Efficiency defence of horizontal merger

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Abstract

In a quantity setting oligopoly fixed costs are assumed to reduce marginal costs. Their size follows from maximizing profits. Following a merger, the price rises and consumer surplus declines, profits of both participating and non-participating firms, rise irrespective of the number of competitors. Total welfare exhibits a maximum at some level of horizontal concentration and can thus serve as the focal point to guide merger control.

Introduction

Mergers typically yield two opposing results, increased monopoly power and the likelihood of lower costs. Mergers may thus be motivated either by the intent to exercise monopolistic market power or to profit from efficiencies or by both. Even where mergers are motivated by the search for efficiency the resulting rise of its market share may inadvertently entail an increase in monopolistic market power. Two questions then arise. First, do firms become more profitable following a merger, and second, how does a merger impact on consumer welfare and to what extent should the possibility to gain efficiencies impact on merger control exercised by the government.

Regarding incentives for horizontal merger, Salant, Switzer and Reynolds (1983) had used a model of a homogeneous oligopoly to show that, given some level of marginal costs, a merger is, profitable for the participating firms, only if their combined market share after accomplishing the merger is no less than 80 percent. This implies that a merger which falls short of this result will not be undertaken unless it is justified by efficiencies. It does not give rise to antitrust concerns. This conclusion has been somewhat modified in some aspects in the case of product differentiation (Deneckere and Davidson (1985) and Perry and Porter (1985)

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for, in comparison to the standard Cournot model, less straightforward assumptions regarding the conduct of competing firms.

With respect to the response to mergers and acquisitions by US antitrust as well as by European competition policy both have primarily been concerned with the impact of a merger on consumer welfare. The most fervent proposition has been advanced by Bork (1993), pleading for maximization of consumer welfare, "or , if you prefer economic efficiency", as the overriding goal of antitrust. Similarly, the EC Merger Regulation (Article 2(1)(b) requires the EC Commission to take into account "the interests of the intermediate and ultimate consumers, and the development of technical and economic progress provided that it is to consumers' advantage and does not form an obstacle to competition.' According to this view a merger must not "substantially lessen competition or tend to create a monopoly", as stated in the US Clayton Act, or, as required by the EC Regulation no. 139/2004 "on the control of concentration s between undertakings", it must "not impede effective competition".

Maximizing consumer welfare is an encompassing concept. Consumer welfare is not confined to the immediate effect of competition on the price consumer have to pay but also on the likely impact on the price caused by enhanced efficiencies. As stated in Article 101 of the Treaty on the Functioning of the European Union ("TFEU"), consumers should receive "a fair share of the benefit" resulting from efficiencies. According to the EC Horizontal Merger Guidelines benefits, arising from efficiencies, must be substantial and passed on, at least in part, to consumers. Although cost efficiencies that lead to reduction in variable costs are more likely to be passed-on to consumers than reductions in fixed costs (Horizontal Merger Guidelines, paras.80-84) the evaluation of welfare effects caused by mergers should take into account both variable and fixed costs.

In the previous literature it has accordingly been asked what reduction in costs would be necessary to compensate for the welfare decreasing effect of monopoly power (Röller/Stennek/Verhoven 2001). Still, it has remained an open question, how the necessary reduction of costs will come about. In this paper costs are assumed to be endogenous following from maximizing profits. In contrast to most of the literature I shall not confine the analysis to marginal costs but also take into consideration fixed costs. Although in the previous literature both marginal costs and fixed costs have been mentioned (Farrell/Shapiro

1990) their interrelationship has largely been left obscure. In the present paper I shall adopt the crucial assumption that marginal costs depend on the level of fixed costs.

Fixed cost may either consist of outlays incurred to buy machinery by which labour costs and other variable costs are saved or by setting up organizational structures which, for example by more sophisticated division of labour, serves the same purpose. Alternatively fixed costs may arise to cope for expenses incurred for R&D aiming at reducing costs. In any case it appears reasonable to assume that marginal costs are lower if fixed costs are higher.

By exploiting the idea that marginal costs depend on the level fixed costs, in contrast to Salant/Switzer/Reynolds (1983) who assumed marginal costs to be unaffected by merger, in this paper I show horizontal mergers in homogeneous markets to be profitable for both participating and non-participating firms. Mergers give rise to higher fixed costs which in turn yields marginal costs to decline and monopolistic market power to increase. Consequently, with rising horizontal concentration consumer surplus declines whilst profits increase. Total welfare, i.e., the sum of consumer surplus and profits, may exhibit a maximum at some level of concentration, which may serve as the appropriate target for merger control, as far as unilateral effects are concerned. For competition policy it will thus be possible to overcome the ambiguities involved by using terms such as “substantially lessen competition” or “no impediment of effective competition”.

I propose to employ a multi-stage decision taking. At the lowest stage, for a homogeneous oligopoly, the output quantities of a Cournot game are derived, which depend on given demand functions and marginal costs. Marginal costs are then derived by assuming firms maximizing profits with respect to fixed costs, which are shown to depend on the number of competing firms. Finally, the regulating authority is assumed o maximize total welfare, being the sum of consumer surplus and profits.

The model

First look at the behaviour of firms in a Cournot oligopoly. Consider an oligopoly facing an inverse demand function $p = a - b(q_1 + q_2 + ... + q_n)$, where $b > 0$ indicates the horizontal size of the market. Costs for output *i* are $C_i = c(F_i)q_i$, where F_i are fixed costs. Marginal costs obey $c(F) \geq 0$, $c' < 0$, $c'' > 0$. They decline with an increasing level of fixed costs,

however, due to the law of diminishing effect, at a decreasing rate. Profits of firm i are $\Pi_i = [p - c(F_i)]q_i - F_i$.

Decisions are taken in two steps. First, fixed costs must be determined to set the stage for the second step, where the level of output is to be found. The solution for this game is found in reverse order. First, for given fixed costs output is chosen to maximize profits. Second, resulting profits are maximized with respect to fixed costs. The ultimate outcome is sub-game perfect.

For determining output assume a Cournot game in quantities. At the Cournot equilibrium the price is

$$p = \frac{a + c_1 + c_2 + ... + c_n}{n+1},$$

and the individual output is

$$q_i = \frac{a - nc_i + \sum_{j \neq i}^{n} c_j}{b(n+1)} \tag{1}$$

where $c_i := c(F_i)$.

The resulting profit of firm 1 is

$$\Pi_1 = \frac{1}{b}\left(\frac{a - nc(F_1) + c(F_2) + ... + c(F_n)}{n+1}\right)^2 - F_1 \tag{2}$$

and similarly for all other firms. Maximizing profits with respect to fixed costs yields

$$\frac{\partial \Pi_1}{\partial F_1} = \frac{2}{b}\left(\frac{a - nc_1 + c_2 + ... + c_n}{n+1}\right)\left(-\frac{n}{n+1}c_1'\right) - 1 = 0 \tag{3}$$

as the first order condition.

Since higher fixed costs entail lower marginal costs, an individual firm by raising fixed costs creates a competitive advantage *vis-a-vis* rivals. If all firms are competing on an equal footing, once one of the rivals starts to achieve a competitive advantage all other firms can be expected to follow suit so that ultimately all firms will have equal fixed costs and equal marginal costs.

Thus assuming all firms to be alike implies $F_i = F$ and hence

$$\frac{\partial \Pi_i}{\partial F_i} = \frac{2}{b}\left(\frac{a-c(F)}{n+1}\right)\left(-\frac{n}{n+1}\right)c'(F)-1 =: H(F,n,b) = 0 \qquad (3a)$$

Second order conditions, after recognizing that fixed costs of all firms are identical, require

$$\Pi_i'' := \frac{\partial^2 \Pi_i}{\partial F_i^{\,2}} = \frac{2n}{b(n+1)^2}\left[(a-c)(-c'') + (c')^2\right] < 0\,. \qquad (4)$$

It will further be noted, that the optimal level of fixed costs depend on both, the number of competitors[1] and the horizontal size of the market, as depicted by the slope of the inverse demand function.

To examine how the number of firms and the horizontal size of the market impact on fixed costs take the total derivative of the first order condition, $\frac{\partial H}{\partial F}dF + \frac{\partial H}{\partial n}dn + \frac{\partial H}{\partial b}db = 0$,

where $\frac{\partial H}{\partial F} = \Pi_i'' < 0$.

For a given size of the market (i.e., a given b) find

$$\frac{dF_i}{dn} = -\frac{2(n^2-1)(a-c)c'}{b\Pi_i''(n+1)^4} < 0 \qquad (5)$$

and, after inserting Π_i'' from (4),

$$\frac{dF_i}{dn} = -\frac{(n-1)(a-c)c'}{n(n+1)\left[(a-c)(-c'') + (c')^2\right]} < 0\,. \qquad (5a)$$

This result yields an important insight. In a particular market, if the number of firms decrease, each one grows larger. Then, according to (5a), fixed costs of the individual firm rise. Thus, larger firms choose a higher level of fixed costs and thus have lower marginal costs, and vice versa.

Similarly, to examine how the size of the market impacts on the level of fixed costs, given the number of firms, take the total derivative of the first order condition for a given number of firms, where $\frac{\partial H}{\partial b} = -\frac{2}{b^2}\left(\frac{a-c}{n+1}\right)\left(-\frac{n}{n+1}\right)c'(F) < 0$,

[1] In the following analysis the number of firms, n , is treated as a continuous variable. Since in reality the number of firms is a integer, the results to be derived in the analysis are not literally true. They can nevertheless taken as indicating trends which also apply to the case of the $n's$ being integers.

and find

$$\frac{dF}{db} = -\frac{\partial H / \partial b}{\partial H / \partial F} = -\frac{2(a-c)nc'}{b^2(n+1)^2\Pi''} < 0\,. \qquad (5b)$$

or, equivalently,

$$\frac{dF}{db} = \frac{-(a-c)c'}{b\left[(a-c)(-c'') + (c')^2\right]} < 0 \qquad (5c)$$

Hence, given the number of firms, fixed costs are larger the larger the market horizontally and marginal costs are lower, too.

Therefore, summarizing yields the following

Lemma: *In a given market larger firms choose a higher level fixed costs so that marginal costs are lower, and for given number of firms fixed costs are higher and marginal costs are lower the larger the market is horizontally.*

Hence, horizontal growth of the market give rise to both larger firms with higher fixed costs and lower marginal costs. This prediction has been borne out by the development of industry since the later decades of the 18th century. In particular in the wake of innovations in transport and communication technology markets grew larger and big firms came into existence which, by using more efficient ways of production, replaced smaller firms which incurred higher costs and could not stand the competition of their larger rivals (Martin 2004, pp. 21f.). An outstanding example has been the United States of America, where in very large market firms came into existence which dwarfed their counterparts in the more fragmented Europe. A more recent case has been the common market of the European Union and more generally the globalisation which followed from tearing down tariff barriers and other impediments to international trade achieved by the activities of GATT.

Although with hindsight the mechanism suggested by the model has apparently been at work it must not be overlooked that synergies to be exploited by an envisaged merger may look bright, actually they are but chances clouded by uncertainties of the future. They may follow from erroneous beliefs regarding technology or exploiting them may be hampered by impediments inherent in the organizations to be merged. Therefore a large number of proposed merger have turned out as failures. Consequently, the empirical evidence regarding the effect of mergers on profitability has so far been mixed Mueller (1995).

Consumer surplus following a merger

Consumer surplus is

$$CS = \frac{1}{2b}(a - p)^2 .$$

Therefore, consumer surplus increases if the price declines. Thus, to evaluate how a merger affects consumer welfare requires to examine the effect of a change of the price following a change in the number of competing firms. In the oligopoly under consideration the price is

$$p = \frac{a + nc}{(n+1)} \tag{6}$$

Following a merger it changes according to

$$\frac{dp}{dn} = -\frac{a - c}{(n+1)^2} + \frac{n}{(n+1)} c'(F) \frac{dF}{dn} . \tag{7a}$$

Inserting dF / dn from (5) yields

$$\frac{dp}{dn} = \frac{a - c}{(n+1)^2} \left[-1 - \frac{n(n-1)(c')^2}{(a-c)(-c'') + (c')^2} \right] \tag{7b}$$

which displays two opposing effects. A decrease in the number of rivals following a merger yields increased monopoly power and thus a higher price. On the other hand, a smaller number of rivals entails higher fixed costs and thus lower marginal costs, which causes the price to decline. At first glance the outcome displayed by (7b) seems to be ambiguous. At a closer look, however, the price can be shown to rise unequivocally upon a decline in the number of firms.

This can be proved as follows. First look at limiting cases. If $n \to 0$, obviously $dp / dn < 0$. At the opposite case, where n approaches infinity, $dp / dn \to 0$. Moreover, since

$$\frac{d^2 p}{dn^2} = \frac{2(a-c)}{(n+1)^3} - \frac{(a-c)(c')^2}{(a-c)(-c'') + (c')^2} \times \frac{3n^2 + 2n - 1}{(n+1)^4} + (a-c)(c')^4 \frac{n(n-1)}{(n+1)^2} > 0 ,$$

dp / dn, moving from n being zero to infinity, stays to be negative. This suggests

Proposition 1: *Following a merger, the price rises and consumer surplus declines.*

Profitability of merger

By contrast, following a merger profits of both participating and non-participating firms increase. Profits of firm i are $\Pi_i = \Pi(n, b, F(n,b))$. Given the horizontal size of the market, as depicted by *b*, upon a change of the number of firms

$$\frac{d\Pi_i}{dn} = \frac{\partial \Pi_i}{\partial n} + \frac{\partial \Pi_i}{\partial F_i}\frac{\partial F_i}{\partial n} \tag{8}$$

Since according to the first order condition for maximizing profits with respect to fixed costs, $\partial \Pi_i / \partial F_i = 0$,

$$\frac{d\Pi_i}{dn} = -\frac{2(a - c(F))^2}{b(n+1)^3} < 0 \tag{9}$$

Hence, the following proposition applies.

Proposition 2: *In a Cournot setting where fixed costs are endogenous, profits of both, participating and non-participating firms, rise following a merger, irrespective of the number of competitors.*

To understand what's going on note that a decrease in the number of rivalling firms, i.e., following a merger, increased monopolistic market power entails higher profits. That is the first term on the right hand side of (8). In addition fixed costs rise, as depicted by (5a), and marginal costs decrease. Hence profits tend to increase. This effect, however, is offset at the margin by higher fixed costs. Hence, ultimately at he margin only the effect of monopolistic market power remains, as shown by (9). The prospect of rising profits constitutes a strong incentives for firms to merge and finally to acquire a monopoly. Since consumer welfare would decline mergers government interventions are called for.

Merger Control

Merger control exercised by the government may be guided by studying how a merger affects consumer surplus or total welfare, the latter being the sum of consumer surplus and profits. Clearly, as a merger is likely to yield consumer surplus to decline, by considering the consumer surplus alone, the government would be inclined to prohibit all mergers of firms supplying a homogeneous good. Actually, in the U.S.A., in the 1950s the authorities adopted a very restrictive stance of merger control in the course of which practically all horizontal

merger were prohibited (Smiley 1995, pp. 65f.). Still, large firms most of which had previously come into existence by merger, and thus by exploiting economies of scale and the ensuing lower marginal costs, were more competitive than smaller competitors, particularly those in other countries. Still, the maintenance of the overly strict stance of merger control forced US firms to forego efficiencies entailed by becoming larger through merger. This reasoning and the experience of the US leads to the insight that focusing on consumer surplus alone is to the detriment of overall economic welfare.

On the other hand, it appears to be unreasonable for merger control to stipulate arbitrary thresholds for intervention that are not grounded in economic theory. This reasoning makes it mandatory to take efficiency gains into consideration. Merger control must in particular take into account that mergers and acquisitions may yield marginal costs to decrease, as assumed in the previous section. This will cause output to rise, which will ultimately also benefit consumers. Therefore, for the government it appears appropriate to examine how a merger impacts on total welfare, rather than to focus exclusively on consumer surplus.

Since with an increasing number of firms, that is with decreasing horizontal concentration, consumer surplus rises, whilst profits decline, total welfare is likely to exhibit a maximum at some level of horizontal concentration. If governmental merger control would focus on this level it could overcome the ambiguities of using such terms as “substantially lessen competition”. Governmental merger control would be well advised to allow mergers as long as total welfare falls short of its maximum.

Given total welfare,

$$TW = CS + n\Pi_i(n, b, F(n, b)),$$

maximizing it, for a given size of the market, by choosing the number of firms, requires

$$\frac{dTW}{dn} = \frac{1}{b}(a - p)(-\frac{dp}{dn}) + \Pi_i + n(\frac{\partial \Pi_i}{\partial n} + \frac{\partial \Pi_i}{\partial F_i}\frac{dF_i}{dn}) = 0, \qquad (10)$$

where, according to (3), $\partial \Pi_i / \partial F_i = 0$. Hence,

$$\frac{dTW}{dn} = \frac{1}{b}(a - p)(-\frac{dp}{dn}) + (\Pi_i + n\frac{\partial \Pi_i}{\partial n}) = 0 \qquad (11)$$

or, by using (9),

$$\frac{dTW}{dn} = \frac{1}{b}(a-p)(-\frac{dp}{dn}) + \Pi_i - \frac{2n}{b(n+1)}\left(\frac{a-c}{n+1}\right)^2 =: TW'(n,b) = 0\,. \qquad (11a)$$

The first order condition for maximizing total welfare may be satisfied at some optimal n^*. It will be a true maximum if the second order condition,

$$TW'' := \frac{d^2TW}{dn^2} = \frac{1}{b}\frac{dp}{dn} - \frac{1}{b}(a-p)\frac{d^2p}{dn^2} + (2\frac{\partial\Pi_i}{\partial n} + n\frac{\partial^2\Pi_i}{\partial n^2}) < 0\,,$$

holds. This yields

Proposition 3: *Total welfare exhibits a maximum at some level n^*. In merger control the government should allow a merger as long as $n > n^*$ and should disallow a merger leading to $n < n^*$.*

A numerical example

A numerical example may serve as illustration and, additionally, to highlight some further points. For this purpose assume that marginal costs depend on fixed costs according to $c = \alpha - m\sqrt{F}$, where the root shall be taken to be positive. Since $c(F) \geq 0$ must be satisfied the admissible range is constraint to $F \leq (\alpha/m)^2$.

For $n = 3$ the Cournot equilibrium in quantities implies

$$\Pi_1 = \frac{1}{b}\left(\frac{a - 3c_1 + c_2 + c_3}{4}\right)^2 - F_1$$

and similarly for firms no. 2 and 3. Maximizing profits of firm no. 1 with respect to F_1 requires

$$\frac{\partial\Pi_1}{\partial F_1} = \frac{2}{b}\left(\frac{a - \alpha + 3m\sqrt{F_1} - m\sqrt{F_2} - m\sqrt{F_3}}{4}\right)\frac{3m}{4} \times \frac{1}{2\sqrt{F_1}} - 1 = 0$$

and similarly for the other firms. If, for example, $m = 1$ and $b = 1$ one obtains a set of equations

$$\begin{pmatrix} 7 & 3 & 3 \\ 3 & 7 & 3 \\ 3 & 3 & 7 \end{pmatrix}\begin{pmatrix} \sqrt{F_1} \\ \sqrt{F_2} \\ \sqrt{F_3} \end{pmatrix} = \begin{pmatrix} 3 \\ 3 \\ 3 \end{pmatrix}(a - \alpha)$$

and hence

$$\sqrt{F_i} = \frac{3}{13}(a-\alpha),\ i = 1,2,3$$

The respective values of marginal costs, profits and consumer surplus can then easily be calculated.

Since in the present model fixed costs, and for that matter marginal costs, for all firms are equal, allowing for $m \neq 1$, the first order condition for maximizing profits requires

$$\frac{1}{b}\frac{a-\alpha+m\sqrt{F}}{n+1}\times\frac{nm}{n+1}\times\frac{1}{\sqrt{F}}-1=0$$

from which follows

$$\sqrt{F} = (a-\alpha)\frac{nm}{b(n+1)^2 - nm}$$

Given $a = 10$, $\alpha = 4$, $m = 0.7$, the respective results for alternative numbers of firms are shown in the following table. Figures are rounded at two decimal digits.

Table 1: Costs, prices, profits, consumer surplus and total welfare for alternative numbers of firms

	n=1	*n=2*	*n=3*	*n=4*	*n=5*	*n=6*
F_i	1.43	1.10	0.75	0.53	0.39	0.30
c_i	3.16	3.27	3.39	3.49	3.56	3.62
p	6.58	5.51	5.04	4.79	4.63	4.53
Π_i	10.26	3.94	1.98	1.16	0.76	0.53
$n\Pi_i$	10.26	7.88	5.93	4.65	3.80	3.19
CS	5.84	10.07	12.28	13.56	14.39	14.97
TW	16.10	17.96	18.21	**18.22**	18.19	18.16
Average costs	3.58	3.76	3.85	3.90	3.93	3.95

In this example the regulating authority would allow mergers leading to four firms which would yield total welfare to attain a maximum, the decline of consumer surplus being offset by increasing profitability of all firms, irrespective of whether or not they participate in the merger. In any case where the number of firms decline by one the individual entities arising

from merger have fixed costs which fall short of the sum of fixed costs firms had to incur before the consummation of the merger. Moreover, with each step of merger, along with increasing fixed costs, marginal costs decline. Clearly, since profits of all firms rise the merger is attractive for all of them. It will also be noted that the general parlance of synergies being created by merger obtains a clear meaning by looking at fixed costs and their effect on marginal costs. Consequently, total average costs decline with a decreasing number of firms. On the other hand, although marginal costs decrease, the price goes up following the increased market power upon merger which is reflected in a rise of the price-cost-marginal costs.

Size of the market

The critical level of horizontal concentration for merger control to step in depends on the horizontal size of the market, which in the present model can be depicted by the slope of the indirect demand function, a smaller b indicating a larger market.

As following from (5b) above, a horizontal enlargement of the market yields causes fixed costs to increase and thus marginal costs to decline. This reduction in marginal costs are but incompletely passed on to consumers. Therefore both profits and consumer surplus rise, profits however increase more than consumer surplus. Hence profits assume a larger weight in total welfare attained at a lower number of firms. The regulatory authority will thus allow mergers which in a smaller market would lie beyond the acceptable level of horizontal concentration.

To examine more closely how a change in the horizontal size of the market affects the welfare maximizing number of firms rewrite (11a) by using (6) and (7a) to read

$$TW'(n^*,b) = \frac{1}{n+1}\left[\frac{1}{b}\left(\frac{a-c}{n+1}\right)^2 - F\right] - \frac{n}{n+1}F + \frac{n}{n+1}\frac{1}{2}\frac{\partial F}{\partial n} = 0\,, \qquad (12)$$

the total differential of which is

$$dTW' = TW''dn^* + \frac{\partial TW'}{\partial b}db = 0$$

and hence

$$\frac{dn^*}{db} = -\frac{\partial TW'/\partial b}{TW''}\,.$$

Since the 2nd order condition for maximizing total welfare requires $TW'' < 0$, the impact of a change of the size of the market depends the numerator, which is[2]

$$\frac{\partial TW'}{\partial b} = -\frac{1}{n+1}\left[\frac{1}{b^2}\left(\frac{a-c}{n+1}\right)^2 - n\frac{\partial F}{\partial b} + \frac{n}{2}\frac{\partial}{\partial b}\left(\frac{\partial F}{\partial n}\right)\right] \qquad (13)$$

If it is positive, an increase in the horizontal size of the market (i.e. a decrease of b) will cause the optimal number of firms, n^*, to decline.

Further note that (5) and (5b), taken together, yield

$$\frac{\partial F}{\partial n} = \frac{b(n-1}{n(n+1)}\frac{\partial F}{\partial b}.$$

Moreover, the 1st order condition for maximizing total welfare, (12), implies

$$\frac{1}{b}\left(\frac{a-c}{n+1}\right)^2 = F + nF - \frac{b(n-1)}{2(n+1)}\frac{\partial F}{\partial b}.$$

Put this into (13) to get

$$\frac{\partial TW'}{\partial b} = -\frac{F}{b} - \frac{n^2+1}{(n+1)^2}\frac{\partial F}{\partial b} + \frac{b(n-1)}{2(n+1)^2}\frac{\partial^2 F}{\partial b^2} \qquad (14)$$

or, equivalently,

$$\frac{\partial TW'}{\partial b} = -\frac{\partial F}{\partial b}\left[\frac{-F/b}{-\partial F/\partial b} + \frac{n^2+1}{(n+1)^2}\right] + \frac{b(n-1)}{2(n+1)^2}\frac{\partial^2 F}{\partial b^2} \qquad (15)$$

The second term on the right hand side of (15) can be expected to be positive since $\partial^2 F/\partial b^2$ will be positive if the fixed costs, upon an increase of the market, are raised only less than proportionally, which is quite likely to happen and is strictly true in the case of the cost function as assumed in the above example. Thus, upon an increase in the horizontal size of the market, total welfare rises if the term within the square bracket is positive. For this to happen the first term within the square bracket must absolutely fall short of $(n^2+1)/(n+1)^2$ which, for alternative values of n^*, is smaller than 0.5 for $n^*=1$ and unity for $n^* \to \infty$. In the example used above for illustrative purposes,

$$\frac{-F/b}{-\partial F/\partial b} = -\frac{1}{2} + \frac{nm}{2b(n+1)^2}$$

[2] Recall that $\Pi_i = \Pi(n, b, F(n,b))$ and $\partial\Pi_i/\partial F_i = 0$.

and thus, in this case, the term in square bracket is definitely positive, which yields $\frac{\partial TW'}{\partial b} > 0$. Hence, given the assumptions underlying the example we have an unambiguous result. It will further be illustrated below.

Anyway we have the following

Proposition 4: *In homogeneous oligopoly, if the size of market increases horizontally, the maximum of total welfare may move to a smaller number of firms*

For the purpose of illustration the following example shows how the horizontal size of the market impacts on the critical level of horizontal concentration.

Table 2: **Total welfare for alternative size of the market and number of firms**

Slope of inverse demand	n=1	n=2	N=3	n=4	n=5
b=1	16.10	17.96	18.21	**18.22**	18.19
b=0.8	21.13	23.15	**23.21**	23.08	22.96
b=0.6	30.69	**32.58**	32.01	31.47	31.09

Assumptions: $a = 10$, $\alpha = 4$, $m = 0.7$

In the example, as indicated by the bold faced numbers of firms, the larger the horizontal size of the market, as depicted by a decreasing slope of the inverse demand function, the lower the critical number firms being allowed by merger control to survive after merger.

Following an enlargement of the market, total welfare will rise. It will also be noticed that although both, consumer surplus and profits, will also increase albeit at different rates, as illustrated in Table 3.

Table 3: Consumer surplus and profits following an enlargement of the market

b	n*	TW	CS	nΠ
1	4	18.22	13.56	4.65
0.8	3	23.21	16.15	7.06
0.6	2	32.58	19.90	12.68

Following a decrease of the slope of the inverse demand function from 1 to 0.6 consumer surplus rises by 47 per cent, whilst total profits increase by 173 per cent. Although both outcomes satisfy the criterion of economic efficiency the enlargement of the market and allowing a higher rate of horizontal concentration causes distributive issues to arise.

Conclusion

For the case of a homogeneous oligopoly it has been shown that governmental merger control would be well advised to abandon ambiguous criteria like "substantially lessen competition" in favour of a "more economic approach" where notions are well grounded in economic theory. Since marginal costs are likely to depend on the level of fixed costs, chosen to maximize profits, in this paper I submit a model in which governmental merger control seeks to maximize total welfare, which ultimately is to the benefit of consumers.

The underlying idea of endogenous fixed costs, which impact on marginal costs, appears to be applicable to a much broader range of cases than just homogeneous oligopoly. At the moment it must be left to further research to examine alternative cases theoretically and to study empirically how fixed costs do impact on marginal costs in various industries. This amounts to examine to what extent mergers give rise to synergies which ultimately cause profits to increase.

Applying the proposed approach may give rise to a high rate of horizontal concentration which entails the drawback that a small number of surviving firms is likely to facilitate tacit collusion (Röller/Stennek/Verhoven 2001, p.53f.). Although unilateral effects of horizontal concentration are being kept at bay by increased efficiency coordinated effects may outweigh them. Moreover, even the very likelihood that the increase in firm size enhances efficiency may be at stake. This point had been decisive for firmly establishing the *per se* rule in the case of cartels in the *Trenton Potteries* case in the U.S.A. (1927) (Neale 1966, pp.35f.) The court rebutted the efficiency defence of the industry by stating that even if at the present time prices

might be reasonable they are likely to become unreasonable in consequence of monopolistic market power exercised by the incumbents *vis-à-vis* potential competitors which would have an incentive to apply more efficient modes of production but are hampered either by participating in the cartel or by being barred from entering the market by the incumbents.. Hence, there is a broad field for competition policy to inhibit an abuse of monopolistic market power.

It should finally be kept in mind that merger control is no more than a part, albeit an important part, not alone of competition policy, but also of economic policy at large. In this broader context competition policy has widely been corrupted by the intrusion of lobbying for particular interests (Duso/Neven/Röller 2009), which frequently led to industrial policy aiming at maintaining existing structures of industry.

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