Private and public incentives for mergers in the face of foreign entry

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May 2006

Abstract

This paper considers the private and public incentives for firms to merge in the face of foreign entry. We set up a standard linear Cournot model of competition within a country and consider the gains to two merging firms and to national welfare in a series of scenarios: homogeneous and heterogeneous firms with and without synergies from mergers. We look first at optimal domestic firm numbers from a social welfare perspective and then consider private and social incentives for mergers. With heterogeneous firms and when synergies can occur, greater foreign entry tends to enhance both private and public incentives for domestic mergers. These results suggest that policymakers have no cause to doubt the intentions of firms seeking to merge: when it is in the firms' interests then it is also in the public interest. However, we also show that, at least for certain parameterisations, private gains from merger become positive at a lower level of foreign entry than do public gains. This suggests that private firms may have an incentive to overstate the degree of foreign competition they anticipate facing – for example, after liberalising foreign investment rules – to persuade policymakers that a proposed domestic merger is in the national interest.

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1. Introduction

In the run-up to – and immediate aftermath of – China's accession to the WTO a number of high profile mergers were proposed and undertaken in China. For example, consider the merger of the Yi Bai and Hua Lian retail companies and their associates to form the Bai Lian Group; the formation of the China Media Group in 2001; the formation of the Shanghai Media Group in the same year; and 2005's steel corporation mergers to form the Anben Steel Group. In commentary on the first of these, Prof. Deming Lu observed, "Once the [domestic retail] market is fully opened [under China's WTO accession terms] foreign capital is going to 'attack' and China is going to face international competition. Today's merger and expansion is to prepare for building our own commercial 'aircraft carriers.'" (Cited in Zheng (2004) and translated by Ryan Fang.) And Prof. Min Hua comments, "[t]his kind of concentration will help to improve the competitiveness of domestic firms…[t]his is not an attempt for monopolising…[i]n contrast to facing no competition, the new entity will face the challenge by much stronger foreign players." (Also cited in Zheng (2004) and translated by Ryan Fang.)

Behind these mergers is government encouragement. Since May 2003, the State Assets Supervision and Administration Commission (SASAC) has reduced the number of "Central Enterprises" (companies under direct control by the central government), through merger arrangements, from 196 to today's 169, with the stated goal to further reduce that number to something between 30 and 50 (Chen, 2005.) These mergers are

part of China's latest efforts to restructure the problematic SOE's, but with a new emphasis on preparing them for increasing exposure to foreign competition.

It is not only the large SOE's that are undertaking mergers and nor are mergers forced upon firms by the government. Similar initiatives have been proposed and implemented by enterprises with diverse scales as well as ownership status, and across industries including media, publishing, information technology, utilities, infrastructure, automobiles, brewing, beverages and more. The individual causes for such initiatives may differ in many ways, but they seem to be generally motivated by China's admission to the WTO and the fact that Chinese domestic markets will be opened up to foreign capital in the near future.

This raises a question about the consequences of trade liberalization for competition policies. The links between trade and competition policy are widely recognized by economists, and many are concerned that following trade liberalization countries may adopt too slack a competition policy in substitution for trade protection. However, Richardson (1999) and Horn and Levinsohn (2001) demonstrate that, in fact, trade liberalization may lead countries to adopt too *strict* a competition policy. Furthermore, by allowing governments' objective functions to vary, Richardson (1999) shows that this is true even when governments do not care about consumers. But Chinese experience seems to run counter to this, so how can we reconcile the prediction of a stricter competition policy pursuant to trade liberalization and the observed wave of mergers in China following its admission by WTO?

It seems to be perceived by the Chinese that domestic firms (often referred to as

the “lamb”), with far smaller capitalization and less sophisticated technology and management expertise, will not be able to survive intense competition with foreign players (the “wolves”). The recent mergers of Chinese firms are thus efforts to improve their chances of survival by somehow strengthening their competitiveness. While there is a number of channels through which such strengthening might occur, one that captures this in a handy short-hand is the idea that mergers create synergies; in particular, lower marginal costs.

But why should such beneficial mergers be triggered by trade liberalization – why not reap the benefits of synergistic merger whatever the level of foreign competition? In fact, the Chinese government has been trying to restructure its problematic SOE’s for decades, so why was merger not a choice before China’s admission to the WTO? Is it now more urgent to restructure the SOE’s as they are expecting foreign competition? If that is the case, what does this imply about the effects of foreign competition on the profitability of such mergers? Moreover, mergers are not only observed amongst the large SOE’s, but also among smaller and private firms. So, why are mergers suddenly so popular? Does prospective foreign competition somehow make mergers of all scales more beneficial to the participating firms as well as to society as a whole? In an attempt to answer these questions, this paper studies both the public and private incentives in horizontal mergers in an open economy context.

There is a rich literature in industrial organization on horizontal mergers. Salant et al. (1983) show that, in the absence of fixed costs, mergers amongst identical firms will not be profitable to the participants unless they result in a significantly more

concentrated market. For example, mergers between two firms will not be profitable except if they start as a duopoly. Lahiri and Ono (1988) allow firms to differ in their technologies, and claim that closing down a firm with a sufficiently low market share will improve national welfare, since part of that firm's output will in the new equilibrium be produced by more efficient firms and hence produce an efficiency gain. Despite the author's main focus on the effects of trade liberalization, Falvey (1998) studies mergers involving firms with different technologies and outlines conditions for such mergers to be profitable. The author also considers mergers involve firms with different nationalities, which will not be discussed in the present paper.

These papers all model mergers as involving no effects other than changing the market structure. They do not recognize potential synergies that might be produced by the merger, which will reduce the marginal cost of the resulting new entity. By contrast, Perry and Porter (1985) suppose firms' marginal costs depend on their possessed quantity of a tangible asset, the supply of which is fixed to the industry. Mergers then concentrate firms' possession of this asset, and hence reduce the new entity's marginal cost. Farrell and Shapiro (1990) use an equilibrium model which generalizes and extends some of the ideas in the literature on merger evaluation by adopting general functional forms while imposing no restrictions on the type and level of synergies associated with a merger. They then evaluate mergers by breaking them down into infinitesimal mergers and examining their effects on non-participating firms and consumers. Finally, Barros and Cabral (1994) generalize this model to open economies.

In this paper, we perform the analysis of mergers with a new focus on a particular comparative static effect, namely how changes in the level of competition affect both public and private incentives in horizontal mergers. In order to relate this to the Chinese example, we model the changes in competition as caused by foreign firms entering the domestic market, and then examine the effects of a change in the level of foreign entry on the profitability of a merger between two domestic firms both to the participants and to national economic welfare. Foreign entry is modeled exogenously, and we do not specify the trade policy changes that cause the changes in the level of entry or foreign entry in the first place.

The next section of the paper examines the effect of changes in the level of foreign entry on the socially optimal number of domestic firms and explores some of the intuition that will underpin our later analyses of mergers. To analyse asymmetries in a manageable way, we then introduce the "quantity equivalence" function in Section 3, which allows us to analyze the heterogeneous cost equilibrium as if firms have the same marginal cost. Section 4 then analyses public and private incentives in a merger involving two domestic firms. We consider both non-synergistic and synergistic mergers and show that an increase in the level of foreign entry will discourage non-synergistic mergers in general, but encourage mergers that create synergies. We conclude with some proposals for further work.

2. Socially Optimal Number of Domestic Firms with Foreign Entry

Suppose, initially, that there are only domestic firms. Consider a homogenous good market with an inverse demand function given by: $p(Q) = a - bQ$ where *a* and *b* are positive constants and Q is market (aggregate) output. There are *n* domestic firms $i = 1,2,\ldots n$, each with a cost function $C_i(q_i) = F + cq_i$, where q_i is firm *i*'s output, *c* is the constant marginal cost facing all firms and *F* accounts for each firm's fixed costs. Note that *F* is assumed to be fixed operation costs per period, which will be incurred and become sunk should the firm decide to operate, but can be salvaged should the firm choose to close down at the beginning of the period. Given this set up, firms play Cournot, choosing their output levels to maximize profits, given their beliefs about the outputs of other firms. Solving the firm's problem yields the familiar Nash equilibrium output of each firm:

$$q_i = \frac{a-c}{b(n+1)} \tag{1}$$

As this is declining in *n* so each firm's output falls as the number of firms in the market increases. This represents what has been termed the business stealing effect.

Equilibrium market supply and price are given by:

$$Q = \frac{n(a-c)}{b(n+1)} \quad \text{and} \quad p(Q) = \frac{a+nc}{n+1} \tag{2}$$

Thus firm *i*'s profit and aggregate domestic profits in equilibrium are, respectively:

$$\pi_i = \frac{(a-c)^2}{b(n+1)^2} - F \quad \text{and} \quad \Pi = \frac{n(a-c)^2}{b(n+1)^2} - nF \tag{3}$$

Consumer surplus is:

$$CS = \frac{n^2(a-c)^2}{2b(n+1)^2} \tag{4}$$

Then a partial equilibrium measure of domestic welfare is given by:

$$W = \Pi + CS = \frac{(a-c)^2}{2b(n+1)^2} \cdot (n^2 + 2n) - nF \tag{5}$$

To find the socially optimal number of domestic firms, we ignore the integer constraint and differentiate W with respect to n.[1] Solving $\partial W/\partial n=0$ for the socially optimal number of domestic firms $\tilde{n}$, we have:

$$\tilde{n} = \sqrt[3]{\frac{(a-c)^2}{bF}} - 1 \tag{6}$$

We assume throughout that a, b and c are finite with $a>c$. Therefore, a sufficient condition for $\tilde{n}$ to be finite is that the fixed cost F is positive.

Following Mankiw and Whinston (1986), if free entry leads to zero profit then $F>0$ guarantees that $\tilde{n}$ lies strictly below the free entry number of firms. The intuition behind this result is obvious, but it helps later analysis of more complex set-ups to discuss it in a bit more detail. When a firm enters the market, the total welfare change can be divided into two components: a net welfare gain due to the increased aggregate output, and a welfare loss equal to the fixed operational costs the entrant incurs. The net welfare gain can be further broken down to three parts: the loss to the incumbent firms' profits due to the business stealing effect and the fall in market price, the gain in consumer surplus, and the gain in aggregate profits equal to the entrant's gross profit (i.e. profit before deducting fixed costs). Clearly, the part of

[1] Note that this analysis is not the same as our subsequent analysis of mergers: in choosing the number of firms here we are also choosing the number of fixed costs incurred, whereas when two firms merge the gains may or may not involve saving fixed costs. This is elaborated more completely in section Four of the paper.

the incumbents' lost profit that is due to the fall in market price is fully transferred to the gain in consumer surplus. In contrast, while in this setting the business stealing effect merely transfers the incumbents' profits to the entrant, this is not necessarily always the case.

We will analyze these complications in later sections but, for now, we can conclude that the net welfare gain is simply the net social benefit (valuation minus costs) from the net increase in aggregate output. The government's cost-benefit analysis then simply involves comparing this gain to *F*. If the fixed costs outweigh the net welfare gain, the new entrant should not be allowed to operate in this market.

Intuitively, market supply, *Q*, is concave in *n*: as more firms enter, the increment to market supply becomes smaller as does the social welfare gain associated with each unit of increased market supply. Finally, the socially optimal number of domestic firms is greater the lower are marginal costs:

$$\frac{\partial \tilde{n}}{\partial c} = -\frac{2}{3}\sqrt[3]{\frac{1}{bF(a-c)}} < 0 \tag{7}$$

Now suppose that, in addition to the *n* domestic firms, we introduce *n** foreign firms into the domestic market. All firms are assumed to still have the same cost function – $C_i(q_i) = F + cq_i$ – and they still play Cournot. Repeating the exercise just conducted[2] and solving for the socially optimal number of domestic firms $\tilde{n}$ now gives:

$$\tilde{n} = \sqrt[3]{\frac{(2n^*+1)(a-c)^2}{bF}} - n^* - 1 \tag{8}$$

[2] These calculations – and all others omitted in the text – are available in a Technical Appendix available from the authors on request.

To see how $\tilde{n}$ changes with n^*:

$$\frac{\partial \tilde{n}}{\partial n^*} = \frac{2}{3}\sqrt[3]{\frac{(a-c)^2}{bF(2n^*+1)^2}} - 1 \tag{9}$$

When there is no foreign entry (i.e. $n^*=0$), $\tilde{n}$ is given by $\tilde{n}_0$:

$$\tilde{n}\big|_{n^*=0} \equiv \tilde{n}_0 = \sqrt[3]{\frac{(a-c)^2}{bF}} - 1 \tag{8a}$$

Thus we can rewrite $\frac{\partial \tilde{n}}{\partial n^*}$ as:

$$\frac{\partial \tilde{n}}{\partial n^*} = \frac{2}{3}(\tilde{n}_0 + 1)(2n^*+1)^{-\frac{2}{3}} - 1 \tag{9a}$$

So $\frac{\partial \tilde{n}}{\partial n^*}\big|_{n^*=0} > 0$ iff $\tilde{n}_0 > \frac{1}{2}$. Recognizing the integer constraint on firm numbers:

Proposition 2.1: A little foreign entry will always increase the socially optimal number of domestic firms, i.e. $\frac{\partial \tilde{n}}{\partial n^*}\big|_{n^*=0} > 0$.

If we were able to choose the number of foreign firms, setting (9a) equal to zero gives the number of foreign firms, call it $\hat{n}^*$, at which the optimal number of domestic firms is maximized. Expressed in terms of $\tilde{n}_0$:

$$\hat{n}^* = \frac{1}{2}\left(\left[\frac{2}{3}(\tilde{n}_0 + 1)\right]^{\frac{3}{2}} - 1\right) \tag{10}$$

Note that $\hat{n}^* > 0$ iff $\tilde{n}_0 > \frac{1}{2}$. Substituting this back into our expression for $\tilde{n}$, we have the maximum of the socially optimal number of domestic firms, denoted $\bar{n}$:

$$\bar{n} = \left[\frac{2}{3}(\tilde{n}_0 + 1)\right]^{\frac{3}{2}} - \frac{1}{2} \tag{11}$$

It is obvious that both $\hat{n}^*$ and $\bar{n}$ are increasing functions of $\tilde{n}_0$ and, noting that $\tilde{n}_0$ is a decreasing function of c, so $\hat{n}^*$ and $\bar{n}$ are also decreasing functions of c. As $\tilde{n}$

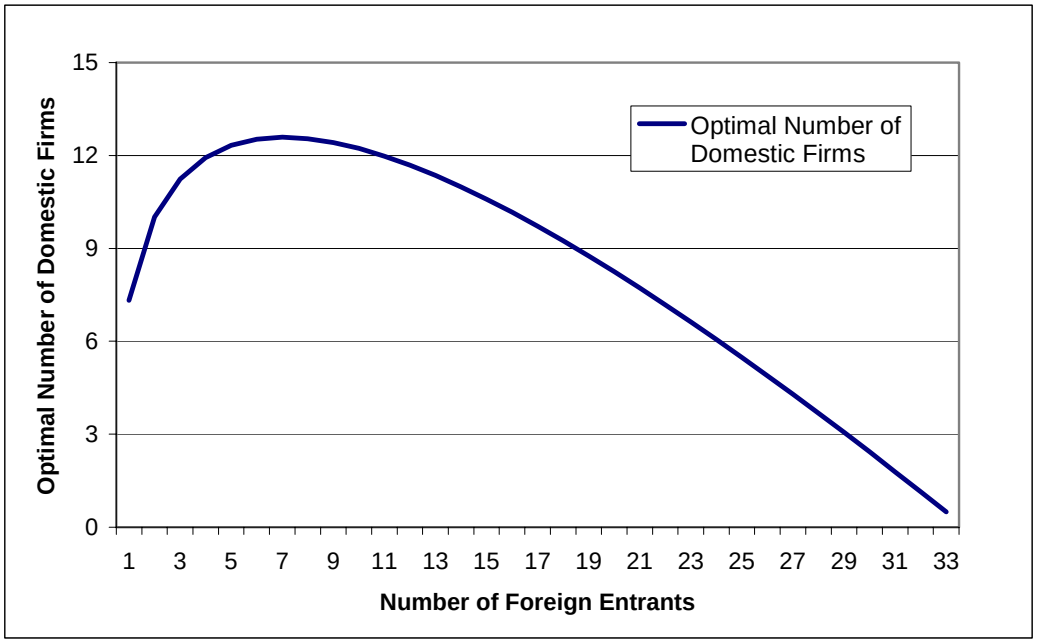
is strictly concave in n^* so it is single-peaked. In summary:

Proposition 2.2: There exists a critical level of foreign entry $\hat{n}^* > 0$ ***such that, at*** $n^* = \hat{n}^*$***, the socially optimal number of domestic firms reaches its maximum*** $\bar{n}$***. Both*** $\hat{n}^*$ ***and*** $\bar{n}$ ***rise if domestic firms have lower marginal costs. For any number of domestic firms that is less than the socially optimal number when there is no foreign entry, i.e.*** $n < \tilde{n}_0$***, there exists a critical level of foreign entry*** $n^* = \bar{n}^*$***, such that greater foreign entry is sufficient to render*** n ***socially excessive, i.e.*** $\tilde{n}(n^*) \le n$ ***for all*** $n^* \ge \bar{n}^*$***.***

Proposition 2.2 implies that, given a sufficiently large number of foreign entrants, it will become profitable for the government to close down or merge domestic firms, even though it would not be profitable to do so without foreign entry.

To see the intuition behind these results, recall that when a domestic firm enters the market, it causes a net welfare gain due to the increased aggregate output, and a welfare loss equal to the fixed operational costs the entrant incurs. When there are foreign firms in the domestic market, the net welfare gain per unit of the domestic entrant's output becomes larger: since the government only cares about domestic aggregate profit, only part of the loss to the incumbent firms' profits is taken into account by the government. Effectively, the entry of a domestic firm transfers some of foreign firms' profits to consumer surplus and domestic aggregate profits.

Figure 1: The Socially Optimal Number of Domestic Firms



The net welfare gain is brought about by the expansion of aggregate output and the business stealing by the new entrant from the foreign firms, and is therefore positively related to the output level of the new entrant. With more and more foreign firms entering the market, each incumbent's output level is reduced by this foreign business stealing effect and so is the prospective entrant's output. Therefore, while the entry of foreign firms increases the net welfare gain per unit of domestic entrant's output, it also reduces the domestic entrant's output level which is the very basis of that welfare gain. At some level of foreign entry, the latter effect becomes dominant, and the net welfare gain decreases as foreign entry increases. Eventually, at $\hat{n}^*$, the socially optimal number of domestic firms starts to decrease as foreign entry increases and, as the net welfare gain keeps shrinking, the optimal number of domestic firms also keeps falling until it reaches zero. A numerical illustration of the relationship between the socially

optimal number of domestic firms and the level of foreign entry is given in Figure 1.[3]

3. Introducing Heterogeneity amongst Firms

Section 2 provides some intuition for the impacts foreign entry has on the net social benefit associated with adding (or removing) one domestic firm into the market and demonstrates that, at high enough levels of foreign entry, it will become profitable for the government to close down or merge domestic firms. However, the results in Section 2 are derived in a very simplified setting. In particular, firms are homogeneous and by closing firms down their fixed costs are salvaged. In our later analyses, we allow mergers to provide different levels (and kinds) of cost savings and firms to differ in their efficiency levels. But introducing heterogeneity into our Cournot model means losing symmetry, which makes firms' equilibrium outputs and market supply difficult to calculate. For example, if there are *k* types of firms in the market, calculating any type's equilibrium output means solving *k* optimisation problems simultaneously. In order to manage this, we develop the Quantity Equivalence function.

Suppose now, in the same linear demand Cournot model, firms still have the same form of cost function, $C_i(q_i) = F + c_i q_i$, but c_i now depends on the firm's type. Let there be K types of firms, each with a marginal cost that is different from that of the

[3] Parameter values for all numerical illustrations are reported in the Appendix.

other types. There are n_k type k firms in the market and each has marginal cost c_k, where $k = 1,2,3,\ldots,K$.

We now define the "quantity equivalence" of *i* in terms of *j*, E_j^i, as the ratio of type *i* firm's equilibrium output to type *j* firm's equilibrium output, i.e. one type *i* firm's output is equal to the sum of E_j^i type *j* firms' outputs.

Supposing there are only these two types of firms in the market and supposing that $c_i < c_j$, we can solve for the Nash equilibrium outputs in the usual way:

$$q_i = \frac{a + n_j c_j - (n_j + 1)c_i}{b(n_i + n_j + 1)}$$
$$q_j = \frac{a + n_i c_i - (n_i + 1)c_j}{b(n_i + n_j + 1)} \qquad (12)$$

Thus $q_i = \mathrm{E}_j^i q_j$ and $q_j = \mathrm{E}_i^j q_i$ where

$E_j^i = \frac{a + n_j c_j - (n_j + 1)c_i}{a + n_i c_i - (n_i + 1)c_j}$, $E_i^j = \frac{1}{E_j^i}$ and clearly $\mathrm{E}_i^j < 1 < \mathrm{E}_j^i$.

Note that the quantity equivalence is defined over different types of firms' *equilibrium* outputs and, therefore, varies as market conditions change. Clearly it is a function of all the variables that define Cournot equilibrium.

Now, in Cournot, firms maximize their profits by choosing their outputs given their beliefs about the outputs of all other firms. So, if each firm believes that each type *j* firm will produce as much output as E_i^j type *i* firms, having n_j type *j* firms in the market is the same for them as having $n_j E_i^j$ more type *i* firms. Therefore, we can rewrite a type *i* firm's equilibrium output as:

$$q_i = \frac{a - c_i}{b(n_i + n_j E_i^j + 1)}$$

Thus the quantity equivalence function allows us to "convert" other types of firms into

one particular type and hence to write algebraic expressions for each type's equilibrium output and the aggregate market variables. Now, actually solving for the value of the quantity equivalence ratio would not be any simpler than solving each type's equilibrium output directly. However, examining some properties of the quantity equivalence function provides information about different types of firms' relative sizes in equilibrium, which will allow us to infer the profitability of mergers.

A more thorough introduction and discussion of the quantity equivalence is provided in the Appendix, where we extend the quantity equivalence to accommodate many types of firms and derive a number of properties of this function. We report these properties here in the two lemmas below:

Lemma 3.1: In a homogenous good market with linear inverse demand curves, where there are many types of firms playing Cournot and each type of firm has a constant marginal cost that is different from others, the ratio of a low cost firm's output to a high cost firm's output is always greater than one. This ratio increases if: more firms enter the market; or the difference between the two types of firms' marginal costs increases holding one of the marginal costs constant; or both types' marginal costs increase holding their difference constant.

Lemma 3.2: For any i and j, the "aggregate quantity equivalence to type i firms", $\Sigma_i = \sum_{k=1}^{K} n_k E_i^k$ ***, is equal to the market supply divided by the equilibrium output of the type i firms, and its derivative with respect to the number of type j firms is given by:***

$$\frac{d\left(\sum_{k=1}^{K} n_k E_i^k\right)}{dn_j} = \left(\sum_{k=1}^{K} n_k E_i^k + 1\right)\frac{E_i^j}{\sum_k n_k + 1}.$$

4: Horizontal Mergers and Foreign Entry

We turn now to study the profitability of horizontal mergers, to both the participating firms (private incentives for merger) and society as a whole (public incentives for merger) and how they change as we introduce different levels of foreign entry. While we allow firms' marginal costs to differ, for simplicity we keep the assumption that all firms in the market incur equal fixed operation costs. So we still have the generic form of firms' cost functions, $C_i(q_i) = F + c_i q_i$.

In contrast to the previous analysis, we categorize mergers based on the opportunities of cost savings they generate. Non-synergistic mergers are those in which the new entity created incurs fixed costs equal to the sum of all of the participants' fixed costs and can choose to adopt the technology of the most efficient firm among the participants. Using subscript *M* to denote the new post-merger entity, *m* the number of firms merging, and *P* the set of merger participants, this means $C_M(q_M) = F_M + c_M q_M$, $F_M = \sum_{i \in P} F_i = mF$ and $c_M \geq \min_{\{i \in P\}}(c_i)$.

Synergistic mergers are those in which the new entity created *either* incurs fixed costs less than the sum of all of the participants' fixed costs, *or* can produce at a marginal cost that is lower than that of the most efficient participant, *or* both. That is,

$C_M(q_M) = F_M + c_M q_M$, $F_M < \sum_{i \in P} F_i = mF$ and/or $c_M < \min_{i \in P}(c_i)$. We call mergers that provide savings in fixed costs only "weakly synergistic" and mergers that improve firms' production technology "strongly synergistic".

It is beyond the scope of this paper to explore or discuss the actual existence or cause of any type of cost savings associated with mergers. So, for any particular type of merger, the nature of the cost savings it provides is exogenously assumed. We study the private and public incentives in these categories of mergers respectively, and show how different levels of foreign entry will affect such incentives. Throughout, we assume that firms have an incentive (private incentives) to merge if mergers provide gains in their profits and the government has an incentive (public incentives) to approve a merger if it enhances domestic welfare. Our main interest is to see whether foreign entry is going to "encourage" or "discourage" any particular type of merger i.e. create or remove both private and public incentives for such mergers.

4.1: Non-synergistic mergers

Suppose there are K types of firms and each has a marginal cost that is different from the other types, but incurs fixed operation costs that are the same as all other firms. There are n_k type k firms in the market and each has marginal cost c_k, where $k = 1,2,3,\ldots,K$. In a non-synergistic merger, the cost function of the post-merger firm is $C_M(q_M) = F_M + c_M q_M$ and $F_M = \sum_{i \in P} F_i = mF$ and we will only analyze mergers involving two participants, so *m* will always be equal to two.[4]

[4] Mergers that involve *n>2* participants and do not create synergies can be viewed as *n-1* two-firm mergers. If the merger is synergistic, it is equivalent to *n-2* non-synergistic two-firm mergers, and one synergistic one that creates

First, we look at the private incentives for such mergers. In a non-synergistic merger, effectively, the less efficient firm is closed down while the remaining participant incurs both the firms' fixed costs. Clearly, the merger will be profitable to the participants if the new entity's post-merger gross profit, defined as total revenue minus total variable costs, is higher than the sum of the participants' pre-merger gross profits. Let the two participants be of type 1 and type 2 where firm 1 is no less efficient than 2. Formally, letting subscripts denote firm types and superscripts denote pre- (0) or post-merger (1) equilibria, the private gains from the merger are given by: $G_p = \pi_1^1 - \pi_1^0 - \pi_2^0$. So we will examine, in particular, how the sign of G_p changes as we introduce different levels of foreign entry.

In our Cournot model, if one firm is removed from the market, the reverse of the business stealing effect will increase each of the remaining firms' outputs while reducing market supply and pushing the market price up. So in our non-synergistic merger, upon the closure of the less efficient firm (firm 2), the remaining participant (firm 1) will produce a larger output and enjoy a higher price than before the merger takes place. We can then identify two main sources of (gross private) gains in this merger: firm 1's pre-merger output is now sold at a higher price; and, in the presence of a higher price, the output of firm 1 is expanded. These (gross) gains are earned at the cost of firm 2's pre-merger profit that is given up. The magnitudes of both the increases in firm 1's output and the market price will depend on two factors: firm 2's

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the same amount of synergies. The net gains or losses from a multi-firm merger will hence be the sum of the gains and losses from all the "sub-mergers". In this paper, however, we will concentrate on the basic two-participant cases.

pre-merger output and the number of non-participating firms in the market. As noted by Falvey (1998), in Cournot with linear demand and constant marginal costs, if one firm is removed from the equilibrium, each remaining firm's output will increase – and the aggregate market supply will decrease – by the level of the departing firm's output divided by the number of firms existing in the initial equilibrium. Therefore, given the participants' pre-merger output levels, the more non-participants there are in the market, the less firm 1's output and market price will increase in the post-merger equilibrium, and hence the smaller will be the profit gains to the participants. However, an increase in the number of non-participants in the market will lower the market price as well as outputs by the participants in the pre-merger equilibrium, which will decrease both the (gross private) gains and the cost associated with the merger. Therefore, as we increase the number of non-participants both the (gross) gains and the cost will decrease, and the changes of the sign of the net private gains from the merger, G_p, will depend on the rates at which the gross gains and cost decrease respectively.

Using the quantity equivalence function, we can write G_p as:[5]

$$G_p = \frac{q_2^0}{\sum_k n_k}\left[(c_2 - c_1) - (a - c_2)\cdot\frac{\sum_k n_k - 1 - E_2^1 - \frac{1}{\sum_k n_k}}{\sum_k n_k E_2^k + 1}\right] \tag{14}$$

where $\sum_k n_k$ is the total number of firms in the market, and $\sum_k n_k E_2^k$ the aggregate quantity equivalence to type 2 firms. Note that $\frac{q_2^0}{\sum_k n_k}$ is always non-negative so the

[5] Derivations are relegated to the appendix.

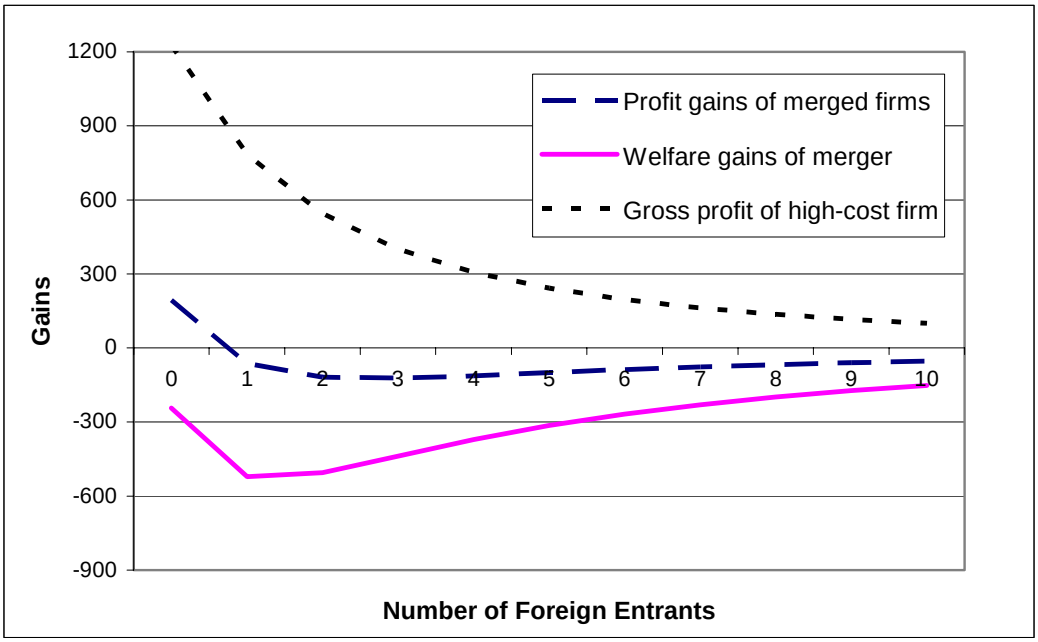
sign of G_p is determined by the term in the square brackets of (14). When there are no non-participants in the market, i.e. the merger involves two firms forming a monopoly, the merger is always profitable: $\sum_k n_k = 2$ and $E^1{}_2 \geq 1$, as firm 1 is (weakly) more efficient than firm 2, so the ratio term in the square brackets is negative and the whole thing must be positive. But as the number of non-participants increases, firm 2's pre-merger output approaches zero, as do the net gains from the merger. If there are other non-participants in the market then the sign of the net gains from the merger, G_p, depends on both firm 2's absolute level of efficiency (hence the size of the $(a - c_2)$ term) as well as its level of efficiency *relative to the other firms* (hence the size of the $(c_2 - c_1)$ term and the quantity equivalence ratios E_2^k.)

Calculating out these effects we find that, as long as firm 2 is not too inefficient so that it can survive entry (i.e. a low level of entry will not drive its output to zero)[6], G_p will become – or remain – negative and then approach zero as we increase the number of non-participant (either domestic or foreign) firms in the market, within the relevant range (i.e. so long as firms are not making losses). As we keep introducing non-participants, firm 2's pre-merger output will fall to zero, and as it approaches zero, G_p will become positive.[7]

[6] Otherwise merging the firms in the face of foreign entry will just mean closing down a firm that does not produce, which is obviously trivial in our analysis.

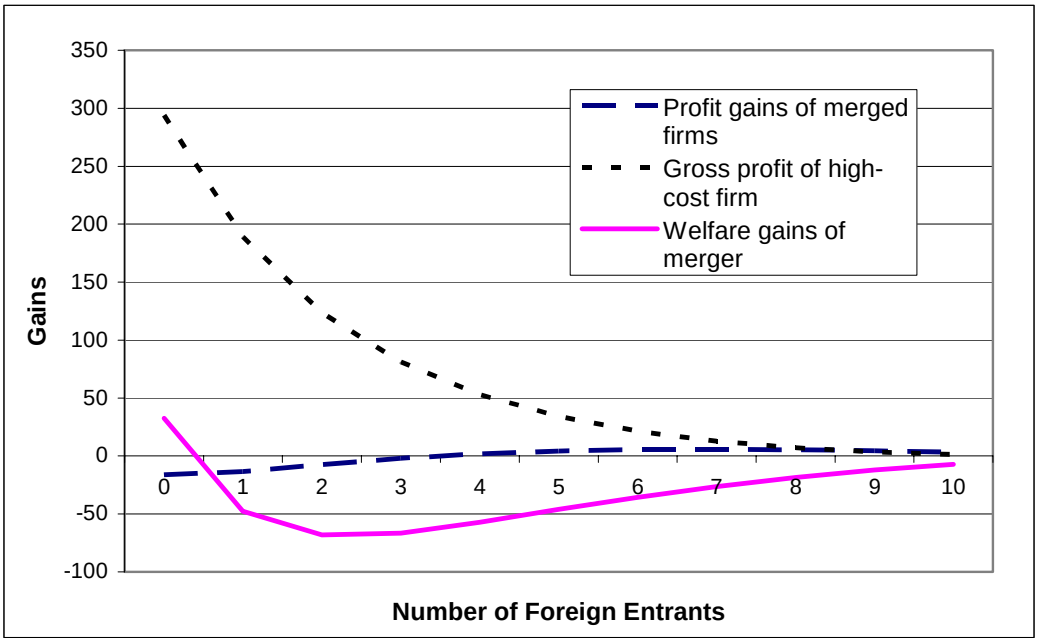
[7] In our Cournot model, output close to zero corresponds to gross profit close to zero (i.e. not including fixed costs). Therefore, with non-trivial fixed costs, firm 2 would be making losses in the pre-merger equilibrium, which suggests that this level of entry has fallen out of the relevant range. Nevertheless, we note this case as a technical possibility.

Figure 2: Non-Synergistic Merger Configuration 1



Note that we have firms of different efficiencies here, so a non-synergistic merger may be privately profitable, in contrast to the results of Salant et al (1983), even if it is not to monopoly. Numerical illustrations of different cases are given in Figures 2 and 3 with different parameterisations, where we also show the gross profitability of a high-cost firm: from this one can infer the level of foreign entry that would lead the high-cost firm to shut down for any particular level of fixed costs. Figure 2 depicts the general case where foreign entry renders the merger unprofitable and the gains from a merger approach zero from below as we increase foreign entry within the relevant range. Figure 3 illustrates the technically possible case (if we have small enough fixed costs) where sufficient foreign entry renders the merger profitable as firm 2's pre-merger output approaches zero.

Figure 3: Non-synergistic Merger Configuration 2



Note, too, that this analysis tells us that for a merger to be privately profitable it must provide some form of cost savings, with the only exception being where the merger creates a monopoly. If there are no cost savings from the merger then $c_1 = c_2$ in expression (14) so, by our earlier reasoning, G_p must be negative if $\sum_k n_k > 2$. That is, we have the result of Salant *et al* (1983) without requiring that non-participants in a merger have equal costs.

We now turn to the public incentives for non-synergistic mergers. The merger is profitable to the public if it increases social welfare, so the net social gain from mergers is given by: $G_s = W^1 - W^0 = CS^1 - CS^0 + \Pi^1 - \Pi^0$.

As established earlier, in a non-synergistic merger one domestic firm (firm 2) will be closed down, which will increase each of the remaining firms' outputs but decrease the total market supply (by the same amount, in this particular model). So consumer surplus must fall after the merger, while all the remaining firms will enjoy a profit gain

(without counting the loss of firm 2's pre-merger profit to the participants).

Using the quantity equivalence function, we can write the net social gain from a non-synergistic merger as:

$$G_s = \frac{q_2^0}{\sum_k n_k}\left[\sum_{k\neq f}(c_2 - c_k)\cdot n_k - (a - c_2)\cdot \frac{n_f E_2^f + n_f + \frac{n_f + 1}{2\sum_k n_k} + 1}{\sum_k n_k E_2^k + 1}\right] \tag{15}$$

Clearly, in contrast to the case for private incentives, nationalities of non-participants do matter here. We assume there is only one type of foreign firm, type *f*, hence changes in the level of foreign entry are represented by changes in n_f. This is for simplicity only and will not affect the analysis: as far as the net domestic welfare gain from the merger is concerned, only the number of foreign entrants and their joint output matter. We can interpret c_f as the average marginal cost of foreign firms, which reflects the average "size" of the foreign firms.

First, we examine the profitability of non-synergistic mergers to the society as a whole when there are no foreign firms in the market. Lahiri and Ono (1988) suggest that, under Cournot oligopoly, removing a firm with a sufficiently low market share is welfare improving. We shall see that this is somewhat misleading. Without foreign entry, G_s becomes:

$$G_s = \frac{q_2^0}{\sum_k n_k}\left[\sum_{k\neq f}(c_2 - c_k)\cdot n_k - (a - c_2)\cdot \frac{2\sum_k n_k + 1}{2\sum_k n_k\left(\sum_k n_k E_2^k + 1\right)}\right] \tag{16}$$

Clearly, if all domestic firms are of type 2, then the merger will always reduce domestic welfare, even when there are many firms in the pre-merger equilibrium and

firm 2's market share is very small. From the expression above, we need $\sum_{k \neq f} (c_2 - c_k) \cdot n_k$ to be large for the merger to be welfare improving. In other words, we need enough non-participants that are significantly more efficient than firm 2: we need firm 2's pre-merger market share to be both absolutely small – closing it down will not then cause activity to fall by too much – and relatively small, so that there is enough efficiency gain to offset the loss due to the fall in activity. A more accurate qualification of the conditions for the closure of firm 2 to be welfare improving, then, is that the average quantity equivalence to a type 2 firm be higher than some threshold defined as a function of the total number of firms in the market, where the threshold will fall as the total number of firms increases, i.e. $\frac{\sum_k n_k E_2^k}{\sum_k n_k} > f\left(\sum_k n_k\right)$ and $f' < 0$.

To determine the effects of changes in the level of foreign entry on the sign of the net social gain from non-synergistic mergers, G_s, again we require that firm 2 can survive foreign entry. Increasing the level of foreign entry will then cause G_s to become negative, even if it was initially positive and it will approach zero from below as we keep increasing foreign entry and firm 2's output falls to zero[8]. Therefore, for any level of foreign entry that is high enough to render G_s negative, G_s will stay non-positive, although it decreases in absolute value as firm 2's pre-merger output falls. Essentially, as foreign entry increases more of the profit of the shut-down domestic firm accrues to them (a bad thing) but that profit is smaller anyway as n^* rises.

So, in general, G_s will be negative initially (or will become negative as we increase

[8] See appendix for a more detailed discussion.

the level of foreign entry) and will then approach zero and initially publicly attractive non-synergistic mergers may become unattractive with foreign entry, but never the converse. (In the possible case where sufficient foreign entry renders a merger privately profitable when firm 2's output approaches zero, mergers will not be approved since they are not publicly profitable.)

Numerical illustrations are given in Figures 2 and 3 where it will be noted that the general shape is the same: a little bit of foreign entry makes the merger unattractive, even if it was initially desirable, but further entry lessens the social loss from the merger.

Proposition 4.1: In a homogenous good market, where firms have potentially different marginal costs and play Cournot, introducing foreign entry will, in general, discourage mergers that are non-synergistic and will never encourage such mergers.

4.2: Synergistic Mergers

We start by looking at weakly synergistic mergers. Essentially, these are the same as non-synergistic mergers, except they also provide some savings in fixed costs to the participants. In terms of the graphs, this is tantamount to shifting the *G* curves up in a parallel fashion. If the fixed cost savings are large enough the merger may always be profitable. Alternatively, with small fixed cost savings, we are back to the non-synergistic mergers case. Accordingly, the net gains from merger will now approach some positive number so low levels of foreign entry *may* remove public and

private incentives for weakly synergistic mergers, if such incentives exist without the entry, but high levels of foreign entry *will* create public and private incentives for weakly synergistic mergers if such incentives do not exist without the entry.

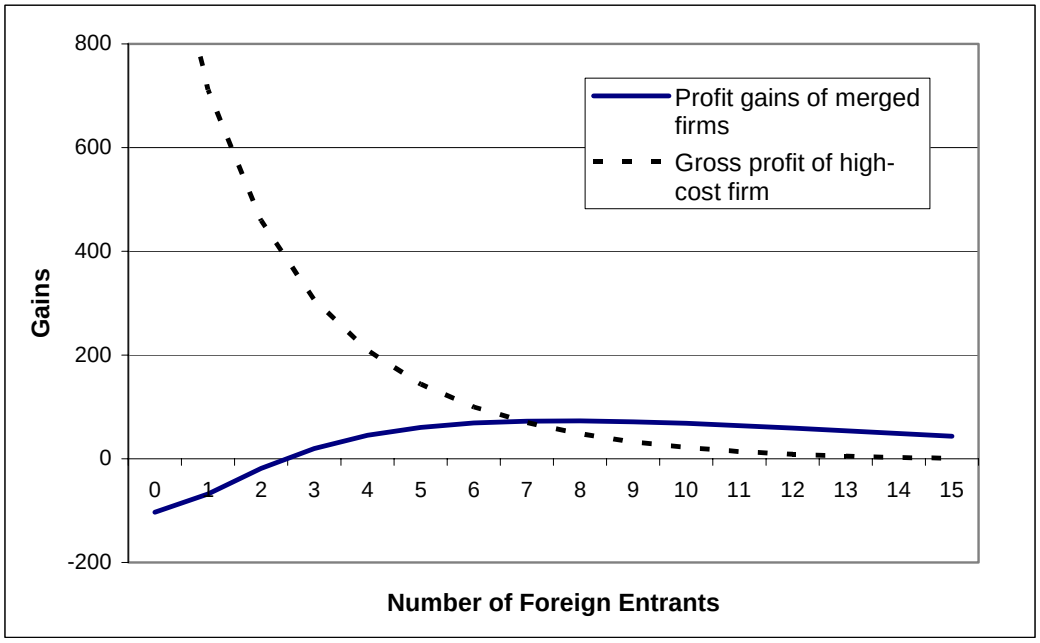
We now turn to strongly synergistic mergers. We will only analyze strongly synergistic mergers that do not provide fixed costs savings, as the effects of adding extra gains from these savings are obvious. First, we look at the private incentives for strongly synergistic mergers. In such a merger, the new entity's marginal cost is lower than that of the more efficient participant. This is equivalent to a two-step process: first, a non-synergistic merger occurs that closes the less efficient participant (firm 2) down; and second, the remaining participant (firm 1) becomes a new entity that is even more efficient. Clearly this second step must be profitable for the participants (see Appendix).

So the net private gain from a strongly synergistic merger equals that of the corresponding non-synergistic merger plus something positive. However, we still need to examine how the net private gains change as we vary the level of foreign entry. The Appendix demonstrates that, for any relevant level of foreign entry that is higher than some threshold level, the net private gain from a strongly synergistic merger is strictly positive. The magnitude of this gain will depend on the level of synergies and the participants' marginal costs. As before, if mergers create large enough synergies, they may be profitable at any level of foreign entry.

So, low levels of foreign entry *may* remove private incentives for strongly synergistic mergers, if such incentives exist without the entry, but high levels of

foreign entry *will always* create private incentives for strongly synergistic mergers, if such incentives do not exist without the entry. A numerical illustration of the net private gains from strongly synergistic mergers is given in Figure 4.

Figure 4: Private Gains from Synergistic Merger



Now consider the effects on public incentives for strongly synergistic mergers of increasing n^*. As in the case for private incentives, a strongly synergistic merger can be decomposed into a two-step process but, unlike in the case of private incentives, the effect of the second step is now not clear: if the lower-cost of the two merging firms is not the lowest-cost firm in the market then a reduction in its costs may be welfare-reducing.[9]

First we recognize that, if we keep increasing the number of firms in the market,

[9] Falvey (1999) argues that the gains from merger are greatest for the lowest-cost firm so we should expect to see such a firm involved in any mergers. This is not clear with synergistic mergers, as the gains from merger depend on the level of synergy which may in turn depend on the participants' identities. However, it is true that given a fixed amount of synergy, the gains from merger are greatest for the lowest-cost firm. Clearly, if the lowest-cost firm is always involved in any merger, the second-step welfare effect will always be positive. However, we discuss the general case for completeness.

the new entity's output in the post-merger equilibrium will become greater than or equal to the sum of the participants' pre-merger outputs. When the new entity's output in the post-merger equilibrium is exactly equal to the sum of the participants' pre-merger outputs, the non-participants' aggregate output as well as the market supply will not be changed by the merger. So consumer surplus and all the non-participating domestic firms' profits stay unchanged after the merger, while the participants' joint profit increases: at this point the net social gains from the merger must be positive.

Given that the new entity is more efficient, we know $q_M^1 > q_1^0$. So the expansion of firm 1's output will reduce all the other firms' outputs and increase the market supply (by $\left(q_M^1 - q_1^0\right) \Big/ \sum_k n_k$.) The welfare effects of this will include a gain due to the increase in market activity, gains from transfers of foreign firms' profits to both domestic consumer surplus and a domestic firm (the new entity), a potential loss due to the business stealing by the new entity from the other domestic firms (which might result in a potential efficiency loss if the new entity is less efficient than the other domestic firms) and, of course, a welfare gain due to the fact that firm 1's output in the old equilibrium is, in the new equilibrium, produced by the new entity at a lower cost.

Clearly, if the level of synergy is 'large', all the gains will become 'large' and the potential efficiency loss will either become 'small' or even turn into an efficiency gain, so the net welfare effect of this process must be positive. In fact, the welfare effect of this second step is eventually strictly increasing in the level of synergy but, if the synergy is small, it may be positive or negative given different market conditions.

Recall that, in general, G_S in a non-synergistic merger will either be negative at

$n^*=0$ or will become negative as n^* rises and will then approach zero as n^* rises further. Here, while the net welfare effect of turning firm 1 into the new entity may be positive or negative at low levels of foreign entry, it must become positive as we increase the level of foreign entry. We show (see Appendix) that when the net social gain from the corresponding non-synergistic merger is positive, the welfare effect of turning the more efficient participant into the new entity may reinforce or offset the gain; however, when the net social gain from the non-synergistic merger is negative, the welfare effect of this second step will, in general, be positive. The sign of the net social gain from a strongly synergistic merger will then depend on the magnitude of this second welfare effect relative to the net social gain from the non-synergistic merger. But this 'second effect' is continuous and increasing in the level of synergy. So, the larger the synergy created by the merger, the more likely the merger will be socially profitable.

Now, the point where the new entity's output in the post-merger equilibrium is equal to the sum of the participants' pre-merger outputs serves as an important reference point. We know that, at this point, the net social gain from the strongly synergistic merger must be positive, and is equal to the gains in the participants' profit obtained from producing the participants' pre-merger outputs at the new entity's marginal cost. If the synergy is really large, then this point will occur at a very low or even negative[10] level of foreign entry and the strongly synergistic merger will always be socially profitable. If, on the other hand, the synergy created is close to zero, then this point will only occur when firm 2's pre-merger output is close to zero, which

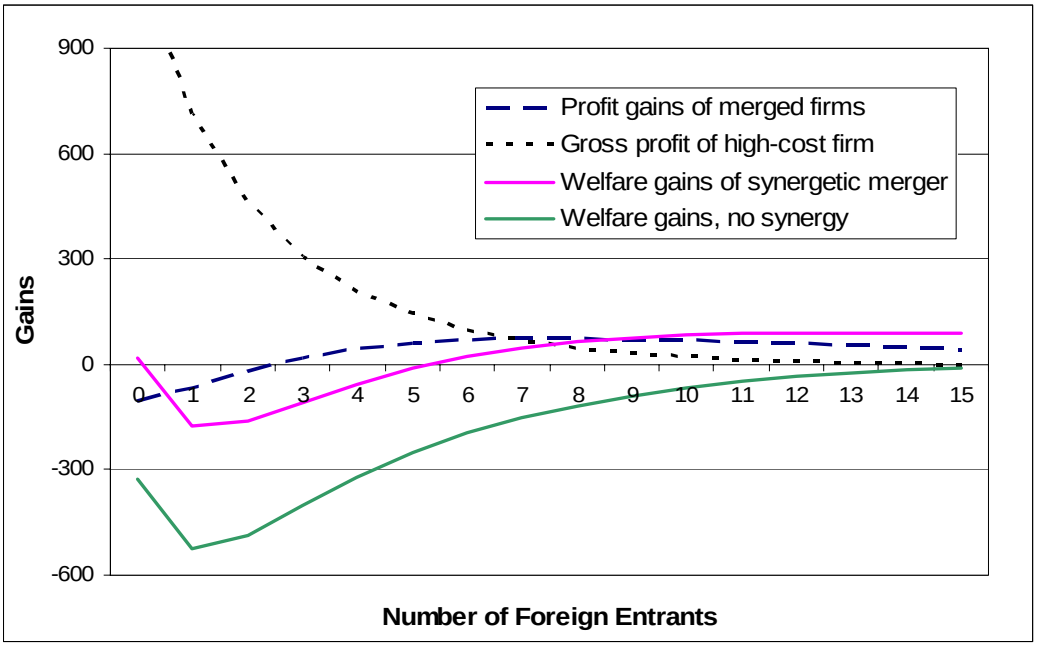
[10] This simply means the new entity's post-merger equilibrium output is strictly larger than the sum of the participants' pre-merger outputs when there is zero foreign entry.

means the net social gain from this strongly synergistic merger will become greater than, but very close to, zero. Having defined the two extreme cases – and given that the net welfare effect is continuous in the level of synergy – we can describe the general behaviour of the net social gain from a strongly synergistic merger when we introduce different levels of foreign entry: it will initially be either positive or negative when there is zero foreign entry and will become negative as we increase foreign entry; however, as n^* increases further, the net social gain will become positive (and significantly greater than zero) and will stay positive over the relevant range of the levels of foreign entry.

So we can again conclude that low levels of foreign entry *may* remove public incentives for strongly synergistic mergers, if such incentives exist without the entry, but high levels of foreign entry *will* create public incentives for strongly synergistic mergers, if such incentives do not exist without the entry.

A numerical illustration of the net social gain from a strongly synergistic merger is given in Figure 5.

Figure 5: Synergistic Merger



We also show the welfare effect of the same merger in the absence of any synergies, in which case it is never desirable.

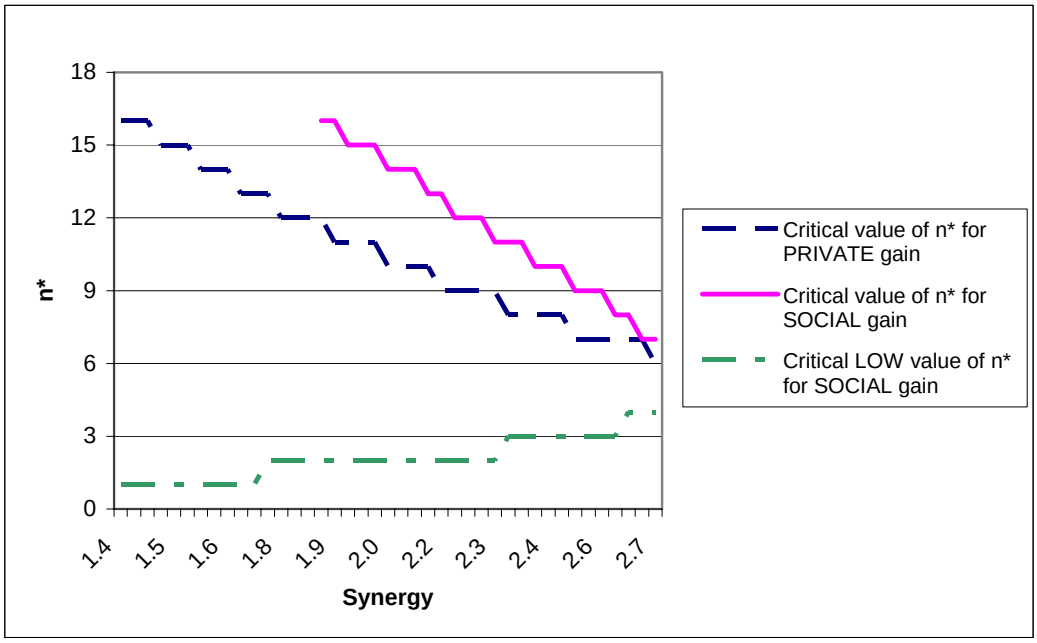
Combining the results we have for both the private and public incentives for strongly synergistic mergers, together with the results we have for weakly synergistic mergers, we have the following proposition:

Proposition 4.2: In a homogenous good market, where firms have potentially different marginal costs and play Cournot, introducing foreign entry at low levels may discourage mergers that are synergistic; however, high levels of foreign entry will encourage such mergers.

One final exercise we consider is to ask: when the private and social gains have the shapes we have described, at what critical level of foreign entry does a merger become privately attractive and at what level does it become socially attractive? Figure 6 illustrates this exercise for one configuration. Synergies greater than those plotted are

such that the merger is socially attractive for any level of foreign entry. As the social gain from the merger is typically ∪-shaped, so zero or a little foreign entry will typically make the merger attractive, higher levels make it unattractive, but higher levels of n^* still might make it attractive again. The plot labelled "Critical low value of n^* for social gain" indicates a level of n^* such that, for any lower level of foreign entry, the merger would be socially desirable and the plot labelled "Critical value of n^* for social gain" indicates any level of n^* such that, for any *higher* level of foreign entry, the merger would again be socially desirable. Finally, the plot labelled "Critical value of n^* for private gain" indicates any level of n^* such that, for any *higher* level of foreign entry, the merger would be privately profitable. For example, when the synergy is 2.06 this merger would be socially desirable if $n^* \leq 2$ *or* $n^* \geq 14$ but is privately profitable for any $n^* \geq 10$. The point to note here is that, for this particular simulation, the threshold level of foreign entry above which the merger is always socially attractive, for any particular synergy, is greater than that above which the merger is always privately profitable to participants. This suggests that merger partners might generally be keener to promote a merger than should be the regulator.

Figure 6: Critical Values of n* for Different Level of Synergies



We conclude this section by relating our findings to the Chinese experience mentioned in the introductory section. Recall that, in this experience, we observed a large number of horizontal mergers amongst Chinese firms after China's admission by the WTO, mergers generally claimed to be undertaken in anticipation of future foreign entry. This clearly is an example of foreign entry encouraging domestic mergers, and according to our findings in this section, the mergers must be – or at least *believed* to be – synergistic, while the perceived level of future foreign entry must be high.

Although throughout the paper we have been using the term "level of foreign entry", this should not be interpreted as referring only to the *number* of foreign firms entering the market. As we have seen in our earlier analysis, both the number of foreign entrants and their levels of efficiency matter in determining the profitability of domestic mergers. For that reason, in the context of this paper, the term "level of foreign entry" is better interpreted as the "level of foreign competition".

With that clarification, Chinese experience seems quite consistent with the findings in this section. In China, it is widely believed that foreign firms are far more efficient than domestic firms ("wolves" versus "lambs") which means, for a given "number" of foreign entrants, that the "level of foreign competition" is going to be very high. Also, managers and government officials, as well as economists, often make the claim that these mergers will enhance domestic firms' "competitiveness", which suggests that the mergers are, at least, believed to be synergistic. These all seem to back our explanation of what is happening in China. However, the fact that these mergers are justified by a perceived higher level of foreign entry and perceived level of synergies also raises more questions.

5. Conclusion

This paper attempts to understand the private and public incentives for horizontal mergers given the presence, or prospect, of foreign entry and how these incentives change as the level of foreign entry varies. We found that while low levels of foreign entry may discourage both non-synergistic and synergistic mergers, high levels of foreign entry will encourage the latter but not the former. These results are not surprising. The profitability of non-synergistic mergers relies on the abilities to increase price significantly (for private incentives) and to shift production from a specific firm to other targeted firm(s) (for both private and public incentives). The

presence of foreign firms constrains and diminishes such abilities and hence renders the mergers unprofitable. On the other hand, the size of the gains provided by a given amount of synergy increases in a relative sense as the level of foreign entry increases and so a high enough level of foreign entry will render synergistic mergers profitable.

Chinese experience is consistent with these findings. In short: although mergers were perceived to be synergistic, the synergies created were not large enough to justify them given the initial market conditions. However, China's admission by the WTO created the prospect for foreign entry, the level of which was perceived to be very high, and the mergers consequently became profitable both to the participants and the society as a whole and hence were undertaken by the firms and encouraged by the government. We say "perceived", since in practice the amount of synergy the merger creates and the level of prospective foreign entry (competition) are both rarely known with certainty. Given incomplete information, there are risks that mergers are undertaken when they should not be. In the Chinese example, overestimating either the amount of synergy the merger creates or the level of prospective foreign competition (in particular, foreign firms' efficiency levels) will lead to mergers that are privately or publicly unprofitable being implemented.

This suggests a useful avenue for further research. In the context of a principal-agent relationship between shareholders and the management of firms, these informational asymmetries make it harder for shareholders to determine whether proposed mergers are in their best interests or just those of management. In fact, given their impacts on the profitability of mergers, these asymmetries may be the cause

of certain conflicts of interests, if the principal and the agent have different attitudes towards risk.

Market wide, uncertainty regarding the level of synergy created by any particular merger makes it harder for non-participants to form expectations of the new entity's efficiency level and hence to work out their best responses. There is also the possibility that non-participants may choose to merge themselves if they believe their competitors' merger may create a large amount of synergies and threaten their own post-merger profitability.

With the prospect of future entry and if incumbent firms have private but incomplete information about the level of that entry, a merger between two particular firms may send signals about the participants' belief of the entry level to non-participants. Non-participants' beliefs could then be altered, and this may lead some of them to undertake mergers. The uncertainties over the extent of any synergy make it harder to interpret the signals and easier to make wrong decisions. In the Chinese example, merger between some firms, citing the prospective foreign entry as the reason, may just lead other firms in the market to believe that they have to do the same.

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