Merger Policy to Promote ‘Global Players’?
A Simple Model

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Abstract

We use a simple framework where firms in two countries serve their respective domestic markets and a world market to analyze under which conditions cost-reducing mergers will be beneficial for the merging firms, the home country, and the world as a whole. For a national merger, the policies enacted by a national merger authority tend to be overly restrictive from a global efficiency perspective. In contrast, all international mergers that benefit the merging firms will be cleared by either a national or a regional regulator, and this laissez-faire approach is also globally efficient. Finally, we allow for multiple mergers and analyse whether national mergers, international mergers or no mergers will be the equilibrium market structure when the firms’ decisions to merge are either taken non-cooperatively or cooperatively.

Keywords: merger policy, international trade
JEL-Classification: L41, F13, H77
1 Introduction

In political circles the argument is sometimes put forth that mergers of domestic firms have the advantage of creating ‘global players’, i.e. bigger firms that will be in a better position to compete with foreign firms in world markets. A recent example in Germany has been the merger between the E.ON and Ruhrgas corporations. The German Federal Cartel Office rejected the merger in 2002, and this decision was backed by the scientific Monopoly Commission. Nevertheless, the German Minister of Economics eventually cleared the merger in 2003, overruling the decision by the cartel authority. A main reason for the positive decision of the Ministry of Economics was the ‘global player’ argument, which was considered to be very important at the onset of energy market liberalization in Europe.\(^1\)

The international competitiveness of domestic firms is an explicit policy objective in the merger guidelines of several countries, including Canada, France, Sweden and the U.K (see Röller, Stennek and Verboven, 2000). According to this policy goal a merger can serve the national interest by increasing the market share of domestic firms in world markets. Another possibility for a merger to improve national welfare, at the expense of foreigners, is that it raises prices for consumers in world markets. Hence, merger policy may be associated with similar goals as strategic export subsidies or tax exporting measures (Brander and Spencer, 1985).

The literature on ‘strategic’ merger policies has taken two different routes. A first set of papers focuses on nationally optimal merger policies and merger profitability when trade policy instruments are simultaneously available to national governments (Richardson, 1999; Horn and Levinsohn, 2001; Huck and Konrad, 2004; De Stefano and Rysman, 2004). A second line of research is based on the concept of the ‘external effects’ of a merger introduced by Farrell and Shapiro (1990). This concept has been extended to an open economy setting by Barros and Cabrol (1994) and Head and Ries (1997), who differentiate between the external effects of the merger on other agents in the home country (i.e., consumers and firms not participating in the merger), and the external effects on agents in other countries. This literature has derived rather general

\(^{1}\)The importance of the ‘global player’ argument in the context of the E.ON-Ruhrgas merger is also stressed by Sinn (2002, pp. 10-12.)
conditions under which a merger benefits, or harms, the parties not participating in the merger. It does not, however, explicitly consider the (possible) cost reductions accompanying a merger, and therefore cannot provide a complete characterization of the post-merger equilibrium.

In this paper we take a different approach by setting up a simple, linear model of Cournot competition in open economies that incorporates the possible cost reductions caused by a merger and is able to make comparisons over discrete merger equilibria. Hence we analyse, in an international setting, the basic trade-off that exists for merger policy when the merger has anti-competitive effects, but also leads to reduced production costs. This trade-off, first analysed by Williamson (1968) for the case of a closed economy, is often referred to as the ‘efficiency defense’ for a merger. The European Union’s new merger control guidelines explicitly acknowledge the possibility of such efficiency gains, and foresee that these enter the Commission’s overall assessment of any merger proposal (European Union, 2004, C31/13).

A second difference to the existing literature is that we focus on a three-country model where two competitors in each of two countries serve their respective home markets, and all firms jointly compete in a third (world) market. This market structure captures the situation in many network industries, such as electricity, natural gas, telecommunications or railways. A typical example is the electricity market, where the German duopolists E.ON and RWE compete with other ‘national champions’ in several European markets, including Sweden, the Netherlands, the Czech Republic, and the United Kingdom. It is also relevant in other markets (for cement, dairy products, etc.) where large national players compete in third markets, but less so in the respective home markets of their competitors.

In this setting we first analyze whether a single merger is in the interest of the firms involved, the home country, and the world as a whole. The simplicity of our model allows us to explicitly link the producer surplus and welfare effects of a merger to two core parameters, the cost reduction accompanying the merger and the relative size of the home and the foreign market. Moreover, it is straightforward in our three-country framework to carry out parallel analyses of national and international mergers, and to

\textsuperscript{2}See Auquier and Caves (1979) for an early analysis of the trade-off that exists for national competition policy when domestic firms sell in imperfectly competitive home and world markets.
compare the different effects. This comparison reveals that national and international mergers have rather different implications in our setting. For national mergers, a potential conflict of interest arises between the merging firms and a national regulator, and the policies enacted by national merger authorities tend to be overly restrictive from a global efficiency perspective. In contrast, all international mergers that benefit the merging firms will be cleared by either a national or a regional regulator, and this laissez-faire approach is also globally efficient.

Building on the analyses of a single national or international merger, we then allow for multiple mergers and analyse whether national mergers, international mergers or no mergers will be the equilibrium market structure when the firms’ decisions to merge are either taken non-cooperatively or cooperatively. The last setting links our model to the recent literature on endogenous merger equilibria (Horn and Persson, 2001a,b; Bjorvatn, 2004; Lommerud et al., 2006). Once again we ask how the equilibrium merger pattern is related to different combinations of cost savings and relative market size.

The paper is set up as follows. Section 2 introduces the basic framework of our analysis. Section 3 analyzes the conditions under which a national merger is in the interest of the merging firms. It also discusses optimal merger policy from the perspectives of a single country, and the (model) world as a whole. Section 4 discusses the analogous effects for an international merger. Section 5 examines non-cooperative merger games when multiple mergers, either national or international, are permitted. Section 6 turns to the case where the firms’ merger decisions are taken cooperatively and analyses the characteristics of the endogenous merger equilibrium. Section 7 concludes.

## 2 The model

In this section we set up a simple model which allows us to analyze some of the dimensions associated with merger policy and the creation of global players. The focus is on an open economy, called the home country H, where the market for a certain good is served by two domestic producers. The same two firms also export to a market abroad, referred to as the world market and indexed W. In the domestic market the

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3The strong increase in international mergers since the 1980s is documented in Gugler et al. (2003).
two firms do not face any competition, whereas on the market abroad they compete with two firms from another country, called the foreign country, F. These two foreign firms in addition supply the good to their respective domestic market, where again they are the only suppliers. The model framework is illustrated in Figure 1.

The two domestic firms consider merging, and we shall also study the consequences of merger plans on the part of the two foreign companies. As far as possible we rely on symmetry in setting up the model. Prior to any merger, all firms have the same (constant) level of marginal cost; all markets are characterized by Cournot competition; and the size of the two ‘national’ markets in $H$ and $F$ are equal. The world market $W$ may be bigger than any of the local markets.

A few remarks on the model are in order. In deciding on the model, our criteria have been that we wish to study merger policy in an open economy; in particular we wish to shed some light on the creation of ‘global players’, i.e. firms which besides being large in the national market are also important players in the world market. So a merger in the model should have international consequences. At the same time, a merged company should still be facing competition from other firms; these we have placed in the foreign country. For symmetry reasons, also the competitors regard the world market as a
market abroad, while at the same time serving their respective own market.\textsuperscript{4}

In line with much of the relevant literature we take imperfect competition to be of the Cournot-Nash type and the good under consideration to be homogeneous. Moreover, markets are segmented and firms maximize profits in each market separately.\textsuperscript{5}

The domestic market is given by the inverted demand schedule\textsuperscript{6}

\[ p = a - b(x_1 + x_2), \quad a > 1. \]  

(1)

The price in the domestic market is labeled \( p \), and the linear demand schedule is characterized by the intercept \( a \) and the slope parameter \( b \). The intercept \( a \) measures the maximum price consumers are willing to pay for the first unit of the good, while the size of the market is determined primarily by the slope parameter \( b \).\textsuperscript{7}

The two home country firms supply \( x_1 \) and \( x_2 \), respectively, prior to merger, and they do so facing a marginal cost of unity (which is why \( a > 1 \) must hold in our model). There are no fixed costs, and the number of domestic firms (two) is held fixed, except for the possibility of a merger of the two.

Quite conventionally, the maximization of profits in the two duopoly firms results in quantities supplied of \( x_1 = x_2 = (a - 1)/(3b) \) and a market price of \( p = (a + 2)/3 \), i.e. \((a - 1)/3\) above the unitary marginal cost.

\textsuperscript{4}As an alternative, we could have set up a two-country model, in which firms in both countries serve each other’s market. In that model, a symmetric set-up of the two countries would have been natural. However, that set-up would not correspond well with the image related to creation of global players in a world market. Hence, we opted for the three-market framework above.

\textsuperscript{5}Again, several alternatives are available, including Bertrand competition (most meaningfully with differentiated goods) and monopolistic competition. It is well known from the work of Kreps and Scheinkman (1983), however, that (under mild assumptions about demand) modelling a two-stage game with capacity competition and subsequent price competition between firms yields the same results as the simple Cournot model. See also Hay and Werden (1991) for theoretical and empirical arguments in defense of the Cournot model. At the same time, in lieu of segmented markets one could have postulated one big integrated market as in Barros and Cabral (1994) and Head and Ries (1997); yet, that corresponds less well with an image of global players with a base in their domestic market.

\textsuperscript{6}The demand schedule can be derived in a general equilibrium framework from a quadratic and quasi-linear utility function.

\textsuperscript{7}More precisely, \( b \) is an inverse measure of market size so that a smaller value of \( b \) implies a larger market. Hence, if market size increases (\( b \) is reduced) more units can be sold in the market for any given price \( p \), whereas the maximum price that can be charged remains unaffected.
The domestic firms are fully owned by residents of the home country whereas the foreign firms are owned by residents of the foreign country. In the home country, consumer surplus $cs$ and joint producer surplus of the two firms, $ps$, each amounts to

$$cs = ps = \frac{2}{b} \left( \frac{a - 1}{3} \right)^2.$$  

(2)

Hence, the sum of consumer and producer surpluses, total surplus $ts$, is twice the amount in the above formula,

$$ts = \frac{4}{b} \left( \frac{a - 1}{3} \right)^2.$$  

(3)

In line with the ‘efficiency defense’ literature on mergers we adopt total surplus as the basic welfare measure in our analysis.\(^8\)

The two home firms both service the market abroad and do so together with the two firms in the foreign country. There, the inverted demand curve is

$$P = a - B(X_1 + X_2 + Y_1 + Y_2).$$  

(4)

Upper-case letters generally refer to the world market (and lower-case letters to the domestic market). Hence, $X_1, X_2$ are the supplies of the two home firms, while $Y_1, Y_2$ denote supplies of the two foreign firms. The slope parameter $B$ will in general be different from the slope parameter $b$ for the market in the home country. A world market which is bigger than the national market is represented by $B < b$ (cf. note 7).

Maximizing profits, all four firms supply the quantity $X_1 = X_2 = Y_1 = Y_2 = (a - 1)/(5B)$, yielding a price of $P = (a + 4)/5$, lying $(a - 1)/5$ above unitary marginal cost.

The two domestic firms together harvest a producer surplus of

$$PS = \frac{2}{B} \left( \frac{a - 1}{5} \right)^2.$$  

(5)

from the world market. World consumers, on the other hand, register a consumer surplus of

$$CS = \frac{1}{2B} \left( \frac{4(a - 1)}{5} \right)^2.$$  

(6)

\(^8\)The alternative view is that merger control authorities base their decisions solely on the maximization of consumer surplus. Clougherty (2005) presents some recent evidence that the merger policy conducted by the United States during the period 1997-2001 was driven primarily by considerations of consumer welfare, rather than total national surplus. He emphasizes, however, that results may be different for other countries, in particular for small open economies.
Finally, the domestic market in the foreign country, assumed to be served exclusively by the two foreign firms, is a complete mirror image of the parallel market in the home country, so there is no need to go into details.

3 National merger

3.1 The firm perspective

We begin by considering the incentives for the two domestic firms to merge and become one firm in the domestic market as well as in the world market. We thus seek to identify the situations in which the sum of producer surpluses on the part of the two firms from both the domestic and world markets stands to increase following a merger. Throughout this section we assume that the foreign firms do not merge and thus consider only the possibility of a single, national merger.9

If the two firms merge we postulate, in line with the discussion of several of the motives for mergers in practice,10 that the merged firm realizes a reduction of marginal cost of $\Delta \geq 0$, so that it falls to $1 - \Delta$. As a special case, there may be no cost reduction at all, $\Delta = 0$, but we shall generally allow for a lowering of marginal cost (and conversely ignore any possibility of a cost increase). On many occasions below, the size of the cost reduction will determine whether a merger will be in the interest of the firms involved or other parties affected by the merger.

A merger of the two domestic firms results in a monopoly in the domestic market. In consequence, profit maximization will result in a quantity of $x^M = [(a - 1) + \Delta]/(2b)$ and a market price of $p^M = [(a + 1) - \Delta]/2$, i.e. $[(a - 1) + \Delta]/2$ above the new marginal cost of $(1 - \Delta)$. The superscript ‘M’ stands for merger of home firms, where needed.

On account of monopoly, consumer surplus in the domestic market has been altered to

$$cs^M = \frac{1}{2b} \left( \frac{a - 1 + \Delta}{2} \right)^2,$$

9This assumption will be relaxed in Sections 5 and 6, where we allow for multiple mergers.

10Röller et al. (2000, pp. 12-13) distinguish between rationalization, economies of scale, technological progress, purchasing economies, and reduction of slack as the possible sources of efficiency gains following a merger. They observe that savings in variable costs may come in all five forms.
while producer surplus is twice this, or

\[ ps^M = \frac{1}{b} \left( \frac{a - 1 + \Delta}{2} \right)^2. \]  

(8)

Compared with the previous duopoly situation, as long as the cost reduction is non-negative, the move to monopoly will for sure increase producer surplus.

We next turn to the consequence of the domestic merger for the world market. At the same time as the merged firm becomes a monopoly in the national market, it will be one of three suppliers on the market abroad. Profit maximization implies sales of the monopolist and its foreign competitors to the world market equal to \( X^M = \frac{a - 1 + 3\Delta}{4B} \), respectively \( Y_1^M = Y_2^M = \frac{a - 1 - \Delta}{4B} \). The price resulting from these quantities is \( P^M = \frac{a + 3 - \Delta}{4} \), generating a producer surplus on the part of the home merged firm of

\[ PS^M = \frac{1}{B} \left( \frac{a - 1 + 3\Delta}{4} \right)^2. \]  

(9)

This compares with joint producer surplus of the two foreign firms of

\[ PS_N^M = \frac{2}{B} \left( \frac{a - 1 - \Delta}{4} \right)^2, \]  

(10)

where a subscript ‘N’ is here used to distinguish non-merged (foreign) firms.

Comparing (9) with (5) we can find the condition under which the merged firms’ profits in the world market rise as a consequence of the merger. This is \( \Delta > \frac{(a - 1)(\sqrt{1.28} - 1)}{3} \approx (a - 1)0.044 \). This can be compared with the condition under which the market share of the merged firm \( (X^M) \) will exceed the market share of the two foreign firms \( (Y_1^M + Y_2^M) \). This latter condition is seen to be \( \Delta > \frac{(a - 1)}{5} \) and thus requires a substantially higher cost reduction following the merger.\(^{11} \) The reason for this difference is that the consumer price will increase in the world market, following the reduction in the number of firms from four to three.

Adding producer surpluses in the two markets, the sum becomes

\[ ps^M + PS^M = \frac{1}{b} \left( \frac{a - 1 + \Delta}{2} \right)^2 + \frac{1}{B} \left( \frac{a - 1 + 3\Delta}{4} \right)^2 \]

\(^{11} \)The flip side to this is that the market share of the foreign firms will rise when \( \Delta < \frac{(a - 1)}{5} \).

8
post-merger, compared to pre-merger producer surpluses of

\[ ps + PS = \frac{2}{b} \left( \frac{a-1}{3} \right)^2 + \frac{2}{B} \left( \frac{a-1}{5} \right)^2. \]

A merger will only be in the two home firms’ interest, if the former sum exceeds the latter. The criterion for this can be written

\[ \Gamma \equiv (a-1)^2 \left[ \frac{1}{b} \left( \frac{1}{4} - \frac{2}{9} \right) + \frac{1}{B} \left( \frac{1}{16} - \frac{2}{25} \right) \right] + \Delta (a-1) \left[ \frac{1}{2b} + \frac{3}{8B} \right] + \Delta^2 \left[ \frac{1}{4b} + \frac{9}{16B} \right] > 0. \]

The formula comprises the gains and losses from merging. First, there is a gain from greater monopoly power and concentration in the domestic market (the first part of the first term). Second, at unchanged costs, there is a loss of market share in the world market (the second part of the first term). Third, whatever cost reduction may ensue from the merger obviously benefits the merged firm in both markets (the second and third terms).

Without any drop in marginal cost, only the former two effects matter. It is easily seen that the condition for a merger to be profitable for the merging firms then is \( B/b > 0.63 \).

In other words, the world market should not be much larger than the domestic market, if the net gain from the merger absent cost reduction is to be positive. A natural benchmark for the size of the world market, given the presence of four firms there initially against only two in each national market, might be that it is twice as large as any national market in the sense that \( B = b/2 \). In our model, this relative size of the world market is not compatible with a net gain from merging in the case where the merger does not result in any lowering of marginal cost.

Underlying these results is the well-known feature that the assumptions of Cournot competition in all markets and a homogeneous good are not very ‘friendly’ towards merger. Salant, Switzer and Reynolds (1983) have shown that in the absence of any cost reductions, aggregate profits of the merging firms will fall, unless the post-merger market share of these firms is at least 80% in the case of linear demands. In our model this condition for the merger to be profitable is met in the domestic market, but not in the world market.\(^{12}\)

\(^{12}\)Results are different under Bertrand competition and heterogeneous goods, where mergers increase profits under rather general conditions (Deneckere and Davidson, 1985). The likelihood for mergers to
Incorporating the possibility of a reduction of marginal cost in the merged firm, the condition on the size of cost reduction for the two home firms to willingly merge is

\[ \Delta > \tilde{\Delta} \equiv (a - 1) \frac{4R + 3}{4R + 9} \left[ \sqrt{\frac{(63 - 100R)(4R + 9)}{225} + \frac{(4R + 3)^2}{(4R + 3)^2}} - 1 \right] \]  

(12)

where we have used \( R \equiv B/b \) to measure the size of the home market relative to the world market. The larger is the relative size of the world market, i.e. the lower is \( R \), the higher is the minimal cost reduction \( \tilde{\Delta} \) required to make the merger profitable. In the complete absence of a world market (\( R \to \infty \)), l’Hôpital’s rule gives a \( \tilde{\Delta} < 0 \). In the other limiting case of an arbitrarily large world market (\( R \to 0 \)), the critical cost reduction reaches an upper bound. Setting \( R = 0 \) in (12) yields \( \tilde{\Delta} = (a - 1) (\sqrt{1.28} - 1)/3 \approx (a - 1)0.044 \). This is just the condition for the merged firm’s profits to increase in the world market. We sum up our findings in

**Result 1.** (Domestic merger.) *A merger between the two home firms will increase their producer surplus, provided (12) holds. The larger is the world market, relative to the home market, the higher is the cost reduction needed for the merger to be profitable.*

### 3.2 Nationally optimal merger policy

Next, we analyse the conditions under which a national merger will raise total surplus in the home country, and will therefore be accepted by national merger control authorities. For easy reference we list in Table 1 surpluses of producer and consumer groupings with and without a domestic merger.

As a preliminary step, we determine the condition for a merger to be in the interest of domestic consumers. From the comparison of (2) and (7), consumers stand to gain from the merger if

\[ \Theta \equiv c_s^M - c_s = \frac{1}{2b} \left[ \frac{\Delta^2}{4} + \frac{\Delta(a - 1)}{2} - \frac{7(a - 1)^2}{36} \right] > 0 \iff \Delta > \Delta^c = \frac{(a - 1)}{3}. \]  

(13)

Increase profits is also raised under Cournot competition when product heterogeneity is accounted for (Lommerud and Sørgard, 1997). For a recent summary of arguments why mergers can be profitable for the merging firms, even in a Cournot framework, see Huck, Konrad and Mueller (2005).
Table 1: Surplus measures for national mergers

<table>
<thead>
<tr>
<th></th>
<th>No merger</th>
<th>Domestic merger</th>
</tr>
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<tbody>
<tr>
<td>home producers</td>
<td>(\frac{2}{b} \left(\frac{a-1}{3}\right)^2 + \frac{2}{B} \left(\frac{a-1}{5}\right)^2)</td>
<td>(\frac{1}{b} \left(\frac{a-1+\Delta}{2}\right)^2 + \frac{1}{B} \left(\frac{a-1+3\Delta}{4}\right)^2)</td>
</tr>
<tr>
<td>home consumers</td>
<td>(\frac{2}{b} \left(\frac{a-1}{3}\right)^2)</td>
<td>(\frac{1}{b} \left(\frac{a-1+\Delta}{2}\right)^2)</td>
</tr>
<tr>
<td>home total surplus</td>
<td>(\frac{4}{b} \left(\frac{a-1}{3}\right)^2 + \frac{2}{B} \left(\frac{a-1}{5}\right)^2)</td>
<td>(\frac{3}{2b} \left(\frac{a-1+\Delta}{2}\right)^2 + \frac{1}{B} \left(\frac{a-1+3\Delta}{4}\right)^2)</td>
</tr>
<tr>
<td>foreign producers</td>
<td>(\frac{2}{b} \left(\frac{a-1}{3}\right)^2 + \frac{2}{B} \left(\frac{a-1}{5}\right)^2)</td>
<td>(\frac{2}{b} \left(\frac{a-1}{3}\right)^2 + \frac{2}{B} \left(\frac{a-1-\Delta}{4}\right)^2)</td>
</tr>
<tr>
<td>world consumers</td>
<td>(\frac{1}{2b} \left(\frac{4(a-1)}{5}\right)^2)</td>
<td>(\frac{1}{2b} \left(\frac{3(a-1)+\Delta}{4}\right)^2)</td>
</tr>
</tbody>
</table>

Hence, consumer surplus will go down, unless it is accompanied by a cost reduction that is substantially higher than the one needed for the merger to increase producer surplus, even if the world market is large (cf. Result 1). In our model this characterizes the ‘rather impressive synergies’ (Farrell and Shapiro, 1990, 114) that are needed for a merger to reduce consumer prices.\(^{13}\)

Now let \(\Delta^*\) be the critical cost reduction beyond which total domestic surplus increases following a merger and recall that \(R = B/b\) measures the size of the home market relative to the world market. In the appendix we derive \(\Delta^*\) as a function of \(R = B/b\):

\[
\Delta^* = (a-1) \frac{6R+3}{6R+9} \left[ \sqrt{\frac{(6R+9)(250R+63)/225+(6R+3)^2}{(6R+3)^2}} - 1 \right].
\]

(14)

It is immediately seen that the merger must always be accompanied by a cost reduction, if it is to increase total domestic surplus. If the foreign market is infinitely large (\(R = 0\)), then (14) reduces to \(\Delta^* = (a-1)(\sqrt{1.28} - 1)/3 = \bar{\Delta}\). In this case the home market does not matter, so the conditions for increasing producer surplus and total national surplus are identical. In the opposite polar case where only the home market matters (\(R \to \infty\)), the critical value \(\Delta^*\) reaches its maximum of \(\Delta^*|_{R \to \infty} \approx (a-1) 0.089\). Hence, the larger is the home market relative to the world market, the higher is the critical value of \(\Delta\) that is required for an increase in total domestic surplus.

More generally, it is shown in the appendix that the critical cost reduction from a perspective of national surplus maximization, \(\Delta^*\), exceeds the critical cost reduction

\(^{13}\)Strictly speaking, if in our simple model \(a \geq 4\), a rise in consumer surplus is completely ruled out, as \(\Delta\) of course cannot exceed one.
from the perspective of the merging firms, $\tilde{\Delta}$ [eq. (12)], for any level of $R$. This result implies that there is a range of cost reductions $\Delta^* > \Delta > \tilde{\Delta}$ for which a merger is in the private interest of domestic firms, but not in the interest of the home country as a whole. The reason is the negative ‘external effect’ (in the language of Farrell and Shapiro, 1990) on domestic consumers. A national merger control authority that is concerned with maximizing total domestic surplus will reject the merger proposal for such values of $\Delta$. When the world market is large ($R$ is small), the range of $\Delta$ for which the merger is blocked becomes smaller, as most of the burden of higher prices is then borne by consumers in the world market. Figure 2 shows the range of relative size parameters $R$ and cost savings $\Delta$ for which a merger is privately profitable, and is either permitted or rejected by a national regulator. The optimal policy towards a national merger is summarized in

**Result 2:** (Nationally optimal merger policy.) A national merger authority that maximizes total national surplus will accept a proposed merger, if (14) holds. For the range of cost reductions $\Delta^* > \Delta > \tilde{\Delta}$, a merger increases the profits of domestic firms, but reduces total national surplus.
3.3 Globally optimal merger policy

When deciding on a merger proposal, national governments in our model neglect two externalities that are caused by the domestic merger: (i) the effect on the producer surplus earned by foreign firms; and (ii) the effect on consumer surplus in the world market.\footnote{Such externalities on foreigners are termed ‘external external effects’ by Barros and Cabral (1994).} To complete our analysis of the welfare effects of mergers, consumer surplus in the world market and producer surplus of competing foreign firms must be incorporated (see Table 1).

The foreign firms benefit from the domestic merger if

\[
\Phi_1 = \frac{2}{B} \left\{ \left( \frac{a - 1}{4} - \Delta \right)^2 - \left( \frac{a - 1}{5} \right)^2 \right\} > 0 \iff \Delta < \Delta^F = \frac{(a - 1)}{5}. \tag{15}
\]

This is just the condition under which the market share of foreign firms in the world market will rise.

The condition for world consumers to benefit from the home merger is

\[
\Phi_2 = \frac{1}{2B} \left\{ \left( \frac{3(a - 1) + \Delta}{4} \right)^2 - \left( \frac{4(a - 1)}{5} \right)^2 \right\} > 0 \iff \Delta > \Delta^W = \frac{(a - 1)}{5}. \tag{16}
\]

Taken together, eqs. (15) and (16) imply that the (external) externalities caused by a domestic merger are counteracting for any level of \(\Delta\), since the turning points for the signs of the individual effects coincide. If the merger causes only a moderate cost reduction \([\Delta < (a - 1)/5]\), then the domestic merger will benefit foreign producers, but hurt consumers in the world market. If, on the other hand, the cost reduction is large \([\Delta > (a - 1)/5]\), then both of these externalities will change sign, and the merger now hurts foreign producers while benefitting consumers in the world market.

To determine the net externality caused by the domestic merger, we have to add up \(\Phi_1\) in (15) and \(\Phi_2\) in (16). It is shown in the appendix that the joint effect of a national merger on foreign producers and world consumers is strictly non-negative in our framework. For \(\Delta < (a - 1)/5\), the positive externality that a domestic merger causes for foreign producers exceeds the negative effect on world consumers, whereas for \(\Delta > (a - 1)/5\), the positive externality of a domestic merger on world consumers exceeds the negative effect on foreign producer surplus.
Defining $\Delta^{**}$ as the critical cost reduction needed to increase global welfare, we get

$$\Delta^{**} = (a - 1) \frac{12R + 5}{12R + 23} \left[ \sqrt{\frac{(12R + 23)(500R + 81)/(225 + (12R + 5)^2)}{(12R + 5)^2}} - 1 \right]. \tag{17}$$

If the world market is negligible ($R \to \infty$), this critical value approaches $\Delta^{**} \approx 0.089(a - 1)$, the same as the limiting value in the case of national welfare maximization. (In this case, of course, the external externalities are also negligible.) If the world market is very large relative to the home market ($R \to 0$), then the critical value is $\Delta^{**} \approx 0.033(a - 1)$, which is less than the corresponding value under the total surplus criterion for national welfare maximization. This reflects that the sum of externalities on agents in F and W is strictly positive in this range. More generally, it is shown in the appendix that $\Delta^{**} < \Delta^*$ holds for all finite values of $R$. Hence, there is a range of cost reductions for which the merger increases global welfare, but is nevertheless rejected by a national government that maximizes total domestic surplus. In our model, domestic merger policy will therefore be ‘too restrictive’ towards national mergers from a perspective of global surplus maximization. Our findings are summarized in

**Result 3:** (Domestic vs. global welfare maximization.) A domestic merger that raises total national surplus will also raise total surplus worldwide. For moderate cost reductions ($\Delta < (a - 1)/5$) the gains to foreign producers exceed the losses to world consumers; whereas for large cost reductions ($\Delta > (a - 1)/5$) the gains to world consumers exceed the losses to foreign producers.

### 4 International merger

A different scenario that can readily be addressed in our framework is a cross-country merger, say between H’s firm 1 and F’s firm 1. In each of the markets H and F, the merged firm is still part of a duopoly, but it may now have gained a cost advantage over its domestic competitor. In the world market W, the merged firm acts as one competitor, thus reducing the total number of firms in this market to three. In this section we analyze the optimal policies towards such international mergers, and compare them to the results derived above for the case of national mergers. Again we consider only a single, international merger and assume that the remaining firms do not merge.
In the home market (and equivalently in market F), profit maximization by the merged firm 1 (with unit cost of $1 - \Delta^I$) and its competitor (with unit costs of 1) yields Cournot duopoly outputs of $x_1^I = [a - 1 + 2\Delta^I] / (3b)$, respectively $x_2^I = [a - 1 - \Delta^I] / (3b)$, where the superscript ‘I’ stands for an international merger. The resulting market price is $p^I = (a + 2 - \Delta^I) / 3$, showing that the cost savings by the merged firm are partly passed on to consumers. Consumer surplus is

$$cs^I = \frac{1}{2b} \left(\frac{2(a - 1) + \Delta^I}{3}\right)^2.$$  \hspace{1cm} (18)

Comparing (18) to (2) shows immediately that an international merger can never hurt consumers in either country H or F, even if $\Delta^I = 0$.

The producer surplus of the merged firm and the non-merged firm (subscript ‘N’) in the home country are

$$ps^I = \frac{1}{b} \left(\frac{a - 1 + 2\Delta^I}{3}\right)^2, \hspace{0.5cm} ps_N^I = \frac{1}{b} \left(\frac{a - 1 - \Delta^I}{3}\right)^2.$$  \hspace{1cm} (19)

In comparison to a national merger, which causes a domestic monopoly [cf. (8)], the producer surplus of the merged firm (in both countries together) is now increased by less. In the world market, the effects of an international merger are the same as those caused by a national merger, and the surplus of the merged firm and its competitors in eqs. (9)–(10) is unchanged from our treatment in Section 3. Hence $PS_M^I = PS^I$ and $PS_N^I = PS_N^I$. Note, finally, that the surpluses of both the merged firm and the non-merged firms are now divided equally between countries H and F.

4.1 Privately profitable international merger

The condition for the merger to be privately profitable is derived in the appendix and given by

$$\Delta^I > \tilde{\Delta}^I \equiv (a - 1) \frac{64R + 27}{(128R + 81)} \left[ \sqrt{\frac{(64R + 27)^2 + 2.52(128R + 81)}{(64R + 27)^2}} - 1 \right].$$  \hspace{1cm} (20)

As in the case of national mergers [eq. (12)], equation (20) determines the critical cost reduction $\tilde{\Delta}^I$ for varying levels of the relative market size parameter $R$. It is seen that, in contrast to a national merger, an international merger can never be profitable in the
absence of cost savings (i.e., for $\Delta^I = 0$). This is because the merged firm will have no gains in markets H and F in this case, relative to the pre-merger situation, while its joint market share in country W falls. If the world market is of negligible size ($R \to \infty$), l’ Hôpital’s rule gives $\tilde{\Delta}^I = 0$. Not surprisingly, in the other extreme case where only the world market matters ($R \to 0$), the critical cost reduction is the same as the limit value for a national merger, $\Delta^I = (a - 1)(\sqrt{1.28} - 1)/3 \approx (a - 1)0.044$. More generally it is shown in the appendix that, for any positive level of $R$, condition (20) is stricter than the corresponding condition for a national merger [eq. (12)].

Result 4. (International merger.) A merger between one home firm and one foreign firm increases the joint producer surplus if (20) holds. The required cost reduction is always higher or equal than in the case of a national merger.

4.2 Regional policy towards cross-country merger

We now consider optimal policy towards international mergers. For the cross-country merger considered here, it is natural to assume that merger control is in the hands of a regional merger authority. This is in line, for example, with the division of competences for merger control in the European Union. We assume that this regional regulator maximizes the total joint surplus in countries H and F. However, due to the complete symmetry of the model in the case of cross-country mergers, it is sufficient to evaluate the total surplus in the home country. In addition to the surplus of the merged firm, this measure includes the consumer surplus in the home market in (18) and the profits of the non-merged home firm in (19). We have already established that consumers in countries H and F will benefit from any international merger that is accompanied by a positive cost reduction. The cost reduction needed to raise the home country’s total surplus is (see the appendix)

$$\Delta^{I^*} = (a - 1) \frac{64R + 9}{176R + 99} \left[ \sqrt{\frac{(64R + 9)^2 - 3.96(176R + 99)}{(64R + 9)^2}} - 1 \right]. \quad (21)$$

This expression equals zero, if the world market is of negligible size ($R \to \infty$), and it is negative when the world market is very large ($R \to 0$). This shows that the national government will accept any international merger that is proposed. The core
The difference to the case of a national merger (Result 2) is that the merged firm will still face a domestic competitor in the home market. In the absence of a world market, both producers and consumers in the home country will just be indifferent towards a merger that entails no cost reductions.\textsuperscript{15} Adding the world market to the picture, the home country always gains from the merger, even in the absence of cost savings, because the merger increases concentration and consumer prices in market W.

On account of symmetry, the effects of the international merger on the total surplus in countries H and F taken together will just be twice the isolated effect on country H. Therefore, the critical value derived in (21) is unchanged if joint surplus maximization in the producing countries H and F is the policy objective. Figure 3 shows the parameter combinations for which international mergers are proposed and cleared by the regional merger authority. We summarize in

\textbf{Result 5:} (Optimal policy towards international merger.) \textit{An international merger will never be blocked by a regulator that maximizes total joint surplus in H and F.}

\textsuperscript{15}This corresponds to the benchmark result in Cournot models that the aggregate external effect of a merger cannot be negative, if the merging firms have a market share of at most 50\% (Levin, 1990). For the international merger considered here, this market share is just 50\% when $\Delta^f = 0$.\textsuperscript{17}
4.3 Global welfare

It remains to determine whether it is possible for an international merger to raise the profits of the merging firms and total surplus in countries H and F, but nevertheless reduce total surplus worldwide. This is not a trivial issue, given that we know from our previous analysis that consumers in country W will be hurt by a merger that is accompanied by only moderate cost reductions. The critical cost reduction required for the international merger to increase global welfare is (see the appendix)

\[ \Delta^I > \Delta^{I**} \equiv (a - 1) \frac{128R + 45}{(352R + 207)} \left[ \frac{\sqrt{(128R + 45)^2 + 3.24(352R + 207)^2}}{(128R + 45)^2} - 1 \right]. \]  

(22)

Evaluating this expression for \( R = 0 \) shows that \( \Delta^{I**}\big|_{R=0} \approx 0.033(a - 1) \). If the world market is very large, the cost reduction that makes the merger profitable for the involved firms will also ensure that the merger increases total surplus worldwide. In the other extreme case where only the home market matters, \( \Delta^{**}\big|_{R \to \infty} = 0 \), which is the same threshold as for total national surplus to increase. More generally, it is shown in the appendix that in our set-up \( \Delta^{I**} \leq \tilde{\Delta}^I \) holds for any level of \( R \). Hence we have

**Result 6:** (Global welfare effects of international merger.) Any international merger that raises the producer surplus of the merged firms will also increase global surplus.

From a perspective of global surplus maximization, there is thus no need for either national or regional control of international mergers in our model. The reason is that an international merger does not create a monopoly in either the home or the foreign market, and hence will be profitable for the merging firms only if cost reductions are sufficiently high. This threshold is in turn sufficient to ensure that global world surplus increases. Note, however, that some of the gains to the producing countries H and F come at the expense of consumers in country W, whose surplus is still reduced by the international merger as long as \( \Delta^I < \Delta^W = (a - 1)/5 \).

5 Merger games

At a principal level, it is possible to perceive mergers as outcomes of an extended game, in which all firms in the sector in question, domestic as well as foreign, and relevant
Table 2: Producer surplus per firm in different national merger scenarios

<table>
<thead>
<tr>
<th>Home</th>
<th>Foreign</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>[ N ]</td>
<td>[ \frac{1}{b} \left( \frac{a-1}{3} \right)^2 + \frac{1}{B} \left( \frac{a-1}{5} \right)^2 ]</td>
</tr>
<tr>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>[ M ]</td>
<td>[ \frac{1}{2b} \left( \frac{a-1+\Delta}{2} \right)^2 + \frac{1}{2B} \left( \frac{a-1+3\Delta}{4} \right)^2 ]</td>
</tr>
</tbody>
</table>

N: no merger; M: merger. The first (second) line in each cell is for the home (foreign) firm.

competition authorities at home and abroad are the players of the game. Mapping the strategies of all these players and fixing the sequence of play are steps towards deriving what the equilibria of the described merger game might be.

A complete investigation of such full-size games is well beyond the scope of the present article. Instead, we shall in this section confine ourselves to a study of more limited merger games. Limited in the sense that we shall ignore the role of competition authorities and consider only specific forms of mergers. The focus is on non-cooperative merger games; in the next section we adopt a more cooperative approach when examining endogenous merger equilibria.

5.1 National mergers

Building on the analysis in Section 3, suppose that not only the two domestic firms but also the two foreign firms may contemplate a national merger. For the moment, authorities have stepped aside, and international mergers are not perceived as relevant. The question is: When all four firms consider a merger with their respective national competitor, will the Nash non-cooperative merger equilibrium feature (i) no mergers at all; (ii) merger in only one country; or (iii) national mergers in both countries? And how will the outcome depend on the scope for productivity improvement as measured by \( \Delta \) and the relative size of the world market as measured by \( R = B/b \)?

In Section 3 we have characterized the effects on producer surplus of home and foreign firms of a merger of the home country firms. A parallel analysis of the consequences of
a national merger in the home country, given that foreign firms merge, can readily be carried out. The result is Table 2.

We know already that when foreign firms do not merge, domestic firms will likewise refrain from merging, if \( \Delta < \tilde{\Delta} \), where the latter is defined in (12). Similarly, we can compute, with the aid of Table 2, that if foreign firms do merge, then domestic firms will also choose to merge, if \( \Delta > \hat{\Delta} \), with \( \hat{\Delta} \) the relevant root in the equation

\[
\Delta^2(18R - 1) + \Delta(a - 1)(36R + 34) + (a - 1)^2(2R - 1) = 0.
\]

The appendix contains a full characterization of \( \hat{\Delta} \). It also shows that this borderline value of \( \Delta \), for which a merger becomes beneficial for domestic firms when foreign firms merge, is smaller than \( \tilde{\Delta} \) for all values of \( R \). Qualitatively, the possible Nash merger equilibria in pure strategies can then be drawn as in Figure 4.

If the world market is of sufficient importance (\( R \) small), then with low productivity gains from a merger the Nash equilibrium will entail no mergers at all. For intermediate values of productivity gains, both a no-merger equilibrium and a two-merger equilibrium are possible, whereas for bigger values of productivity gains, only the two-merger equilibrium remains. Equilibria with only one merger cannot be supported by pure strategies in the national merger game. Conversely, if the world market is relatively unimportant (\( R \) large), the only Nash equilibrium in the game will feature national
Table 3: Producer surplus per firm in different international merger scenarios

<table>
<thead>
<tr>
<th>Firm 1</th>
<th>N</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>( \frac{1}{6} \left( \frac{a-1}{3} \right)^2 + \frac{1}{b} \left( \frac{a-1}{5} \right)^2 )</td>
<td>( \frac{1}{6} \left( \frac{a-1}{3} \right)^2 + \frac{1}{b} \left( \frac{a-1}{5} \right)^2 )</td>
</tr>
<tr>
<td>M</td>
<td>( \frac{1}{6} \left( \frac{a-1+2\Delta}{3} \right)^2 + \frac{1}{2b} \left( \frac{a-1+3\Delta}{4} \right)^2 )</td>
<td>( \frac{1}{6} \left( \frac{a-1+4\Delta}{3} \right)^2 + \frac{1}{2b} \left( \frac{a-1+5\Delta}{4} \right)^2 )</td>
</tr>
</tbody>
</table>

mergers in both the home and the foreign country. This is summarized in

**Result 7:** (National merger equilibria). When only national mergers are permitted, the Nash equilibrium entails no mergers when cost reductions are below the threshold \( \hat{\Delta} \) defined by (23), and it entails two mergers when cost reductions are above \( \hat{\Delta} \) in (12). For \( \hat{\Delta} < \Delta < \tilde{\Delta} \), there are two possible Nash equilibria, with either two or no mergers.

### 5.2 Merger games with international mergers

Next suppose that for some reason (perhaps the interference of national competition authorities) national mergers are excluded, whereas international mergers are not. The question now is which Nash non-cooperative international merger equilibria will result, and how the outcome will depend on the gains in productivity, \( \Delta^I \), and the relative size of the world market, \( R \). Section 4 already characterizes producer surpluses for firms in and outside of international mergers. In a parallel way, producer surpluses for firms contemplating an international merger can be computed, given that the remaining firms have already merged. The result is Table 3.

From the analysis in Section 4 we know that the ‘1’ firms in the home and foreign countries will abstain from a merger, given that the ‘2’ firms do not merge, if \( \Delta^I < \hat{\Delta}^I \). From Table 3 we can compute that if the two ‘2’ firms merge, so will the ‘1’ firms, if \( \Delta^I > \hat{\Delta}^I \), where \( \hat{\Delta}^I \) is given by the expression

\[
\hat{\Delta}^I = (32R + 17)(a - 1) \left[ 1 - \sqrt{\frac{(32R + 17)^2 - 1}{(32R + 17)^2}} \right].
\] (24)
This borderline value is positive for all finite values of $R$. Moreover, it is shown in the appendix that $\hat{\Delta}^I < \tilde{\Delta}^I$ must hold in the relevant parameter range. These findings are illustrated in Figure 5.

The implication is that for every finite value of the relative size of the world market, $R$, a sufficiently low value of the productivity gain from a merger will prevent international mergers from taking place. For intermediate values of $\Delta^I$, there are two Nash international merger equilibria – one without any mergers and one with two international mergers. Finally, for high productivity gains, the only Nash equilibrium will entail all firms engaging in international mergers. Hence we have

**Result 8:** (International merger equilibria). When only international mergers are permitted, the Nash equilibrium entails no mergers when cost reductions are below the threshold $\hat{\Delta}^I$ defined by (24), and it entails two mergers when cost reductions are above $\tilde{\Delta}^I$ in (20). For $\hat{\Delta}^I < \Delta < \tilde{\Delta}^I$ there are two possible Nash equilibria, with either two or no mergers.

To summarize, our qualitative insights from games with international mergers are quite parallel to the conclusions from games of national mergers. Low productivity gains point in the direction of the absence of mergers altogether, whereas high productivity gains imply that all firms will take part in a merger. For intermediate values of $\Delta$, the two
types of equilibria can coexist, and in no circumstances will situations in which only two of the four firms merge form a Nash non-cooperative merger equilibrium. If at all, national and international mergers will come in waves.

6 Endogenous merger equilibria

A recent development in the merger literature is that the firms’ choice between different possible partners is endogenised. Horn and Persson (2001a, 2001b) treat mergers as a cooperative game of coalition formation and show that an equilibrium market structure maximizes the sum of industry profits, rather than just the profits of the merging firms. This result is very intuitive: if total industry profits are not maximized under a given ownership structure, then there will always be an incentive for at least one firm (including those which have not merged) to make a merger offer to some other firm that leaves both of these firms better off.\footnote{In general, only the sum of profits among the decisive owners matters for the equilibrium merger structure (Horn and Persson, 2001b). In our model, however, the owners of all firms are decisive.}

In this section we apply this general approach to our simple model and analyze the nature of endogenous merger equilibria. This quickly turns into a study of the conditions under which the equilibrium ownership structure is characterized by two national mergers or two international mergers. In line with the relevant literature, we here exclude the case of a worldwide monopoly. The latter would obviously be in the interest of all firms, but it would also go against consumer interests in all countries. Thus, the maximum degree of concentration we allow for is international duopoly.\footnote{Having excluded worldwide monopoly, there is in principle one more merger outcome to consider. This is the ‘twin merger’ situation, where, say, the two country H firms and one of the F firms merge. This outcome creates a monopoly in H, but only duopoly in F and W. We shall ignore this outcome in the following, for two reasons: First, the four firms together will typically prefer the outcome with two national mergers, as this allows deeper exploitation of cost reduction and monopoly power. Second, merger authorities in country H are likely to be rather unsympathetic to the double merger, as it combines a monopoly in H with a loss of market share in W for H’s shareholders (they get to own 2/3 of the merged firm which has only around half of the world market).}

To begin with, we assume that the cost savings associated with a national and an international merger is the same ($\Delta = \Delta^I$). Our analysis relies on the symmetry between
the home and foreign countries and proceeds in three steps.

First, it is obvious that the four firms will always prefer a double national merger, as this will give them monopoly power in their respective home markets and altogether maximize industry profits. Any other merger outcome, including double international merger, will be dominated by double national merger, even in the absence of productivity gains from mergers. Hence, the unrestrained endogenous merger equilibrium in the model is the double national merger. However, as we have discussed in Section 3, these mergers may not be permitted by merger authorities, because they simultaneously reduce consumer surplus.

To keep the analysis as simple as possible and, in particular, rule out strategic interaction between national merger control authorities, we assume that all policy decisions are taken by a regional merger agency that maximizes the total joint surplus in countries H and F (and hence, due to the symmetry of the home and the foreign countries, the total surplus in each of them). Moreover, the regional authority is exogenously constrained to treat the national merger proposals in a non-discriminatory way, that is, it cannot accept just one of the (identical) merger proposals. With these constraints, the regional merger authority will accept both national merger proposals, if total national surplus in one country (say, country H) is higher in the double national merger case, as compared to the situation without any mergers. In the opposite case, both national merger proposals will be blocked.

Second, the merging firms anticipate the decision of the regional merger authority. If the national merger proposals reduce total surplus in each of countries H and F, and will therefore be forbidden by the merger agency, the attention of the firms involved should shift to international mergers. As international mergers leave concentration in the goods markets in the home and foreign countries unchanged, and since they lead to increased concentration in the world market on top of possible productivity gains, such mergers will always be privately profitable. Further, and for the same reason, the regional merger authority will always prefer the double international merger to a no-merger outcome. As a result, a double international merger is always feasible and will indeed become the endogenous merger equilibrium in the situation where authorities choose to disallow the double national merger.

Third, it now follows that the endogenous merger equilibrium will either be a double
national merger (when this is allowed by the merger authority) or a double international
merger (when it is not). What remains is to compute for what combinations of cost
savings $\Delta$ and the relative size of the world market $R$ a double national merger will be
disallowed, respectively permitted, by the regional authority.

Utilizing Tables 1 and 2 we can compute that the double national merger will raise
national surplus in each of countries H and F, provided that $\Delta > \Delta^A$, where

$$\Delta^A \equiv (a - 1) \left( \sqrt{\frac{800R + 144}{675R + 200}} - 1 \right).$$

Observe here that $\Delta^A$ is only positive, if $R > 0.448$, that is if the world market is
small enough relative to national markets. Only in this situation are sizeable produc-
tivity gains required for authorities to accept a double national merger proposal. In
the opposite situation, where $R < 0.448$, the world market (and the market concentra-
tion occurring there) is sufficiently important to induce authorities to accept a double
national merger, even if no productivity gains are involved.

Figure 6 summarizes the equilibrium merger structure for different parameter combi-
nations. Higher cost savings are associated with more national mergers in equilibrium,
because firms always prefer national over international mergers, and the regional merger
authority will be inclined to accept national mergers in this case. Similarly, a large rel-
ative size of the world market ($R \rightarrow 0$) implies that most of the losses in consumer
surplus occur in third countries, which again will induce the merger authority to accept
national mergers. In contrast, if the share of sales in world markets is low ($R \rightarrow \infty$),
and cost savings are moderate, then the equilibrium market structure is characterized
by cross-border mergers. We summarize the analysis in this section in our last result:

Result 9: (Endogenous merger equilibrium.) If domestic and international mergers
lead to identical cost savings, then the equilibrium market structure is characterized by
double international merger, if cost savings are moderate and the share of sales in third

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18Note here that merger authorities will allow the double national merger, when this does not
harm national surplus in the home or foreign countries. Authorities would strictly prefer the
double international merger to the double national merger. But they are not in a position to select the type
of merger, only to reject or accept the double national merger proposal with reference to its national
surplus impact.
markets is low; otherwise by double national merger. International mergers are only part of the endogenous merger equilibrium when authorities rule out national mergers.

Our analysis has presupposed that cost savings are identical for a national and a regional merger. This is, however, a restrictive assumption. Reasons why international mergers may be associated with higher cost savings include reduced aggregate transport costs (Horn and Persson, 2001a; Bjorvatn, 2004), higher synergies due to a more diverse knowledge base, or a weakening of national trade unions as a result of international mergers (Lommerud, Straume and Sørgard, 2006). In this case, whether firms will prefer double national merger or double international merger becomes a question of weighing the monopoly profits stemming from higher concentration in home markets against the higher productivity gains from cross-border merger which materialize in both home and world markets. If the world market is important enough, the scale may tip in favor of double international merger. Conversely, if the world market is relatively unimportant, double national merger may still be preferred by firms, despite lower productivity gains.
7 Conclusions

In this paper we have set up a simple three-country model with segmented markets and Cournot competition between firms. A home country and a foreign country both have two domestic firms, which supply the respective domestic markets plus a third (world) market. Within this set-up we have formally analyzed the effects of national and cross-border mergers on the firms involved, on selected groups of consumers, and on the world as a whole. We argued that when national merger authorities pursue national surplus, they tend to be overly restrictive vis-a-vis national mergers, so some proposed national mergers will be rejected by authorities despite being beneficial from a world perspective. In contrast, proposed international mergers will be efficiently cleared by national and regional authorities. Finally, we have allowed for multiple mergers, assuming either non-cooperative or cooperative behaviour on the part of the merging firms. Our analysis of non-cooperative mergers has yielded outcomes of either no or double mergers while our study of the more cooperative situation of mergers as coalition formation has always led to double merger situations. Which merger pattern is to be expected, for given combinations of cost reductions and the relative size of the world market, will thus hinge on which description of firm behaviour is the more suitable one. Moreover, the equilibrium will depend on the policy stance adopted by merger authorities. In this last respect, our analysis has considered only the simplest setting where merger policy is in the hands of a single, regional authority and this authority is constrained to either accept or reject both national mergers.

Despite its simplicity, our model allows to derive a foundation for the empirical observation that mergers seem to come in waves. In particular, we found that whenever any two of the four firms in our model decide to merge, either within a country or cross-border, so will the remaining two firms. Further, a striking result of our analysis is the pronounced difference between national and international mergers. This result captures, in a stylized form, an important asymmetry between national and cross-border mergers in markets where national players dominate. In these markets a national merger will indeed reduce the number of firms that actively supply the market, whereas an international merger will not. Our model shows that the conditions for an international merger to be in the interest of the participating firms are unambiguously stricter than
in the case of a national merger, but when indeed proposed, international mergers will not be vetoed by neither national nor regional merger authorities. This finding is compatible with the permissive stance of merger control at the level of the European Union: of almost 1600 merger proposals that the European Commission had to decide upon until the end of 2000, more than 85 per cent were accepted immediately and only 13 mergers, or less than 1 per cent, were finally rejected (Schmidt, 2001, p. 237).

Lastly, our analysis does not lend support to the hypothesis that national or regional merger policy is used as a beggar-thy-neighbour instrument. This is partly due to the property of the Cournot oligopoly model that a merger will typically benefit the firms that are not participating in it. There is another element in our model which is responsible for this result, however. It is well known that the strategic effects of national policies are strongest when all domestic output is sold in a third market (Brander and Spencer, 1985). In contrast, in our model the output of the merged firm is also consumed in the country that undertakes the regulation. This ensures that mergers are not accepted unless they are associated with cost savings, which outweigh the efficiency losses resulting from reduced competition at home.

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Appendix

Section 3: National merger

Nationally optimal merger policy: Adding (13) and (11) implicitly defines $\Delta^*$ by
\[
\Lambda \equiv \frac{3}{2b} \left( \frac{a-1}{2} + \Delta^* \right)^2 + \frac{1}{B} \left( \frac{a-1}{4} + 3\Delta^* \right)^2 - \frac{4}{b} \left( \frac{a-1}{3} \right)^2 - \frac{2}{B} \left( \frac{a-1}{5} \right)^2 = 0. \tag{A.1}
\]
Multiplying by $B$, introducing $R = B/b$ and solving for $\Delta^*$ yields (14).

To see that $\Delta^* > \tilde{\Delta}$ for any level of $R$, note first from (A.1) that $\Lambda(\Delta) \equiv \Gamma(\Delta) + \Theta(\Delta)$ is monotonically increasing in $\Delta$. Moreover, $\Lambda(\tilde{\Delta}) < 0$ since $\Gamma(\tilde{\Delta}) = 0$ [eq. (11)] and $\Theta(\tilde{\Delta}) < 0$ [eq. (13)]. Hence we can unambiguously infer that $\Delta^*$, which solves (A.1), must exceed $\tilde{\Delta}$. 

Globally optimal merger policy: To determine the net externality caused by the domestic merger, we have to add up $\Phi_1$ in (15) and $\Phi_2$ in (16). This yields
\[
\Phi \equiv \frac{1}{160B} \left[ 25\Delta^2 - 10\Delta(a-1) + (a-1)^2 \right] \geq 0 \tag{A.2}
\]
which is positive for all values of $\Delta \neq (a-1)/5$ and zero for $\Delta = (a-1)/5$.

Adding $\Lambda$ in (A.1) and $\Phi$ in (A.2) gives a measure of the change in global total surplus$^{19}$
\[
\Omega \equiv \Delta^2 \left[ \frac{3}{8b} + \frac{23}{32B} \right] + \Delta^*(a-1) \left[ \frac{3}{4b} + \frac{5}{16B} \right] - (a-1)^2 \left[ \frac{5}{72b} + \frac{9}{800B} \right], \tag{A.3}
\]
which is negative at $\Delta = 0$ and monotonically rising in $\Delta$. The condition $\Omega = 0$ implicitly determines the critical level of cost reductions, $\Delta^{**}$ given in (17), which is positive for any level of $R$. Since $\Lambda(\Delta^*) = 0$ and $\Phi(\Delta^*) \geq 0$, it follows that $\Omega(\Delta^*) \geq 0$, with the inequality holding strictly when $\Delta^* \neq (a-1)/5$. From the positive monotonicity of $\Omega(\Delta)$ it then follows that $\Delta^{**} \leq \Delta^*$.

Section 4: International merger

Profitability for merging firms: The change in producer surplus for the merging firms is $ps^I + PS^I - ps - PS > 0$. Using eqs. (2), (5), (9) and (19), this gives
\[
\Gamma^I \equiv (a-1)^2 \left[ \frac{1}{B} \left( \frac{1}{32} - \frac{1}{25} \right) \right] + \Delta^I(a-1) \left[ \frac{4}{9b} + \frac{3}{16B} \right] + (\Delta^I)^2 \left[ \frac{4}{9b} + \frac{9}{32B} \right]. \tag{A.4}
\]

$^{19}$Foreign consumer surplus is not included in this welfare measure, because it is unaffected by the domestic merger.
Setting (A.4) equal to zero, multiplying by $B$, introducing $R = B/b$ and solving for $\Delta^I$ gives (20).

To show that the critical cost reduction needed to benefit the merging firms [eq. (20)] is always stricter (or equally strict) than the parallel condition for a national merger [eq. (12)], we evaluate the net gain to the firms from an international merger, $\Gamma^I$ in (A.4), at the critical level of cost reduction for the national merger ($\tilde{\Delta}^I$) and show that $\Gamma^I(\tilde{\Delta}^I) \leq 0$. Substituting (12) into (A.4) and rearranging gives

$$\Gamma^I(\tilde{\Delta}^I) = \frac{1}{Rb} \left[ -\frac{7(a - 1)^2}{800} + \frac{(a - 1)^2(4R + 3)}{288(4R + 9)^2} \rho \right],$$

$$\rho = (512R^2 + 48R) \left( 1 - \sqrt{1 + \frac{(63 - 100R)(4R + 9)}{225(4R + 3)^2}} \right) + \frac{(512R^2 + 708R + 243)(63 - 100R)(4R + 9)}{225(4R + 3)^2}.$$

For $R = 0$ it is easily confirmed that $\Gamma^I(\tilde{\Delta}^I) = 0$. Moreover, straightforward, but tedious calculations show that $d\Gamma^I(\tilde{\Delta}^I)/dR < 0$, establishing the result.\(^{20}\)

**Regionally optimal merger policy:** The sum of all changes in domestic surplus is, from (18) and (19)

$$\Lambda^I = (\Delta^I)^2 \left[ \frac{11}{18b} + \frac{11}{32B} \right] + \Delta^I (a - 1) \left[ \frac{4}{9b} + \frac{1}{16B} \right] + \frac{11(a - 1)^2}{800B}.$$

Setting this equal to zero, introducing $R = B/b$ and solving for $\Delta^I$ gives (21).

**Globally optimal merger policy:** The sum of all welfare changes caused by the international merger is (i) the change in total surpluses in H and F which, due to symmetry are two times the change given in (A.5); and (ii) the change in consumer surplus for consumers in W, as given in (16). Thus

$$\Omega^I = (\Delta^I)^2 \left[ \frac{11}{9b} + \frac{23}{32B} \right] + \Delta^I (a - 1) \left[ \frac{8}{9b} + \frac{5}{16B} \right] - \frac{9(a - 1)^2}{800B}.$$

This sum is negative at $\Delta^I = 0$ and monotonically rising in $\Delta^I$. Introducing $R$ and setting $\Omega^I = 0$ gives (22).

\(^{20}\)We have performed these calculations using Mathematica. The results are available from the authors upon request.
To prove that any international merger that raises the profits of the merged firm will also raise world welfare, we have to show that \( \Omega^I \) in (A.6) is positive when evaluated at \( \hat{\Delta}^I \). Substituting \( \hat{\Delta}^I \) from (20) into (A.6) and rearranging gives

\[
\Omega^I (\hat{\Delta}^I) = \frac{(a-1)^2}{Rb} \left[ \frac{(352R + 207)}{288} \frac{(64R + 27)^2}{(128R + 81)^2} (a^2 - 2\alpha + 1)
\right.
\]

\[
+ \frac{(128R + 45)}{144} \frac{(64R + 27)}{(128R + 81)} (\alpha - 1) - \frac{9}{800} \right],
\]

where \( \alpha \equiv \sqrt{\frac{(128R + 54)^2 + 10.08(128R + 81)}{(128R + 54)^2}} \).

Evaluating this with Mathematica shows that \( \Omega^I (\hat{\Delta}^I) > 0 \) holds for all finite levels of \( R \), with \( \Omega^I (\hat{\Delta}^I) \to 0 \) for \( R \to \infty \).

Section 5: Merger games

Two national mergers

This part of the appendix characterizes the borderline value \( \hat{\Delta} \), for which a domestic merger just pays off when foreign firms merge. Four different cases must be distinguished, ranked according to the relative importance of the world market.

(a) for \( R < 1/18 \) :

\[
\hat{\Delta} \equiv (a-1)^{18R + 17} \left[ 1 - \sqrt{\frac{(18R + 17)^2 - (1 - 2R)(1 - 18R)}{(18R + 17)^2}} \right]
\]

(b) for \( R = 1/18 \) :

\[
\hat{\Delta} \equiv (a-1)2/81
\]

(c) for \( 1/2 > R > 1/18 \) :

\[
\hat{\Delta} \equiv (a-1)^{18R + 17} \left[ \sqrt{\frac{(18R + 17)^2 + (1 - 2R)(18R - 1)}{(18R + 17)^2}} - 1 \right]
\]

(d) for \( R > 1/2 \) :

\[
\hat{\Delta} \equiv 0.
\]
Demonstrating that $\hat{\Delta} < \tilde{\Delta}$ must hold in the relevant parameter range is equivalent to showing that the gain in producer surplus is larger for the second national merger than for the first. (This equivalence must hold because producer surplus for the merging firms is monotonously increasing in $\Delta$.) We thus have to show that the inequality

$$(M, M) - (N, M) > (M, N) - (N, N),$$

(A.7)

holds from the perspective of the home firms when $M$ and $N$ denote ‘merger’ and ‘no merger’, respectively, and the first (second) entry in each bracket refers to the home (foreign) firms.

Substituting in the values from Table 2 shows that the above inequality is met iff

$$13(a - 1)^2 + 350(a - 1)\Delta - 2075\Delta^2 > 0.$$  (A.8)

The inequality (A.8) is clearly met for $\Delta = 0$. Setting the RHS of (A.8) equal to zero and solving the quadratic equation yields a critical value of $(a - 1)/5$, for which the RHS in (A.8) is just equal to zero; hence, the inequality (A.8) is met for all values of $\Delta < (a - 1)/5$. This implies that $\hat{\Delta} < \tilde{\Delta}$ holds throughout the relevant parameter range, as shown in Figure 4.

**Two international mergers**

By analogy to the case of national mergers, demonstrating that $\hat{\Delta}^I < \tilde{\Delta}^I$ is equivalent to demonstrating that the inequality (A.7) holds from the perspective of the two ‘1’ firms, when the first (second) entry in each bracket refers to the ‘1’ (‘2’) firms. Substituting in the values from Table 3, this inequality is met when

$$13(a - 1)^2 + 350(a - 1)\Delta - (2075 + 3200R)\Delta^2 > 0.$$  (A.9)

The inequality (A.9) corresponds to (A.8) when $R = 0$, as only the world market matters in this case and domestic and international mergers have the same effects in this market. In the opposite extreme where $R \rightarrow \infty$, the critical value for which the RHS in (A.9) turns zero is $\approx 0.06(a - 1)$. Since this is still above the cost reductions for which the distinction between $\hat{\Delta}^I$ and $\tilde{\Delta}^I$ matters, $\hat{\Delta}^I < \tilde{\Delta}^I$ is true throughout the relevant parameter range in Figure 5.
References


