are sufficiently close gross substitutes (i.e.  $t$  is not too high).<sup>31</sup>

The symmetric monopolist (owner of A and B) adjusts  $p_B$  such that there is no ‘market stealing’ effect of a price cut.  $\bar{x}$  is constant at  $1/2N$  so the *monopoly elasticity of demand* is:

$$(6) \quad -\frac{d \frac{1}{2} q_A^M}{dp_A} \frac{p_A}{\frac{1}{2} q_A^M} = \eta_M(p_A, t, N) = \frac{-p_A \int_0^{1/2N} f'(p_A + tx) dx}{\int_0^{1/2N} f(p_A + tx) dx}$$

If a product has a monopoly in one half-market and competition in the other, if price discrimination is not possible, and if all other products are symmetric in these respects, the relevant *duopoly elasticity* for price setting (i.e. case 3D) is the quantity weighted average:

$$(7) \quad \eta_D = \sigma \eta_C + [1 - \sigma] \eta_M, \text{ where } \sigma = \frac{1}{2} q^C / [\frac{1}{2} q^C + \frac{1}{2} q^M] \text{ and } \frac{1}{2} q^C \text{ and } \frac{1}{2} q^M \text{ are evaluated at the common equilibrium price.}$$

***Proof of Lemma 1:***

*Part a).* Marginal costs are constant and demand is independent of non-neighbouring product prices, so the profit function facing a competitive oligopolist or a competitive duopolist includes no direct effect of the price of one co-owned product on the demand for another.

There is therefore no incentive to deviate from the competitive Nash equilibrium prices.

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<sup>31</sup> Aggregation of individual demand curves makes it difficult to find appropriate parameter restrictions to ensure strategic complementarity, even in the simplest cases. For example, if individual demand is  $v - p_A - tx$ , where  $v$  is a constant, products are strategic complements around the competitive equilibrium except for high values of  $t$ . Simple simulations show that if  $v=10$ , and marginal cost is 4, there is strategic complementarity for all  $t < 23$ , and competitive equilibrium exists (i.e. all consumers are supplied) for  $t < 32$ ; for  $v=8$ , we need  $t < 16$  for strategic complements (competitive equilibrium if  $t < 22$ ); and for  $v=12$ , we require  $t < 31$  (where competitive equilibrium exists if  $t < 43$ ).

*Part b):*

1.  $p_1 < p_5$ . The profit maximising price is found by setting the price-cost margin equal to the reciprocal of the relevant elasticity of demand. Evaluating (5) and (6) at the monopoly price,  $\eta_C > \eta_M$  because of the second term in the numerator of (5) (i.e. the ‘market stealing’ effect).

It follows that  $p_1 < p_5$ .

2.  $p_1 < p_3 < p_5$ . Using (7) with (5) and (6) in turn, the proof is the same as in part 2.

3.  $p_1 < p_2(1) < p_2(2)$ . By the same argument as before, at  $p_1$ , the merged oligopolist has an incentive to raise price. By strategic complementarity, the independent firms must choose a higher equilibrium price. Suppose that  $p_2(1) = p_2(2)$ , so all products have the same market area (equation 1). This cannot be an equilibrium: the two-product firm faces a duopoly elasticity and the single product firms face a higher, competitive elasticity, so  $p_1 < p_2(1) < p_2(2)$ .

4.  $p_2(1) < p_2(2) < p_3$ . Start at  $p_3$ , consider a de-merger of one duopolist, and follow the same argument as in part 3.

***Proof of Corollary 1:*** This follows straightforwardly from elastic individual demands, the absence of cost effects, and the strict ranking of prices given by Lemma 1.

***Proof of Lemma 2:*** For each (in-)equality in turn,

1. The equality follows trivially from all products setting the same price.

2. Since  $p_2(1) > p_1$ , demand for the oligopolist’s two products at price  $p_1$  is raised compared with a fragmented structure. The oligopolist’s best response of  $p_2(2)$  must benefit the coalition.<sup>32</sup>

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<sup>32</sup> This follows Deneckere and Davidson’s (1985) proof of their Theorem 1, where price ‘responses’ are conceptually separated.

3. Consider products on opposite sides of the circle, say A and C, which face the same neighbouring products, and so identical equilibrium, neighbour prices. The independent product sets  $p_2(1)$  to maximise profit at these rival prices, so must make higher profits than the contribution of one co-owned product.
4. Since the pre-merger oligopolist now sets  $p_3 > p_2(2)$ , combined demand rises for the independent products merging to duopoly. The new coalition's best reply, also  $p_3$ , must result in increased profits.
5. The final inequality must hold because the monopolist maximises joint profits, and does so at a price higher than holds in duopoly.

### *Appendix 2: Equilibrium Merger Paths*

[EXTENDED VERSION FOR REFEREES]

We begin by listing the set of candidate equilibrium market structures, before solving for subgame perfect equilibrium.

Suppose  $\{A, B\}$  has been proposed and accepted. The following mergers are then possible: none;  $\{C, D\}$ ;  $\{A, B, C\}$ ; or  $\{A, B, D\}$ . The latter two mergers differ only in labelling, so we restrict attention to  $\{A, B, C\}$ . This merger proposal might also offer the divestiture of product B or A as a remedy, and that product might be bought by an entrant or by the independent firm already in the market. Subsequently, if one of these mergers has been allowed without remedy, merger to monopoly might be proposed (with or without divestiture). Also, there may be a product swap between  $\{A, B\}$  and  $\{C, D\}$  (e.g. of B for C). If one of these mergers has taken place subject to divestiture, the resultant market structure is the same as one already discussed.

Next, suppose  $\{A, C\}$  has been proposed and accepted in the first round. The following mergers are possible: none;  $\{B, D\}$ ;  $\{A, B, C\}$ ;  $\{A, C, D\}$ . The latter is

distinguished only by labelling.  $\{A, B, C\}$  might also offer the divestiture of product C or A as a remedy, and that product might be bought by an entrant or by the independent firm already in the market. Subsequently, merger to monopoly might be proposed. Also, there may be a product swap between  $\{A, C\}$  and  $\{B, D\}$  (e.g. of C for B).

Some of these emerging structures would necessarily be blocked even by the less restrictive TWS, or would never be proposed as they achieve a less profitable market structure. We can eliminate further consideration of merger to monopoly because this always reduces gross welfare without yielding any efficiencies, and so is rejected under both standards. Merger from  $\{A, B\}$  to  $\{A, B, C\}$  generates market power with no further efficiencies, and so would not be allowed under either standard without a divestiture that would render it privately unprofitable. As shown below, however, the creation of a dominant firm starting from  $\{A, C\}$  may have strategic advantages. A similar merger subject to the sale of C to an entrant has no strategic advantages over a direct move to  $\{A, B\} \{C\} \{D\}$ , but incurs transaction costs, and so is not further considered. A product swap between  $\{A, B\}$  and  $\{C, D\}$  is obviously unprofitable. A consequence of these eliminations, and of no ‘circular’ mergers, is that there will be no more than two mergers in equilibrium (i.e. stages 2 and 3 will be repeated at most once). Finally, for simplicity, we assume  $\lambda < -\Delta_{14}W / F$  so that a dominant firm is never an equilibrium. The remaining patterns of mergers that might be allowed under the TWS are summarized in Figure 3. These are numbered for future reference. Arrows signify divestitures as part of the merger proposal.

### *Stages 2 and 3 under the CWS*

Under the CWS,  $\{A, B\}$  would not be allowed. Starting from  $\{A, C\}$ , the only acceptable second merger is  $\{B, D\}$ . This is competitively identical to  $\{A, C\}$ , and so will be proposed and allowed. This sequence of mergers is more profitable than no mergers. Therefore,

starting from a fragmented market, the equilibrium market structure subject to CWS scrutiny is always a competitive duopoly:  $\{A, C\}$  and  $\{B, D\}$ . As compared with the initial structure, there are social gains of  $2[1-\lambda]F$ .

*Stages 2 and 3 under the TWS*

The TWS permits a wider range of potential equilibrium structures, and the equilibrium depends on the welfare costs of higher prices. First consider the possibilities following  $\{A, B\}$ , which is allowed if  $F > -\Delta_{12}W$ .  $\{C, D\}$  is TWS acceptable if  $F \geq -\Delta_{23}W$ ,<sup>33</sup> and the social gain from this sequence of mergers to duopoly (2), is  $2F + \Delta_{13}W$ . If there is no second merger proposal, the market structure stays at oligopoly (1), with resulting social gains of  $F + \Delta_{12}W$ .

Next, consider merger possibilities following  $\{A, C\}$ , which is always allowed. No further merger would leave a competitive oligopoly (4). Merger  $\{B, D\}$  to form a competitive duopoly (3) is always allowed, as it does not affect competition. A further product swap to form a full duopoly (5) of  $\{A, B\}$   $\{C, D\}$  would be allowed if  $[1+\lambda]F \geq -\Delta_{13}W$ . Merger to  $\{A, B, C\}$  is only acceptable if it is conditional on the divestiture of product C. Assuming that efficiencies in  $\{C, D\}$  are taken into account, merger  $\{A, B, C\}$  subject to sale of C to D to form duopoly (6) is allowed if  $[1+\lambda]F \geq -\Delta_{13}W$ . The results are summarised in Table 2.

***Proof of Lemma 3: Part a): [Principles refer those given in the text of section 3.2]***

(3) > (7) because joint profits  $2\pi_1 + F > 2\pi_1$  [Principle 1 (P1)]

(1) > (3) because  $\pi_2(2) + F > 2\pi_1$  [by Lemma 2 (L2) and (P1)]

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<sup>33</sup> Notice that the competition authority must appraise superficially similar mergers  $\{A, B\}$  and  $\{C, D\}$  differently because the wider market conditions are different, even though the market shares and product overlaps created by the two mergers are similar.

(6) > (1) because  $\pi_3(2) + F > \pi_2(2) + F$  [by (P2), (L2), (P1)]

(5) = (6) by (P2)

(2) > (5) profits would be the same under both paths, by (P2), except that the indirect route incurs additional transaction costs

*Part b):*

(2) > (1) because  $\pi_3(2) + F > 2\pi_1$

(4) = (7) because  $2\pi_1 = 2\pi_1$

(3) > (4) because  $2\pi_1 + (1 - \lambda)F > 2\pi_1$

(6) > (3) because  $\pi_3(2) + F > 2\pi_1 + (1 - \lambda)F$

(5) = (6) by (P2)

### ***Proof of Proposition 2***

This combines the regulatory hurdles and welfare consequences summarised in Table 2, with the profit rankings of Lemma 3. Starting from {A, B}, if {C, D} satisfies the TWS, the merger path (2) is proposed. Otherwise, no further merger takes place, (1).

Starting from {A, C}, (3) and (4) are always acceptable, but (3) dominates (4) for B and D, so (4) is never an equilibrium. Similarly, the no-merger path (7) is dominated by (3). (5) and (6) give the firms the same payoffs, and are also equivalent under the TWS. If (5) and (6) are acceptable, they dominate (3).

Working back to the first merger, if  $-\Delta_{12}W / F > 1$  and  $-\Delta_{13}W / F > [1+\lambda]$ , equilibrium is competitive duopoly, (3), which is also the unique CWS outcome. If  $-\Delta_{12}W / F < 1$ ,  $-\Delta_{23}W / F > 1$  and  $-\Delta_{13}W / F > [1+\lambda]$ , the equilibrium merger path is (1) leading to oligopoly. If  $-\Delta_{12}W / F < 1$  and  $-\Delta_{23}W / F < 1$ , the equilibrium is merger path (2), resulting in a duopoly structure. Either if  $-\Delta_{12}W / F < 1$ ,  $-\Delta_{23}W / F > 1$ , and  $-\Delta_{13}W / F < [1+\lambda]$ , or if  $-\Delta_{12}W / F > 1$  and  $-\Delta_{13}W / F < [1+\lambda]$ , the equilibrium strategy is an indirect route to duopoly, (5) or (6). QED