International Journal of the Economics of Business

Routledge
Taylor & Francis Group

ISSN: 1357-1516 (Print) 1466-1829 (Online) Journal homepage: http://www.tandfonline.com/loi/cijb20

Economies as an Antitrust Defense Revisited: The Welfare Trade-offs and Safe Harbors

Kam Hon Chu

Int. J. of the Economics of Business, 2014
Vol. 21, No. 1, 99–119, http://dx.doi.org/10.1080/13571516.2013.864116

Economies as an Antitrust Defense Revisited: The Welfare Trade-offs and Safe Harbors

KAM HON CHU

ABSTRACT *This paper incorporates a Cournot model of oligopoly pricing into Williamson's (1968a) model to assess the welfare effect of a merger that yields economies and market power simultaneously. The results show: (i) in most cases, economies from mergers can offset price increases due to market power such that there are positive net allocative effects, and (ii) the safe harbors in the merger guidelines may fail to screen out mergers correctly. The reliability, however, can be improved by considering cost savings and price elasticities in addition to the current use of increases in HHI and post-merger HHIs.*

Key Words: Antitrust Policy; Mergers and Acquisitions; Merger Guidelines; Safe Harbors; Welfare Tradeoff.

JEL classifications: L41, L44, K21.

1. Introduction

As its title clearly indicates, this study is closely related to the classic paper by Nobel laureate Oliver Williamson (1968a/1987),[1] who applies a partial-equilibrium approach to analyze a merger between two (or more) firms that yields economies but also increases market power simultaneously. It is well recognized that Williamson's insights have not been fully incorporated into the current practice of antitrust policy, even though his paper was published more than four decades ago. A main result of his paper is the proposition that "a merger which yields nontrivial real economies must produce substantial market power and result in relative large price increases for the net allocative effects to be negative" (Williamson 1968a/1987, 8). This paper adopts Williamson's analytical framework to address the same welfare trade-off question arising from a merger between two firms under the same

I am grateful for the comments received in the anonymous refereeing process. I would like to thank Ted Frech, James Feehan, Aidan Hollis, Derek Pyne, Chung-Yi Tse, and Ralph A. Winter for their suggestions and comments on earlier versions of this paper. As usual, I alone am responsible for all remaining errors.

Kam Hon Chu, Department of Economics, Memorial University of Newfoundland, St. John's, Newfoundland & Labrador, Canada A1C 5S7; e-mail: kchu@mun.ca.

conditions – namely, cost savings and market power at the same time – but it differs from his in a couple of aspects.

First, in Williamson's (1968a/1987, 8, table 1.1, 10, table 1.2) numerical evaluation of the percentage cost reductions required to offset percentage price increases so as to achieve a welfare gain, these two variables are more or less free to vary. Without imposing any specific market model, his results are, of course, quite general. However, costs and price should be related to each other based on certain equilibrium conditions according to an economic theory that is deemed appropriate and applicable to the problem at hand. This paper conducts a welfare analysis by imposing a relationship between costs and price based on an economic theory – that is, if a merger between two firms results in a certain percentage cost reduction, and also if price is determined by market power according to a certain economic theory, then there should be a corresponding percentage price increase. Simply put, only one – but not both – of the two variables is allowed to be free to vary.[2] As will be seen below, our chosen theory is actually a well-known standard model in oligopoly theory.

Second, the price-cost ratio is used as a market power parameter in Williamson's paper. In this paper, this market power parameter is translated into the Herfindahl–Hirschman Index (HHI). This is done because the HHI is a commonly used metric for market concentration or market power and, more importantly, the Merger Guidelines issued by the Antitrust Division of the US Department of Justice (DOJ) and the Federal Trade Commission concerning their policy toward mergers are expressed in terms of the HHI.[3] Against this background, the use of the HHI should make our welfare analysis more appealing when it is put into practice because it is more operational and directly related to the Merger Guidelines.[4]

In sum, from the regulator's point of view, this study is slightly more pragmatically oriented than Williamson's seminal paper. When a proposal for a merger between two firms in an industry is submitted with the relevant information such as the two merging firms' market shares, the expected cost reduction from the proposed merger, the current HHI, the change in HHI due to the proposed merger, the elasticity of demand in the industry, and the economic model (assuming it is the valid theory to capture the behavior of the firms in the industry where the merger is proposed), the regulator can more or less readily deduce the post-merger cost reduction and hence the price increase so as to evaluate the net welfare effect accordingly.

In addition, there is also a minor difference between Williamson's analysis and ours. In his analysis, perfect competition is assumed to prevail before the merger such that price equals average cost ($P = AC$) initially. Our analysis is more general in that it allows pre-merger market power to exist such that $P \geq AC$. This is also the case of horizontal merger under imperfect competition in pre-merger stage, as briefly discussed in Viscusi, Harrington, and Vernon (2005, 213). However, they do not work out formally and algebraically the welfare analysis as they do for the case of perfect competition in pre-merger stage (Viscusi, Harrington, and Vernon, 2005, 210–212). More recently, in analyzing the welfare effects of the DOJ's 2010 Merger Guidelines, Blair and Haynes (2011) also address the welfare trade-off diagrammatically rather than algebraically. Against this background, this study fills the gap by providing a more formal analysis.

Despite the above differences, our approach to welfare analysis and numerical evaluation here remain loyal to Williamson's original model and are similar to Brennan (1996), although the latter examines the welfare effect of cost-of-service regulation instead of horizontal mergers. Admittedly, there are other theoretical analyses of the welfare effects of horizontal mergers using different approaches. For example, based on Cournot oligopoly, Farrell and Shapiro (1990) analyze theoretically the welfare effects under different scenarios – one of them is the case of constant elasticity and constant costs, which is essentially the case analyzed by Williamson and this study as well. Using a Nash–Cournot framework with certain assumptions, Salant, Switzer, and Reynolds (1983) show that for a considerable range of possibilities, some horizontal mergers can be unprofitable for the merged firms, even though such mergers can create efficiency gains. Nevertheless, their counterintuitive comparative-static results have been countered or reversed by subsequent studies based on different assumptions. See, for example, Deneckere and Davidson (1985) and Perry and Porter (1985), to name just a few. All those approaches are different from that of Williamson and this study, and also their analyses are more rigorous and sophisticated in terms of both theories and analytical techniques. Like many previous studies, however, they do not explicitly relate their analysis and findings to safe harbors, which are commonly used by competition agencies to screen out mergers. Against this background, we hope this study can be a timely and useful exercise that echoes Yang and Pickford (2011) who call for more rigor in the specification of safe harbors in merger guidelines.

The organization of this paper is straightforward. The next section extends Williamson's analysis by incorporating a standard Cournot model of oligopoly without collusion. It is shown (derivation in the Appendix) that the net welfare effect of a proposed merger depends on several factors, namely cost reductions from mergers, changes in HHI, the post-merger HHI, and price elasticity of demand. Section 3 reports the numerical results of the welfare analysis based on different selected values of these factors. Concluding remarks are given in the last section.

2. The Naive Trade-off Model Once Again

Following Williamson's approach, the welfare effects of a merger that yields economies but extends market power at the same time can be investigated with the help of Figure 1. Before we proceed with the welfare analysis, we first characterize the relationship between costs and price for individual firm i based on the profit maximization condition in a standard Cournot model of oligopoly with homogeneous goods and without collusion as follows:

$$\frac{s_i}{\varepsilon} = \frac{(P - c_i)}{P} \tag{1}$$

where s_i is firm i's market share, c_i is its marginal cost, ε is the absolute value of price elasticity of market demand, and P is the price in the industry.[5] Following the approach of Cowling and Waterson (1976) and also Willig,

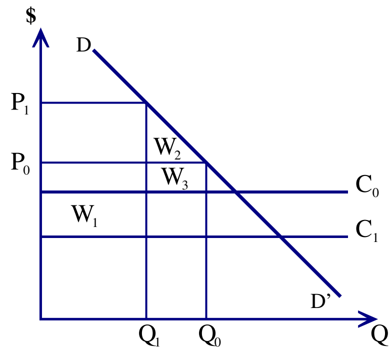

Figure 1. Social benefits and costs of a horizontal merger with economies and market power.

Salop, and Scherer (1991), sum over all firms in the industry to get the average mark-up of price over marginal cost in the industry as follows:

$$\frac{(P - C)}{P} = \frac{h}{\varepsilon} \tag{2}$$

where $C = \sum s_i\ c_i$, that is, the marginal cost of the industry (a weighted average of the individual firms' average marginal costs, with the weights being their respective market shares), and h represents the Herfindahl–Hirschman Index (HHI) – in terms of theoretical analysis – that lies between 0 and 1 (in practice, the reported HHI is scaled upward to lie between 0 and 10,000).

Then, following Williamson's assumption of constant marginal cost and diagrammatical analysis, the horizontal line labeled C_0 in Figure 1 represents the level of average costs of the industry before a proposed merger. Now suppose two firms, i and j, propose a merger that will reduce the cost of the merged firm to c_m. Assuming the cost structure of the other firms and also market shares to remain intact after the merger, the new marginal cost of the industry is $C_1 = C_0 + \Delta C$, where $\Delta C = s_m c_m - (s_i c_i + s_j c_j) = (s_i + s_j)\ c_m - (s_i c_i + s_j c_j)$, and s_m is the market share of the merged firm.[6] Diagrammatically, the level of average costs of the industry after the merger is labeled as C_1 in Figure 1. The merger affects not only the variable C on the left-hand side of equation (2) but also h, that is, the HHI, on the right-hand side. Let HHI_0 and HHI_1 be the values of the HHI respectively before and after the merger.[7] Then $\mathrm{HHI}_1 = \mathrm{HHI}_0 + 2\ s_i s_j \times 10{,}000$ if the market shares are assumed to remain intact after the merger. Based on the industry's new level of cost, the new HHI and the given demand elasticity, we can compute the new price level after the merger according to equation (2). Diagrammatically, given a linear demand schedule DD′, the price before the merger is given by P_0, while the price after the merger is given by P_1 in Figure 1, whereas the quantities are respectively Q_0 and Q_1.

From Figure 1, the welfare gain to society due to cost saving from the merger is given by the rectangle W_1, whereas the welfare loss from reduced supply and higher price is given by the trapezoid (sum of the triangle W_2 and the rectangle W_3). The net welfare effect (ΔW) is therefore

$$\Delta W = \Delta C * Q_1 - \left[(P_0 - C_0) * \Delta Q + \frac{1}{2} * \Delta P * \Delta Q \right] \tag{3}$$

In the above equation, the first term is the area of the rectangle W_1, the second term is the area of the rectangle W_3, and the last term is the area of the triangle W_2. Given a linear demand schedule and data on cost, price, and quantity before and after a merger, equation (3) can be applied directly to compute the *actual* welfare change. It is straightforward to show that (the derivation can be found in the Appendix) the net welfare gain given by equation (3) can be expressed alternatively in terms of demand elasticity and the HHI as follows:

$$\Delta W = C_0 Q_1 * \left\{ \frac{\Delta C}{C_0} - \left[\left(\frac{h_0}{\varepsilon - h_0} \right) \frac{\Delta Q}{Q_0} \frac{Q_0}{Q_1} + \frac{1}{2} \left(\frac{\varepsilon^2}{\varepsilon - h_0} \right) \left(\frac{\Delta P}{P_0} \right)^2 \frac{Q_0}{Q_1} \right] \right\} \tag{4}$$

Equation (4) can be applied to give an *approximation* of the welfare change due to a merger in the case of a linear demand schedule as well as a constant elasticity demand schedule (see the Appendix for details about the computation of the *actual* welfare change under a constant elasticity demand schedule). The net welfare effect of a merger depends on whether the above expression is greater or less than zero. When equation (4) is positive, $\Delta W > 0$; in other words, the welfare gain due to cost saving outweighs the welfare loss due to market power, and *vice versa*.

For an industry with initial price and quantity, equation (4) implies the welfare change due to a merger can be computed when data on the following parameters are given: (i) the merger-specific cost reduction, that is, ΔC; (ii) the pre-merger HHI, h_0; and (iii) the price elasticity of market demand, ε. On the surface, it seems that changes in price (ΔP) and in quantity (ΔQ), and hence the new quantity level Q_1 are also required in the computation. But in fact they are not necessary because the change in price is implicitly determined by equation (2) once the cost reduction, the HHI, and the price elasticity of demand are known, and once the change in price is known, the change in quantity and the new level of output are determined by the given price elasticity.

To evaluate the net welfare effects numerically, the pre-merger cost C_0 (c_i and c_j as well) is normalized to 1 and the pre-merger quantity Q_0 is normalized to 100.[8] Given the pre-merger market concentration HHI_0, demand elasticity ε, the market price P_0 can be computed based on equation (2). Now for a merger between firms i and j with market share s_i and s_j and post-merger cost c_m, the post-merger quantity Q_1, post-merger price P_1, and the net welfare effect can be computed according to equations (2) and (4).[9] Table 1 reports the numerical results of the net welfare changes based on different selected values for the market shares of the two firms involved in the merger, the cost reductions, demand elasticity, and post-merger market concentration. For the purpose of exposition, the two firms i and j are assumed to be symmetrical in terms of their market shares and pre-merger costs.[10] The selected pre-merger market shares s_i (= s_j) in Table 1 are closely related to the DOJ's 1992 and 2010 Merger Guidelines: 1%, 5%, 7.071%, and 10%. The 1% market share case represents the

Table 1. Net welfare effects of mergers based on equation (4) and different parametric values of market share, cost reduction, HHI, and demand elasticity

		Cost Reductions from Mergers											
		Small Cost Reduction (2.5%) (i.e., $c_m = 0.975\ c_i$) Price Elasticity of Demand				Moderate Cost Reduction (5%) (i.e., $c_m = 0.95\ c_i$) Price Elasticity of Demand				Large Cost Reduction (10%) (i.e., $c_m = 0.9\ c_i$) Price Elasticity of Demand			
Firm's Market Shares ($s_i = s_j$)	Post-Merger HHI	2	1	0.5	0.25	2	1	0.5	0.25	2	1	0.5	0.25
1% (ΔHHI = 2)	4	0.05	0.05	0.05	0.05	0.10	0.10	0.10	0.10	0.20	0.20	0.20	0.20
	1,000	0.05	0.05	0.05	0.04	0.11	0.11	0.11	0.09	0.22	0.22	0.22	0.21
	1,500	0.06	0.05	0.05	**–0.01**	0.11	0.11	0.11	0.06	0.23	0.23	0.23	0.20
	1,800	0.06	0.06	0.05	**–0.10**	0.12	0.12	0.11	**–0.02**	0.24	0.24	0.24	0.15
	2,500	0.06	0.06	0.04	**n.e.s.**	0.13	0.12	0.11	**n.e.s.**	0.26	0.26	0.26	**n.e.s.**
5% (ΔHHI = 50)	100	0.25	0.25	0.24	0.24	0.50	0.50	0.50	0.49	1.03	1.01	1.00	0.99
	1,000	0.25	0.22	0.13	**–0.23**	0.53	0.49	0.41	0.06	1.10	1.05	0.97	0.64
	1,500	0.25	0.19	0.01	**–1.41**	0.54	0.49	0.31	**–1.07**	1.14	1.08	0.91	**–0.39**
	1,800	0.25	0.17	**–0.11**	**–3.79**	0.55	0.48	0.21	**–3.39**	1.16	1.09	0.85	**–2.58**
	2,500	0.24	0.11	**–0.59**	**n.e.s.**	0.56	0.45	**–0.22**	**n.e.s.**	1.22	1.11	0.52	**n.e.s.**
7.071% (ΔHHI = 100)	200	0.35	0.34	0.33	0.29	0.71	0.70	0.68	0.65	1.46	1.42	1.40	1.36
	1,000	0.34	0.27	0.10	**–0.58**	0.73	0.66	0.50	**–0.17**	1.53	1.45	1.29	0.64
	1,500	0.32	0.21	**–0.15**	**–2.80**	0.74	0.63	0.28	**–2.33**	1.58	1.46	1.13	**–1.37**
	1,800	0.32	0.17	**–0.38**	**–7.21**	0.74	0.60	0.07	**–6.64**	1.61	1.46	0.97	**–5.50**
	2,500	0.29	0.04	**–1.35**	**n.e.s.**	0.75	0.51	**–0.83**	**n.e.s.**	1.68	1.45	0.22	**n.e.s.**
10% (ΔHHI = 200)	400	0.48	0.45	0.38	0.20	1.00	0.96	0.89	0.71	2.07	2.00	1.92	1.74
	1,000	0.45	0.33	0.02	**–1.21**	1.00	0.88	0.57	**–0.64**	2.13	1.98	1.68	0.50
	1,500	0.41	0.20	**–0.48**	**–5.20**	0.99	0.78	0.11	**–4.53**	2.18	1.95	1.31	**–3.19**
	1,800	0.39	0.11	**–0.92**	**–12.85**	0.98	0.71	**–0.30**	**–12.05**	2.21	1.92	0.96	**–10.44**
	2,500	0.33	**–0.17**	**–2.79**	**n.e.s.**	0.96	0.48	**–2.06**	**n.e.s.**	2.28	1.80	**–0.60**	**n.e.s.**

Notes: Because of rounding up and truncation, some numbers may appear to remain unchanged even though the parametric values have changed. Bold entries represent welfare losses.
n.e.s., "not economically sensible" for the net welfare losses in those cases are theoretically negative infinitive in value because consumer surplus and the price are both unbounded. In practice, it suffices to note that the net welfare losses in those cases are substantial.

case in which the two merging firms do not have significant market power, whereas they have considerable market power both before and after the merger in the 10% case. In the latter case, the increase in HHI due to the merger is 200, which is a threshold related to merger-induced concentration increase, as specified in the latest 2010 Merger Guidelines. On the other hand, the other two cases – the 5% and the 7.071% pre-market shares – represent a post-merger increase in HHI by 50 and 100 respectively, which were the thresholds under the 1992 Merger Guidelines.[11] By including these thresholds, we can evaluate and compare the welfare implications of the two Guidelines, which will be discussed below.

Table 1 also shows the post-merger HHIs and, once again, the selected values are related to the two Merger Guidelines.[12] In the 1992 Guidelines, the spectrum of market concentration is divided into three regions: unconcentrated (HHI < 1,000), moderately concentrated (HHI between 1,000 and 1,800), and highly concentrated (HHI > 1,800).[13] In the 2010 Guidelines, the thresholds of 1,000 and 1,800 are replaced by 1,500 and 2,500 respectively. The post-merger HHI and the increase in HHI due to a merger together define the so-called safe harbors under the Merger Guidelines. Although they may not be explicitly referred to as safe harbors in some countries and also the measures of market concentration and thresholds can vary quite widely (see Yang and Pickford, 2011, for details in countries other than the United States such as Australia, Canada, European Union, New Zealand, and the UK), they serve as a screening mechanism to reduce the range of proposed mergers subject to further investigation by regulatory agencies. Proposed mergers that do not breach the specified thresholds are deemed to be unlikely to be anti-competitive. According to the DOJ's 1992 Merger Guidelines, any proposed merger that either (i) increased the HHI by 50 or more and resulted in a post-merger HHI of 1,800 or higher or (ii) increased the HHI by 100 or more and resulted in a post-merger HHI of 1,000 or higher fell outside the safe harbors and was viewed as unsafe – that is, likely to have adverse competitive effect – and hence it would likely be challenged. In the 2010 Merger Guidelines, the specifications have been slightly simplified to the effect that any proposed merger that would lead to either a post-merger HHI less than 1,500 or an increase in HHI less than 100 ordinarily requires no further analysis (i.e., it falls in the safe harbors).[14]

For cost reductions due to mergers, three parametric values – 2.5%, 5%, and 10% – are chosen to represent respectively small, moderate, and large cost savings incurred by the merged firm. The reductions in the average costs of the industry also depend on the pre-merger market shares of the two merging firms. For instance, if s_i (=s_j) = 10% and $c_m = 0.95\ c_i$ (i.e., a moderate, 5% cost saving from merger), the average costs of the industry will be reduced by 1%, but even if $c_m = 0.9\ c_i$ (i.e., a large, 10% cost saving from merger) the average costs of the industry will be lowered by a meagre 0.2% only if the firm's market share (s_i) is 1%! This reveals another aspect of a trade-off that may not appear to be so obvious to regulators. Conventionally, large firms are less likely than small firms to be legally allowed to merge for fear that the increased market power would cause steeper price increases and hence larger welfare losses in terms of consumer surpluses.[15] But our analysis here reveals that the net welfare effects are not so straightforward and unambiguous because it is possible for mergers between large firms to result in larger cost savings and hence less steep price increases, not to mention that the post-merger price can possibly be lower than the pre-merger level.[16]

The last set of parameter values in our numerical analysis are the price elasticities of demand. In addition to Williamson's selected values of 2, 1, and 0.5, we include 0.25 as well. While the first three parameter values already cover a large variety of goods and services, ranging from price elastic to inelastic, such as taxicab (2.0535), computers (1.0164), and purchased food (0.5418), we do not want to omit those highly inelastic goods and services such as food at home (0.1194), banking services (0.2256), and so on.[17] The last category of 0.25 serves to cover these products. As can be seen in Table 1, this category also has some interesting welfare trade-off results and policy implications for the Merger Guidelines.

3. Welfare Trade-offs and the Merger Guidelines

The net welfare effects of various merger scenarios with computation based on equation (4) are tabulated as Table 1. As competition agencies are also concerned about post-merger prices, the corresponding percentage changes in price are computed and reported in Table 2. For the case of a linear demand schedule, the actual net welfare effects are reported in Table 3, whereas the percentage price changes are shown in Table 4. For the case of a constant elasticity demand schedule, they are reported respectively as Tables 5 and 6.

Table 2. Percentage Price Changes (%) due to Mergers based on Equation (4) and Different Parametric Values of Market Share, Cost Reduction, HHI, and Demand Elasticity

		Cost Reductions from Mergers											
		Small Cost Reduction (2.5%) (i.e., $c_m = 0.975\ c_i$) Price Elasticity of Demand				Moderate Cost Reduction (5%) (i.e., $c_m = 0.95\ c_i$) Price Elasticity of Demand				Large Cost Reduction (10%) (i.e., $c_m = 0.9\ c_i$) Price Elasticity of Demand			
Firm's Market Shares ($s_i = s_j$)	Post-Merger HHI	2	1	0.5	0.25	2	1	0.5	0.25	2	1	0.5	0.25
1% (ΔHHI = 2)	4	−0.04	−0.03	−0.01	0.03	−0.09	−0.08	−0.06	−0.02	−0.19	−0.18	−0.16	−0.12
	1,000	−0.04	−0.03	−0.01	0.08	−0.09	−0.08	−0.05	0.03	−0.19	−0.18	−0.15	−0.07
	1,500	−0.04	−0.03	0.00	0.15	−0.09	−0.08	−0.04	0.10	−0.19	−0.18	−0.14	−0.00
	1,800	−0.04	−0.03	0.01	0.24	−0.09	−0.08	−0.04	0.19	−0.19	−0.18	−0.14	0.09
	2,500	−0.04	−0.02	0.03	**n.e.s.**	−0.09	−0.07	−0.02	**n.e.s.**	−0.19	−0.17	−0.12	**n.e.s.**
5% (ΔHHI = 50)	100	0.00	0.25	0.77	1.83	−0.25	0.00	0.51	1.57	−0.75	−0.50	0.01	1.06
	1,000	0.01	0.30	1.00	3.08	−0.24	0.05	0.74	2.82	−0.74	−0.45	0.24	2.30
	1,500	0.02	0.34	1.18	4.74	−0.23	0.09	0.92	4.48	−0.73	−0.42	0.41	3.95
	1,800	0.02	0.36	1.31	**6.88**	−0.23	0.11	1.05	**6.61**	−0.73	−0.40	0.55	**6.07**
	2,500	0.04	0.42	1.75	**n.e.s.**	−0.22	0.16	1.49	**n.e.s.**	−0.72	−0.34	0.98	**n.e.s.**
7.071% (ΔHHI = 100)	200	0.15	0.66	1.72	3.98	−0.20	0.31	1.36	3.61	−0.92	−0.40	0.64	2.87
	1,000	0.17	0.75	2.14	**6.29**	−0.19	0.40	1.78	**5.91**	−0.90	−0.32	1.05	**5.16**
	1,500	0.19	0.82	2.49	**9.61**	−0.17	0.46	2.13	**9.22**	−0.88	−0.25	1.40	**8.44**
	1,800	0.19	0.86	2.76	**13.88**	−0.16	0.50	2.40	**13.48**	−0.87	−0.21	1.67	**12.67**
	2,500	0.22	0.98	3.63	**n.e.s.**	−0.14	0.62	3.26	**n.e.s.**	−0.85	−0.10	2.53	**n.e.s.**
10% (ΔHHI = 200)	400	0.52	1.57	3.83	**8.98**	0.01	1.06	3.30	**8.43**	−1.00	0.04	2.26	**7.33**
	1,000	0.55	1.71	4.48	**12.77**	0.04	1.20	3.95	**12.20**	−0.97	0.18	2.90	**11.07**
	1,500	0.58	1.84	**5.19**	**19.40**	0.07	1.33	4.66	**18.80**	−0.94	0.31	3.60	**17.60**
	1,800	0.59	1.93	**5.72**	**27.93**	0.09	1.41	**5.19**	**27.29**	−0.92	0.39	4.13	**26.00**
	2,500	0.64	2.15	**7.46**	**n.e.s.**	0.13	1.64	**6.92**	**n.e.s.**	−0.88	0.61	**5.84**	**n.e.s.**

Notes: Because of rounding up and truncation, some numbers may appear to remain unchanged even though the parametric values have changed. Percentage price changes of more than five percent are in bold.

n.e.s., "not economically sensible" for the price increases in those cases are theoretically positive infinitive in value because consumer surplus and the price are both unbounded. In practice, it suffices to note that the price increases in those cases are substantial and exceed competition agencies' thresholds.

Table 3. Net Welfare Effects of Mergers based on Linear Demand Schedule and Different Parametric Values of Market Share, Cost Reduction, HHI, and Demand Elasticity

		Cost Reductions from Mergers											
		Small Cost Reduction (2.5%) (i.e., $c_m = 0.975\ c_i$) Price Elasticity of Demand				Moderate Cost Reduction (5%) (i.e., $c_m = 0.95\ c_i$) Price Elasticity of Demand				Large Cost Reduction (10%) (i.e., $c_m = 0.9\ c_i$) Price Elasticity of Demand			
Firm's Market Shares ($s_i = s_j$)	Post-Merger HHI	2	1	0.5	0.25	2	1	0.5	0.25	2	1	0.5	0.25
1% (ΔHHI = 2)	4	0.05	0.05	0.05	0.05	0.11	0.10	0.10	0.10	0.24	0.22	0.21	0.20
	1,000	0.05	0.05	0.05	0.04	0.11	0.11	0.10	0.10	0.24	0.23	0.22	0.20
	1,500	0.06	0.05	0.05	0.03	0.11	0.11	0.11	0.09	0.25	0.23	0.22	0.21
	1,800	0.06	0.05	0.05	0.01	0.12	0.11	0.11	0.07	0.25	0.23	0.22	0.19
	2,500	0.06	0.05	0.04	**−19.93**	0.12	0.12	0.10	**−19.87**	0.26	0.24	0.22	**−19.75**
5% (ΔHHI = 50)	100	0.25	0.25	0.24	0.24	0.57	0.50	0.50	0.49	1.57	1.13	1.00	0.99
	1,000	0.25	0.22	0.16	**−0.01**	0.57	0.50	0.43	0.26	1.49	1.11	0.98	0.80
	1,500	0.25	0.21	0.10	**−0.33**	0.57	0.49	0.38	**−0.05**	1.46	1.11	0.95	0.52
	1,800	0.25	0.20	0.06	**−0.71**	0.57	0.48	0.34	**−0.43**	1.44	1.10	0.92	0.15
	2,500	0.24	0.17	**−0.09**	**−19.46**	0.57	0.47	0.21	**−19.16**	1.41	1.09	0.81	**−18.56**
7.071% (ΔHHI = 100)	200	0.35	0.34	0.33	0.30	0.88	0.70	0.69	0.65	2.25	1.50	1.40	1.37
	1,000	0.34	0.29	0.17	**−0.15**	0.87	0.67	0.56	0.23	2.12	1.48	1.32	0.99
	1,500	0.33	0.25	0.05	**−0.74**	0.86	0.65	0.44	**−0.35**	2.05	1.47	1.24	0.44
	1,800	0.32	0.23	**−0.04**	**−1.44**	0.85	0.63	0.36	**−1.04**	2.02	1.46	1.17	**−0.23**
	2,500	0.31	0.16	**−0.33**	**−19.10**	0.84	0.59	0.09	**−18.68**	1.96	1.44	0.94	**−17.84**
10% (ΔHHI = 200)	400	0.48	0.45	0.39	0.26	1.00	0.97	0.90	0.77	2.96	2.00	1.93	1.79
	1,000	0.45	0.36	0.15	**−0.42**	1.00	0.90	0.69	0.12	2.82	1.98	1.76	1.19
	1,500	0.43	0.28	**−0.10**	**−1.45**	0.99	0.84	0.46	**−0.90**	2.73	1.96	1.58	0.21
	1,800	0.41	0.23	**−0.27**	**−2.61**	0.99	0.80	0.29	**−2.04**	2.68	1.94	1.43	**−0.91**
	2,500	0.38	0.10	**−0.82**	**−18.45**	0.97	0.69	−0.23	**−17.86**	2.58	1.88	0.96	**−16.68**

Note: Because of rounding up and truncation, some numbers may appear to remain unchanged even though the parametric values have changed. Bold entries represent welfare losses.

In all those tables reporting the net welfare effects, a positive number means a net welfare gain as the cost savings of a merger is larger than the welfare loss due to stronger market power (i.e., area W_1 > areas $W_2 + W_3$ in Figure 1), whereas a negative number means a net welfare loss. It can be seen from these tables that the welfare effects are qualitatively similar whether the results are based on equation (4), a linear demand schedule or a constant elasticity demand schedule. This verifies what has been mentioned in the previous section and also in the Appendix that equation (4) can be taken as an approximation to the latter two cases. Furthermore, in practice, competition agencies often may not be able to ascertain whether the demand is linear or of constant elasticity. For the above reasons and for brevity, our exposition and discussion below will focus on the results in Tables 1 and 2 that are based on equation (4).

Table 4. Percentage Price Changes (%) due to Mergers based on Linear Demand Schedule and Different Parametric Values of Market Share, Cost Reduction, HHI, and Demand Elasticity

Firm's Market Shares ($s_i = s_j$)	Post-Merger HHI	Cost Reductions from Mergers: Small Cost Reduction (2.5%) (i.e., c_m = 0.975 c_i) Price Elasticity of Demand				Moderate Cost Reduction (5%) (i.e., c_m = 0.95 c_i) Price Elasticity of Demand				Large Cost Reduction (10%) (i.e., c_m = 0.9 c_i) Price Elasticity of Demand			
		2	1	0.5	0.25	2	1	0.5	0.25	2	1	0.5	0.25
1% (ΔHHI = 2)	4	–0.04	–0.03	–0.01	0.03	–0.09	–0.08	–0.06	–0.02	–0.19	–0.18	–0.16	–0.12
	1,000	–0.03	–0.02	–0.00	0.05	–0.08	–0.06	–0.04	0.02	–0.16	–0.15	–0.11	–0.04
	1,500	–0.03	–0.02	0.00	0.05	–0.07	–0.06	–0.03	0.03	–0.15	–0.13	–0.09	–0.01
	1,800	–0.03	–0.02	0.01	0.06	–0.07	–0.05	–0.02	0.04	–0.15	–0.12	–0.07	0.02
	2,500	–0.03	–0.01	0.01	0.06	–0.06	–0.04	–0.01	0.06	–0.13	–0.10	–0.05	0.06
5% (ΔHHI = 50)	100	0.00	0.25	0.75	1.74	–0.25	0.00	0.50	1.50	–0.74	–0.49	0.01	1.01
	1,000	0.01	0.25	0.73	1.68	–0.21	0.04	0.54	1.54	–0.64	–0.37	0.17	1.25
	1,500	0.02	0.25	0.72	1.65	–0.19	0.06	0.56	1.56	–0.59	–0.31	0.25	1.37
	1,800	0.02	0.25	0.71	1.63	–0.17	0.07	0.57	1.57	–0.56	–0.28	0.30	1.44
	2,500	0.02	0.25	0.70	1.60	–0.15	0.10	0.60	1.59	–0.50	–0.20	0.39	1.58
7.071% (ΔHHI = 100)	200	0.15	0.64	1.62	3.59	–0.20	0.29	1.28	3.26	–0.89	–0.39	0.60	2.59
	1,000	0.15	0.62	1.55	3.43	–0.16	0.32	1.29	3.22	–0.77	–0.26	0.76	2.81
	1,500	0.15	0.61	1.52	3.34	–0.14	0.34	1.30	3.21	–0.71	–0.19	0.85	2.94
	1,800	0.15	0.60	1.50	3.29	–0.12	0.35	1.30	3.20	–0.67	–0.15	0.90	3.01
	2,500	0.15	0.59	1.45	3.19	–0.10	0.37	1.31	3.18	–0.60	–0.06	1.01	3.15
10% (ΔHHI = 200)	400	0.49	1.45	3.38	**7.25**	0.01	0.98	2.92	**6.81**	–0.94	0.04	2.00	**5.92**
	1,000	0.47	1.40	3.25	**6.96**	0.04	0.98	2.87	**6.65**	–0.84	0.15	2.11	**6.04**
	1,500	0.46	1.36	3.16	**6.75**	0.06	0.98	2.83	**6.54**	–0.76	0.23	2.19	**6.12**
	1,800	0.46	1.34	3.10	**6.63**	0.07	0.98	2.81	**6.47**	–0.70	0.29	2.25	**6.17**
	2,500	0.45	1.29	2.98	**6.37**	0.09	0.98	2.77	**6.34**	–0.62	0.37	2.34	**6.27**

Note: Because of rounding up and truncation, some numbers may appear to remain unchanged even though the parametric values have changed. Percentage price changes of more than five percent are in bold.

Before we go into concrete illustration and detailed discussion about the welfare and price changes, the results in Tables 1 and 2 may give an impression that most of the welfare and price changes are numerically very small, particularly when market concentration is low and demand is elastic. As already explained in the previous section and will be illustrated in the next paragraph and Note 18 in particular, one reason for this is simply normalization. Another reason is more relevant to economics. Intuitively, when both market concentration and the merged firms' market shares are low, the welfare and price effects of the merger tend to be small because of weak market power. Similarly, the merger is less likely to result in a high increase in price if demand is more elastic. In sum, Cournot is intuitively pretty close to perfect competition under these circumstances, and hence we observe

Table 5. Net Welfare Effects of Mergers based on Constant Elasticity Demand Schedule and Different Parametric Values of Market Share, Cost Reduction, HHI, and Demand Elasticity

		Cost Reductions from Mergers											
		Small Cost Reduction (2.5%) (i.e., c_m = 0.975 c_i) Price Elasticity of Demand				Moderate Cost Reduction (5%) (i.e., c_m = 0.95 c_i) Price Elasticity of Demand				Large Cost Reduction (10%) (i.e., c_m = 0.9 c_i) Price Elasticity of Demand			
Firm's Market Shares (s_i = s_j)	Post-Merger HHI	2	1	0.5	0.25	2	1	0.5	0.25	2	1	0.5	0.25
1% (ΔHHI = 2)	4	0.05	0.05	0.05	0.05	0.10	0.10	0.10	0.10	0.20	0.20	0.20	0.20
	1,000	0.05	0.05	0.05	0.04	0.11	0.11	0.11	0.09	0.22	0.22	0.22	0.21
	1,500	0.06	0.05	0.05	**–0.01**	0.11	0.11	0.11	0.06	0.23	0.23	0.23	0.20
	1,800	0.06	0.06	0.05	**–0.10**	0.12	0.12	0.11	**–0.02**	0.24	0.24	0.24	0.15
	2,500	0.06	0.06	0.04	**n.e.s.**	0.13	0.12	0.11	**n.e.s.**	0.25	0.26	0.26	**n.e.s.**
5% (ΔHHI = 50)	100	0.25	0.25	0.24	0.24	0.50	0.50	0.50	0.49	1.03	1.01	1.00	0.99
	1,000	0.25	0.22	0.13	**–0.23**	0.53	0.49	0.41	0.06	1.08	1.05	0.97	0.63
	1,500	0.25	0.19	0.01	**–1.41**	0.54	0.49	0.31	**–1.07**	1.12	1.07	0.91	**–0.39**
	1,800	0.25	0.17	**–0.11**	**–3.79**	0.55	0.48	0.21	**–3.38**	1.15	1.09	0.85	**–2.57**
	2,500	0.24	0.11	**–0.59**	**n.e.s.**	0.56	0.45	**–0.22**	**n.e.s.**	1.21	1.11	0.52	**n.e.s.**
7.071% (ΔHHI = 100)	200	0.35	0.34	0.33	0.29	0.71	0.70	0.68	0.65	1.46	1.42	1.40	1.36
	1,000	0.34	0.27	0.11	**–0.58**	0.73	0.66	0.50	**–0.17**	1.52	1.45	1.29	0.64
	1,500	0.32	0.21	**–0.15**	**–2.78**	0.73	0.63	0.28	**–2.31**	1.57	1.46	1.13	**–1.36**
	1,800	0.32	0.17	**–0.38**	**–7.13**	0.74	0.60	0.07	**–6.56**	1.60	1.46	0.97	**–5.44**
	2,500	0.29	0.04	**–1.35**	**n.e.s.**	0.75	0.51	**–0.82**	**n.e.s.**	1.67	1.45	0.22	**n.e.s.**
10% (ΔHHI = 200)	400	0.48	0.45	0.38	0.20	1.00	0.96	0.89	0.72	2.05	2.00	1.92	1.74
	1,000	0.45	0.33	0.02	**–1.18**	1.00	0.88	0.57	**–0.61**	2.11	1.98	1.66	0.52
	1,500	0.41	0.20	**–0.48**	**–5.06**	0.99	0.78	0.12	**–4.40**	2.16	1.95	1.31	**–3.09**
	1,800	0.39	0.11	**–0.92**	**–12.34**	0.98	0.71	**–0.29**	**–11.57**	2.19	1.92	0.96	**–10.02**
	2,500	0.33	**–0.17**	**–2.77**	**n.e.s.**	0.96	0.48	**–2.04**	**n.e.s.**	2.26	1.80	**–0.59**	**n.e.s.**

Notes: Because of rounding up and truncation, some numbers may appear to remain unchanged even though the parametric values have changed. Bold entries represent welfare losses.
n.e.s., "not economically sensible" for the net welfare losses in those cases are theoretically negative infinitive in value because consumer surplus and the price are both unbounded. In practice, it suffices to note that the net welfare losses in those cases are substantial.

relatively small welfare and price changes. As can be seen from Tables 1 and 2, however, the welfare and price changes become more considerable in magnitude when market concentration is high and demand is inelastic.

Let us now turn to consider a couple of concrete examples to illustrate how to find out the welfare effects of proposed mergers. For example, if the cost reduction from merger is 5%, then a merger between two firms each with a pre-merger market share of 5% in an industry with a pre-merger HHI of 950 (i.e., post-market HHI of 1,000) and a price elasticity of 0.25 would lead to a net welfare gain of $0.06 if the cost reduction is 5% (see the entry in the 7th row and 8th column in Table 1); but if, all other things equal, the pre-merger

Table 6. Percentage Price Changes (%) due to Mergers based on Constant Elasticity Demand Schedule and Different Parametric Values of Market Share, Cost Reduction, HHI, and Demand Elasticity

		Cost Reductions from Mergers											
		Small Cost Reduction (2.5%) (i.e., $c_m = 0.975\ c_i$) Price Elasticity of Demand				Moderate Cost Reduction (5%) (i.e., $c_m = 0.95\ c_i$) Price Elasticity of Demand				Large Cost Reduction (10%) (i.e., $c_m = 0.9\ c_i$) Price Elasticity of Demand			
Firm's Market Shares ($s_i = s_j$)	Post-Merger HHI	2	1	0.5	0.25	2	1	0.5	0.25	2	1	0.5	0.25
1% (ΔHHI = 2)	4	–0.04	–0.03	–0.01	0.03	–0.09	–0.08	–0.06	–0.02	–0.19	–0.18	–0.16	–0.12
	1,000	–0.04	–0.03	–0.00	0.08	–0.09	–0.08	–0.05	0.03	–0.19	–0.18	–0.15	–0.06
	1,500	–0.04	–0.03	0.01	0.15	–0.09	–0.08	–0.04	0.10	–0.19	–0.18	–0.14	–0.00
	1,800	–0.04	–0.03	0.01	0.24	–0.09	–0.08	–0.04	0.18	–0.19	–0.18	–0.14	0.09
	2,500	–0.04	–0.02	0.03	**n.e.s.**	–0.09	–0.07	–0.02	**n.e.s.**	–0.19	–0.17	–0.12	**n.e.s.**
5% (ΔHHI = 50)	100	0.00	0.25	0.77	1.83	–0.25	0.00	0.51	1.57	–0.75	–0.50	0.01	1.06
	1,000	0.01	0.30	0.99	3.08	–0.24	0.05	0.74	2.82	–0.74	–0.45	0.24	2.30
	1,500	0.02	0.34	1.18	4.74	–0.23	0.09	0.92	4.48	–0.73	–0.42	0.41	3.95
	1,800	0.02	0.36	1.31	**6.88**	–0.23	0.11	1.05	**6.61**	–0.73	–0.40	0.55	**6.07**
	2,500	0.04	0.42	1.75	**n.e.s.**	–0.22	0.16	1.49	**n.e.s.**	–0.72	–0.34	0.98	**n.e.s.**
7.071% (ΔHHI = 100)	200	0.15	0.66	1.72	3.98	–0.20	0.31	1.36	3.61	–0.92	–0.40	0.64	2.87
	1,000	0.17	0.75	2.14	**6.29**	–0.18	0.40	1.78	**5.91**	–0.89	–0.32	1.05	**5.16**
	1,500	0.19	0.82	2.49	**9.61**	–0.17	0.46	2.13	**9.22**	–0.88	–0.25	1.40	**8.44**
	1,800	0.19	0.86	2.76	**13.88**	–0.16	0.50	2.40	**13.45**	–0.87	–0.21	1.67	**12.67**
	2,500	0.22	0.98	3.63	**n.e.s.**	–0.14	0.62	3.26	**n.e.s.**	–0.85	–0.10	2.53	**n.e.s.**
10% (ΔHHI = 200)	400	0.52	1.57	3.83	**8.99**	0.01	1.06	3.30	**8.43**	–1.00	0.04	2.26	**7.33**
	1,000	0.55	1.71	4.48	**12.77**	0.04	1.20	3.95	**12.20**	–0.97	0.17	2.90	**11.74**
	1,500	0.58	1.84	**5.19**	**19.40**	0.07	1.33	4.66	**18.80**	–0.94	0.31	3.60	**17.60**
	1,800	0.59	1.93	**5.72**	**27.93**	0.09	1.41	**5.19**	**27.29**	–0.92	0.39	4.13	**26.00**
	2,500	0.64	2.15	**7.46**	**n.e.s.**	0.13	1.64	**6.92**	**n.e.s.**	–0.88	0.61	**5.84**	**n.e.s.**

Notes: Because of rounding up and truncation, some numbers may appear to remain unchanged even though the parametric values have changed. Percentage price changes of more than five percent are in bold.

n.e.s., "not economically sensible" for the price increases in those cases are theoretically positive infinitive in value because consumer surplus and the price are both unbounded. In practice, it suffices to note that the price increases in those cases are substantial and exceed competition agencies' thresholds.

HHI is 1,750 (i.e., post-merger HHI of 1,800), then the merger would lead to a net welfare effect loss, that is, −\$3.39 (the entry in the 9th row and the same 8th column).[18] In the latter case, the market power is so strong that its associated welfare loss (areas $W_2 + W_3$ in Figure 1) offsets the welfare gain from cost reduction (area W_1).

The above two examples are consistent with the 1992 Merger Guidelines. Here, we first focus on the 1992 Merger Guidelines before we examine the 2010 Guidelines, since some of the policy and welfare implications of the latter can perhaps be better realized with reference to the former. Now in the first example in the previous paragraph, with an increase in HHI of 50 and a post-merger HHI of 1,000, the merger falls into one of the safe harbors as defined under the 1992 Merger Guidelines. Accordingly, the merger is viewed as safe from challenge because it is unlikely to have an adverse competitive effect. This is consistent with our finding of a positive net welfare effect. In the second example, the merger falls outside the safe harbors and is regarded as unsafe because the increase in HHI is 50 but the post-merger HHI is 1,800. As such, it is viewed as likely to have an adverse competitive effect, and the DOJ would examine other factors to determine if the merger should be challenged. The view and the subsequent policy implication are again in line with our numerical finding of a negative net welfare effect. In most cases, our findings are consistent with the 1992 Merger Guidelines. In particular, for mergers with post-merger HHIs below 1,000, the safe harbors unambiguously remain safe according to our welfare analysis.

However, a further study of our results indicates that the reliability of the safe harbors to discriminate between safe and unsafe proposed mergers is somewhat undermined. Proposed mergers that fall outside the safe harbors can actually be safe when cost savings are considerable. For example, proposed mergers with an increase in HHI of 100 and a post-merger HHI of 1,800 are undoubtedly regarded as unsafe according to the 1992 Merger Guidelines, but in many cases their net welfare effects are positive so long as cost savings are not small and demand is not highly inelastic (see row 14 in Table 1). There are other incidents in which the proposed mergers can be viewed as unsafe, even though their net welfare effects are positive. Of course, one can argue that this is unlikely to result in wrong merger decisions because the DOJ would consider other relevant factors when a proposed merger falls outside the safe harbors.

What is potentially problematic is, however, those proposed mergers that fall into one of the safe harbors but are actually welfare decreasing. Consider a proposed merger that would increase the HHI by 50 and lead to a post-merger HHI of 1,000. Under the 1992 Merger Guidelines, it would be regarded as safe from challenge. But our results indicate that it can lead to a net welfare loss if demand is highly inelastic. As a further example, consider the reported results in Table 1: those proposed mergers all fall into the safe harbors because of the small increases in HHI. Yet some of these proposed mergers could result in net welfare losses when demand was highly inelastic. As such, the DOJ might make decision errors if it simply regarded those mergers as safe from challenge and did not investigate further.

Instead of going into a case-by-case comparison, Figure 2 serves to summarize our findings. Proposed mergers are categorized into the safe or unsafe harbors, as defined in the 1992 Merger Guidelines according to increases in HHI and post-merger HHIs. The top left-hand corner of each section denotes the safe or unsafe harbors. In certain sections, whenever applicable, we state briefly the conditions under which safe harbors can turn out to be unsafe or unsafe harbors can in fact be safe according to our welfare analysis results.

Let us now turn to the 2010 Merger Guidelines. The safe harbors following the changes in the thresholds are shown in Figure 3. Similarly, the safe or unsafe harbors are denoted, and the conditions under which an unsafe harbor may turn out to be actually safe, or vice versa, are also briefly described. The

Post-merger HHI	**Safe** Can be unsafe if demand highly inelastic & cost savings not large	**Unsafe** Can be safe under moderate to large cost savings unless demand highly inelastic	**Unsafe** Can be safe under moderate to large cost savings unless demand highly inelastic
1800	**Safe**	**Safe** Can be unsafe under small cost savings & highly inelastic demand	**Unsafe** Can be safe unless demand highly inelastic
1000	**Safe**	**Safe**	**Safe**
Increase in HHI	50	100	

Figure 2. The safe harbors under DOJ's 1992 Merger Guidelines.

Post-merger HHI	**Safe** Can be unsafe if demand highly inelastic	**Unsafe** Can be safe when elasticity is larger than one	**Unsafe** Can be safe under large cost savings and elastic demand
2500	**Safe** Can be unsafe if demand highly inelastic	**Unsafe** Can be safe under elastic demand or large cost savings	**Unsafe** Can be safe under elastic demand or large cost savings
1500	**Safe**	**Safe**	**Safe**
Increase in HHI	100	200	

Figure 3. The safe harbors under DOJ's 2010 Merger Guidelines.

new thresholds (i.e., a post-merger HHI of 1,500 and increase in HHI of 100) will now make proposed mergers with either (i) $1{,}000 < \text{HHI} < 1{,}500$ and $\Delta\text{HHI} > 100$, or (ii) $\text{HHI} > 1{,}800$ and $50 < \Delta\text{HHI} < 100$ to fall into the safe harbors, whereas they would have remained as unsafe under the 1992 Merger Guidelines. Hence, the new Guidelines would be beneficial to the DOJ because it can now focus its limited resources on merger cases that are more likely to be anti-competitive.

However, this resource saving is not without its potential costs, since those proposed mergers that actually have adverse welfare effects will continue to fall into the safe harbors and remain undetected by the DOJ so long as they do not breach the thresholds.[19] This possibility is reinforced by the 2010 Merger

Guidelines, which have higher thresholds than their predecessors. Of course, given uncertainties and imperfect information, it is unrealistic to expect the DOJ not to make any mistakes at all in its merger decisions. In practice, the specification of thresholds is to make a trade-off between the resource saving and the chance of making "Type II" errors – as in statistical decision making – of allowing some proposed mergers that are anti-competitive to fall into the safe harbors.

As can be seen from our welfare analysis, the DOJ can potentially achieve resource saving on the one hand and reduce the chance of making mistakes in merger decisions on the other by redefining the safe or unsafe harbors with reference not only to increases in HHI and post-merger HHIs but also to demand elasticity and cost savings from mergers. For example, proposed mergers leading to increases in HHI <50 and post-merger HHIs of ≥1800 can continue to remain safe in most cases, but such proposed mergers can be considered as falling outside the safe harbors if demand is highly inelastic. It can be seen from Table 1 that the chance of having negative net welfare changes is higher when price elasticity is 0.5 or lower. On the other hand, proposed mergers leading to increases in HHI of ≥100 and post-merger HHIs of ≥1,500 can be regarded as safe if cost savings are high and demand is not highly inelastic. The above are just illustrative examples. In practice, how the thresholds can be refined to re-specify the safe harbors has to take into account both the expected net welfare effects of proposed mergers and the regulators' resource or enforcement costs in merger investigations.

Unfortunately, Williamson's insights have not been fully incorporated into the current practice of antitrust policy. Most, if not all, competition agencies, notably the DOJ, focus on consumer welfare or consumer surplus rather than social welfare.[20] A pass-through requirement – efficiency from a merger has to be sufficient to result in no predictable increase in price above the pre-merger level – is commonly imposed. Alternatively, a price increase of, say, 5%, is implicitly used by competition agencies as a threshold to determine if a merger is a cause for concern. In general high price increases adversely affect social welfare, but our welfare analysis shows that such a price increase threshold, like the safe harbors, may not be a reliable screening device. For example, in the case of a proposed merger with a cost reduction of 2.5%, ΔHHI = 50, post-merger HHI of 1,000, and price elasticity of 0.25, our numerical result indicates a net welfare effect of −\$0.23 (i.e., loss), whereas the predicted price increase is 3.08% only (see the corresponding entry in Table 2). By contrast, as another example, a proposed merger with a cost reduction of 10% and ΔHHI = 200, with the same post-merger HHI and price elasticity would lead to a net welfare gain, even though the predicted price increase would be 11.07%!

The latter example is most likely undesirable from the consumer's perspective because of the considerable price hike. Although mergers resulting in post-merger prices exceeding a certain price threshold – say, 5% (which are printed in bold in Table 2) – tend to yield net welfare losses, there are some exceptions. By considering both Tables 1 and 2 at the same time, competition agencies can judge whether there are net welfare gains or losses in those mergers that are deemed to be hurting consumers because of considerably higher post-merger prices. It would be a mistake to focus on consumer surplus only and ignore the cost saving because it means that society's scarce resources would be available to produce other goods and services, which would ultimately benefit the consumers. As already alluded to in Williamson's classic paper, a merger that has market power and cost-saving consequences may yield a loss in a sector but a desirable reallocation of resources for the whole economy.

All in all, both safe harbors and price increase threshold have pitfalls that competition agencies should avoid in their merger decisions. Unfortunately, for one reason or another, competition agencies tend to focus on consumer welfare rather than social welfare to such an extent that their enforcement policies or decisions may appear to be misguided, if not economically irrational.[21] Therefore, it may be advisable for competition agencies to consider both Tables 1 and 2 at the same time when they come to merger decisions so that they can perhaps strike a balance between the economic aspects and "non-economic" concerns – such as political resistance from consumer protection groups – in the process of promoting economic welfare.

4. Conclusion

By incorporating a standard Cournot model of oligopoly to characterize the cost-price relationship, we have extended Williamson's (1968a) seminal paper to analyze the net welfare effect of a merger that yields economies and market power at the same time. To facilitate the assessment of welfare trade-offs in practice, we have derived an equation in terms of factors such as cost reductions from mergers, changes in HHI, post-merger HHIs, and price elasticity of demand, which are used in merger guidelines or by competition agencies in their merger decisions. The numerical welfare analysis results show that Williamson's insights and results remain correct except in some extreme cases such as demand is highly inelastic. In most cases, economies from mergers offset price increases due to market power such that there are positive net allocative effects. The results also indicate that the safe harbors as defined in the DOJ's Merger Guidelines may fail to screen out proposed mergers correctly. The reliability of safe harbors as a screening device can be improved upon by taking into consideration of cost savings and price elasticities in addition to the current use of increases in HHI and the post-merger HHIs.

As Yang and Pickford (2011, 15) correctly point out, "to provide more rigour in the specification of safe harbours in merger guidelines is a timely and potentially useful exercise." Furthermore, Williamson's insights have not been fully incorporated into antitrust policy today, despite the fact that his findings were published more than 40 years ago. By revisiting Williamson's classic paper, we hope this paper will draw the attention of not only the economic profession but also regulators to the above two issues.

Notes

1. This paper refers to the amended version of Williamson (1968a/1987), which is based on the original paper (1968a) with the correction and replies (1968b, 1969) to incorporate the comments by Ross (1968) and DePrano and Nugent (1969).
2. This is essentially a point raised by DePrano and Nugent (1968) that "costs and prices are obviously not independent of each other." Unfortunately, their numerical welfare analysis is

based on an incorrect equation. Furthermore, their findings are considered by Williamson (1969) as operationally irrelevant and exaggerating because of their assigned parameter values.

3. In fairness to Williamson, the HHI was first introduced by the DOJ into the 1982 Merger Guidelines, more than a decade after the publication of his classic paper.
4. In practice, the 1984 revision to the 1982 Merger Guidelines and the subsequent 1992 and 2010 Guidelines tend to de-emphasize the market structure presumption between concentration and market power. Moreover, the enforcement record shows discrepancy between the Guidelines and actual practice. Despite all these developments, the Guidelines continue to state, at least on the surface, that the enforcement agencies' first step would be to assess market concentration based on the HHI in any investigation.
5. For analytical tractability, equation (1) assumes zero conjectural variations for all firms. Details can be found in standard industrial organization textbooks such as Hay and Morris (1991).
6. In the case of economies, $\Delta C < 0$ algebraically. However, the conventional approach is adopted in the computation of the net welfare effects according to equation (4) below, that is, the absolute value of the welfare gain due to cost reductions and that of the welfare loss due to market power are compared. In other words, $\Delta C/C$ is treated as positive instead even though there are economies.
7. In all likelihood, market shares do not remain intact after mergers. In Salant, Switzer, and Reynolds (1983), for example, the merged firm has an incentive to reduce output, whereas its rivals expand, also known as the Cournot merger paradox. In theory, there can be an infinite number of possible equilibria after a merger, depending on model specifications and assumptions, especially on conjectural variations. To avoid further complication and to maintain analytical tractability, we follow the competition agencies' practice to assume that market shares remain intact, at least instantaneously after a merger, and proceed with the welfare analysis.
8. This normalization does not qualitatively affect our results and conclusion because, as can be seen from equation (4), it is the percentage changes in cost and in quantity rather than the actual value of C_0 and Q_0 that really matter in affecting whether ΔW is positive or negative.
9. We have assumed a linear demand schedule with constant demand elasticity in the derivation and computation of equation (4). It is well known, however, that the value of demand elasticity changes along a linear demand schedule. To simplify the computation, a constant elasticity demand schedule is assumed (for the relevant range involved in the merger analysis), and we can hence compute $Q_0/Q_1 = [1/(1 + \Delta P/P_0)]^{-e}$. If we assume instead a constant elasticity demand schedule, then it is a hyperbola, and hence area W_2 will no longer be a triangle. Strictly speaking, therefore, equation (4) is only an approximation to the actual welfare change. We have also considered the actual welfare changes for a linear demand schedule as well as for a constant elasticity demand. For the technical details, see the Appendix. For the numerical results, see Tables 3–6.
10. This is just to make the presentation of Table 1 simple and neat. Different parametric values of s_i, s_j, c_i, c_j, c_m, ε, and HHI_0 can in fact be used in the simulation.
11. From a US perspective, the 1992 Merger Guidelines appear to be dated as the 2010 Guidelines have already been released. But from an international perspective, the Guidelines are still of interest and relevance to other competitive agencies for their reference if their current thresholds are similar to those in the 1992 Guidelines.
12. It is straightforward to figure out the pre-merger HHIs from the information given in Table 1. For example, for a merger in which each of the involved firm's market share is 5% and a post-merger HHI of 1,800, the pre-merger HHI is simply 1,750.
13. The lowest HHIs for the unconcentrated cases as reported in Table 1 are not all the same, because the market shares s_i and s_j imply not only a certain change in HHI but also a lower bound for the HHI. For example, if $s_i = s_j = 1\%$, then HHI_0 has to be at least equal to 2, even if we assume all other firms hold smaller and negligible market shares, and the post-merger HHI thus becomes 4.
14. More specifically, in moderately concentrated markets (1,500 < HHI < 2,500) or highly concentrated markets, any proposed merger that would lead to ΔHHI >100 would "potentially raise significantly competitive concerns and often warrant scrutiny," whereas it would be "presumed to be likely to enhance market power" if HHI > 2,500 and ΔHHI > 200. See the 2010 Merger Guidelines for details.
15. As Blair and Haynes (2011) point out, the Guidelines adopt consumer welfare rather than social welfare or allocative efficiency as the criterion to guide merger policy.

16. Williamson (1987, 7) correctly points out that if post-merger price "were less than [the pre-merger price] the economic effects of the merger would be strictly positive." Nevertheless, he assumes the post-merger price to exceed the pre-merger price throughout his analysis. In contrast, this study does not impose such an assumption. The post-merger price can be higher or lower than the pre-merger price, depending on the relative magnitudes of the relevant factors such as market shares, cost reductions, elasticity, and so on.
17. The examples here refer to the pattern of consumer demand in the United States, and they are taken from Houthakker and Taylor (2010, 405, table 18.8).
18. The welfare figures in Table 1 may appear to be misleadingly small because of normalization (C_0 = 1 and Q_0 = 100). In our latter example, the welfare loss can be interpreted as $3.39 per $100 (i.e., $C_0 \times Q_0$ = 100) or roughly 3.4% of the total cost of production in the industry. The welfare gain or loss will increase with the size of the industry, and it can be a considerable amount in pecuniary terms if the industry is large.
19. For example, based on their modeling and simulations, Werden and Froeb (1996) show that the thresholds in the US merger guidelines do a poor job of identifying mergers that could give rise to serious concerns. On the other hand, Yang and Pickford's (2011) simulation results find that the safe harbor thresholds used by various competitive agencies tend to be too restrictive that they fail to identify or screen out mergers that are most unlikely to generate anti-competitive harm, although there are also cases where the thresholds are not restrictive enough.
20. While anti-competitiveness and price increases created by mergers are competition agencies' main concerns and focus, there can be exceptions. For example, Canada's Competition Act has an efficiency exception that allows mergers with anti-competitive effects if the merging parties can demonstrate sufficient efficiency gains, including allocative efficiency. For details, see Section 12 of the Merger Enforcement Guidelines of Competition Bureau, Canada (2010).
21. Of course, the competition agencies' behavior and decisions can be rational if they are the outcomes of political processes.

References

Blair, Roger D., and Jessica S. Haynes. 2011. The Efficiencies Defense in the 2010 Horizontal Merger Guidelines. *Review of Industrial Organization* 39 (1–2): 57–68.

Brennan, Timothy J. 1996. Is Cost-of-Service Regulation Worth the Cost? *International Journal of the Economics of Business* 3 (1): 25–42.

Competition Bureau of Canada. 2010. *Merger Enforcement Guidelines*. Ottawa: Competition Bureau.

Cowling, Keith, and Michael J. Waterson. 1976. Price-Cost Margins and Market Structure. *Economica* 43 (171): 267–274.

Deneckere, Raymond, and Carl Davidson. 1985. Incentives to Form Coalitions with Bertrand Competition. *RAND Journal of Economics* 16 (4): 473–486.

DePrano, Michael E., and Jeffrey B. Nugent. 1969. Economies as an Antitrust Defense: Comment. *American Economic Review* 59 (5): 947–953.

Farrell, Joseph, and Karl Shapiro. 1990. Horizontal Mergers: An Equilibrium Analysis. *American Economic Review* 80 (1): 107–126.

Hay, Donald A., and Derek J. Morris. 1991. *Industrial Economics and Organization: Theory and Evidence*. 2nd ed. New York: Oxford University Press.

Houthakker, Hendrik S., and Lester D. Taylor. 2010. *Consumer Demand in the United States: Prices, Income and Consumption Behavior*. 3rd ed. New York: Springer.

Perry, Martin K., and Robert H. Porter. 1985. Oligopoly and the Incentive for Horizontal Merger. *American Economic Review* 75 (1): 219–227.

Ross, Peter. 1968. Economies as an Antitrust Defense: Comment. *American Economic Review* 58 (5): 1371–1372.

Salant, Stephen W., Sheldon Switzer, and Robert J. Reynolds. 1983. Losses from Horizontal Mergers: The Effects of an Exogenous Change in Industry Structure on Cournot–Nash Equilibrium. *Quarterly Journal of Economics* 98 (2): 185–199.

US Department of Justice and Federal Trade Commission. 1992. *Horizontal Merger Guidelines*.

US Department of Justice and Federal Trade Commission. 2010. *Horizontal Merger Guidelines*.

Viscusi, W. Kip, Joseph E. Harrington Jr., and John M. Vernon. 2005. *Economics of Regulation and Antitrust*. 4th ed. Cambridge: MIT Press.

Werden, Gregory J., and Luke M. Froeb 1996. Simulations as an Alternative to Structural Merger Policy in Differentiated Products Industry. In *The Economics of the Antitrust Process*, edited by Malcolm B. Coates and Andrew N. Kleit, 65–88. New York: Springer-Verlag.

Williamson, Oliver E. 1968a. Economies as an Antitrust Defense: The Welfare Trade-off. *American Economic Review* 58 (1): 18–36, reprinted with amendments as Chapter 1, pp. 3-23, in Williamson, O.E. 1987. *Antitrust Economics*. Oxford: Basil Blackwell.

Williamson, Oliver E. 1968b. Economies as an Antitrust Defense: Correction and Reply. *American Economic Review* 58 (5): 1372–1376.

Williamson, Oliver E. 1969. Economies as an Antitrust Defense: Reply. *American Economic Review* 59 (5): 954–959.

Willig, Robert D., Steven C. Salop, and Frederic M. Scherer. 1991. *Merger Analysis, Industrial Organization Theory and Merger Guidelines*, 281–332. Brookings Papers on Economic Activity: Microeconomics.

Yang, Qing Gong, and Michael Pickford. 2011. Safe Harbours in Merger Guidelines: What Should They Do? *Australian Economic Review* 44 (1): 13–35.

Appendix

This appendix provides details about the computations of the net welfare changes under a linear demand schedule and a constant elasticity demand schedule respectively, as well as the derivation of equation (4) in the text. To begin with, we follow Williamson's approach and consider the case of a linear demand schedule first. From Figure 1, the net welfare effect is geometrically given by the difference between the area of the rectangle W_1 and the area of the trapezoid as represented by the sum of W_2 and W_3. The net welfare effect (ΔW) is therefore

$$\Delta W = \Delta C * Q_1 - \left[(P_0 - C_0) * \Delta Q + \frac{1}{2} * \Delta P * \Delta Q\right]. \tag{A1}$$

The first term is the area of the rectangle W_1, the second term is the area of the rectangle W_3, and the last term is the triangle W_2. Since an area cannot be negative in value, here we follow the convention to treat these terms as positive (or in terms of their absolute values), even though $\Delta C < 0$ and $\Delta Q < 0$ in the merger problem we have at hand. There is a welfare gain from the merger as long as (A1) is positive. Given a linear demand schedule and data on cost, price, and quantity before and after a merger, equation (A1) or equation (3) in the text can be applied directly to compute the *actual* welfare changes. These are reported in Table 3.

To derive equation (4), first divide (A1) throughout by $(C_0Q_1)/(C_0Q_1)$ to get

$$\Delta W = \frac{C_0Q_1}{C_0Q_1} * \left\{\Delta C * Q_1 - \left[(P_0 - C_0) * \Delta Q + \frac{1}{2} * \Delta P * \Delta Q\right]\right\} \tag{A2}$$

Then divide the expression inside the curly brackets to obtain:

$$\Delta W = C_0Q_1 * \left\{\frac{\Delta C}{C_0} - \left[\frac{(P_0 - C_0)}{C_0}\frac{\Delta Q}{Q_1} + \frac{1}{2}\frac{\Delta P}{C_0}\frac{\Delta Q}{Q_1}\right]\right\} \tag{A3}$$

Define the market power parameter $k = P_0/C_0$ and substitute it into the above equation to get

$$\Delta W = C_0 Q_1 * \left\{ \frac{\Delta C}{C_0} - \left[(k-1)\frac{\Delta Q}{Q_1} + \frac{1}{2}k\frac{\Delta P}{P_0}\frac{\Delta Q}{Q_1} \right] \right\} \tag{A4}$$

Next use the definition of the absolute value of price elasticity $\varepsilon = |(\Delta Q/Q)(P/\Delta P)|$ to get

$$\Delta W = C_0 Q_1 * \left\{ \frac{\Delta C}{C_0} - \left[(k-1)\frac{\Delta Q}{Q_0}\frac{Q_0}{Q_1} + \frac{1}{2}k\varepsilon\left(\frac{\Delta P}{P_0}\right)^2\frac{Q_0}{Q_1} \right] \right\} \tag{A5}$$

In the special case when $k = 1$, the expression inside the curly brackets of the above equation is reduced to the same as equation (1.2) in Williamson's (1987, 7) paper, even though the notation is slightly different. Now equation (2) in the text is equivalent to $1 - 1/k = h/\varepsilon$, which also implies that $k = \varepsilon/(\varepsilon - h)$ and $(k-1) = h/(\varepsilon - h)$. Finally, substitute these two expressions into (A5) to get

$$\Delta W = C_0 Q_1 * \left\{ \frac{\Delta C}{C_0} - \left[\left(\frac{h_0}{\varepsilon - h_0}\right)\frac{\Delta Q}{Q_0}\frac{Q_0}{Q_1} + \frac{1}{2}\left(\frac{\varepsilon^2}{\varepsilon - h_0}\right)\left(\frac{\Delta P}{P_0}\right)^2\frac{Q_0}{Q_1} \right] \right\} \tag{A6}$$

which is equation (4) in the text. Hence, there is a welfare gain from the merger, as long as (A6) or equation (4) in the text is positive.

It is well known that the value of demand elasticity changes along a linear demand schedule. Nevertheless, if price changes are not substantial such that we can assume as if the demand elasticity to be constant in the relevant range in the merger analysis, equation (4) can be used to compute the approximate net welfare changes due to mergers under a linear demand schedule. These are reported in Table 1.

By the same token, equation (4) can be applied to cases under which the demand schedule is of constant elasticity. In fact, we can also compute the actual net welfare changes following the above approach. Consider Figure 1 again. Instead of a downward sloping straight line, the demand schedule in this case is now a hyperbola. The rectangles W_1 and W_3 are unaffected, and hence computations of their areas remain intact. However, the triangle W_2 will now have its hypotenuse replaced by a curve instead of a straight line. The area W_2 can be computed as follows:

$$W_2 = \int_{P0}^{P1} Q dP - (P_1 - P_0)Q_1 \tag{A7}$$

The first term on the right-hand side of the above equation is the loss in consumer surplus due to an increase in the price from P_0 to P_1. But part of this loss in consumer surplus is transferred into the gain in producers' profits. This is represented by the area of the rectangle or the second term on the right-hand side of the above equation. The difference between these two terms therefore represents the deadweight loss or W_2. Now substituting a constant elasticity demand schedule, which can be represented mathematically as $Q = \alpha P^{-\varepsilon}$, into the above equation yields:

$$W_2 = \int_{P0}^{P1} \alpha P^{-\varepsilon} dP - (P_1 - P_0)Q_1 \tag{A8}$$

where α is a scale parameter that can be determined once the values of price, quantity, and demand elasticity are given. The second term of the above equation can be easily computed in a straightforward manner. The first term involves integration and the result depends on the value of the elasticity ε. When ε =1 (i.e., unitary elasticity), we have

$$W_2 = \alpha(\ln P_1 - \ln P_0) - (P_1 - P_0)Q_1. \tag{A9}$$

and when $\varepsilon \neq 1$, we have

$$W_2 = \frac{\alpha}{1-\varepsilon}(P_1^{1-\varepsilon} - P_0^{1-\varepsilon}) - (P_1 - P_0)Q_1. \tag{A10}$$

The *actual* net welfare change in this case is thus the difference between the area of the rectangle W_1 and the sum of the areas W_3 and W_2. The numerical results are tabulated as Table 5. The above computation procedures may appear to be somewhat complicated. Fortunately, equation (4) can be applied as an approximation regardless whether ε = 1 or not. A comparison of our numerical results (Tables 1 and 5) indicates that it provides highly satisfactory and accurate approximations to the actual net welfare changes.

The above analysis is based on the notion that mergers lead to economies and price increases at the same time. For cases in which cost reductions result in price decreases, the above framework is still applicable. With appropriate relabeling of Figure 1 by reversing P_0 and P_1 as well as Q_0 and Q_1 accordingly, the net welfare change can be calculated as the sum of the areas W_1, W_2, and W_3. In other words, W_1 and W_3 are producers' efficiency gains due to cost reductions and higher output, whereas W_2 is the gain in consumer surplus due to lower price and higher output.