BANK OF CANADA
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Working Paper/Document de travail
2009-30

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www.bank-banque-canada.ca

Bank of Canada Working Paper 2009-30

October 2009

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ISSN 1701-9397

Abstract

The purpose of our paper is to examine the profitability and social desirability of both domestic and foreign mergers in a location-quantity competition model, where we allow for the possibility of hollowing-out of the target firm. We refer to hollowing-out as the situation where the target firm is shut down following a merger with a domestic or foreign acquirer. Our analysis shows that mergers have ambiguous effects on the profitability of merged firms and on social welfare. Hollowing-out occurs in very few instances in our framework. One such instance is the case of firms located side-by-side in the same cluster and only if it is very costly to transfer the more efficient technology of the acquirer to the domestic target firm. This happens regardless of the origin of the acquirer, domestic or foreign. We also show that there are instances when a cross-border merger with hollowing out is not profitable but it is socially desirable.

JEL classification: D43, G34, L41, L13
Bank classification: Economic models; International topics; Market structure and pricing

Résumé

À l'aide d'un modèle de concurrence spatiale fondée sur les quantités, les auteures examinent la rentabilité de fusions menées par des entreprises nationales ou étrangères et leurs retombées sur le bien-être social. Le modèle permet la fermeture de la firme acquise par l'acheteur national ou étranger. Les auteures montrent dans leur analyse les effets mitigés des fusions sur la rentabilité et le bien-être. La fermeture de l'entreprise ne survient que dans un petit nombre de cas à l'intérieur du modèle. L'un de ces cas concerne la situation d'établissements voisins géographiquement et il ne se réalise que si les coûts de transfert de technologies au profit de la firme résidente visée par la fusion sont prohibitifs pour l'acquéreur (peu importe sa nationalité). D'après les auteures, il arrive aussi qu'une fusion transfrontière accompagnée d'une fermeture soit non rentable mais socialement préférable.

Classification JEL : D43, G34, L41, L13
Classification de la Banque : Modèles économiques; Questions internationales; Structure de marché et fixation des prix

1 Introduction

Cross-border mergers and acquisitions (M&As) account for an increasing proportion of all mergers. According to UNCTAD reports, the value of cross-border M&As increased from less than $100 billion in the late 1980s to $720 billion in 1999 (UNCTAD, 2000). The recent increase in cross-border mergers has fuelled a lot of discussion about their perceived negative effects on domestic economies. Opponents of cross-border mergers argue that following a cross-border takeover, domestic economies are being hollowed out, that is, domestic target firms are either shut down or losing their head office functions. In this view, foreign takeovers have invariably negative effects on governance, head office location, employment, capital spending, etc. However, as Grant and Bloom (2008) indicate, hollowing-out is not an inevitable consequence of foreign takeovers. Hollowing-out is rather seen as one possible outcome of post-acquisition decisions made by the new owners. Thus, hollowing-out, that is, the negative effects resulting from a takeover, is neither inevitable nor limited to foreign takeovers. In fact, foreign takeovers often have positive effects on the operations of the acquired firm, while domestic takeovers may result in hollowing-out.

The purpose of our paper is to determine circumstances when mergers–domestic and/or foreign–result in hollowing-out of the domestic target firm. We refer to hollowing-out as the situation where the target firm is shut down following a merger with a domestic or foreign acquirer. In what follows, we employ the terms merger, acquisition, and takeover interchangeably.

To this end, we use a spatial Cournot competition (circular city) model in which firms, domestic and foreign, choose their location on a circle and compete in quantities à la Cournot.[1] Mergers, either domestic or foreign, may occur and may result in hollowing-out; that is, the domestic target being shut down. The attractiveness of a location-quantity model is two-fold. Firstly, Cournot competition results in overlapping geographic markets of competing firms selling a homogeneous product. Secondly, a spatial model allows us to examine firms' location choices and the resulting agglomeration equilibria. In this framework, we determine firms' equilibrium location and the implications of mergers, domestic and cross-border, on merging

[1] This type of model is well suited for describing the behaviour of firms in industries such as automobile or oil where several brands of the same product are delivered by plants (Matsushima, 2001b). The model has also good predictions in terms of pricing for the cement industry (McBride, 1983) and for a representative sample of industries (Greenhut, Greenhut, and Li, 1980).

and non-merging firms' profits and social welfare. In addition, we analyze the merged firm's decision to shut down the target firm following a merger–domestic or cross-border. We refer to this event as hollowing-out.

The industrial organization (IO) literature on horizontal mergers in a spatial model examines implications of mergers on firm profits (merging and non-merging firms) and social welfare. The literature goes back to Stigler (1950) who shows that it is more profitable to be outside a merger than participate in it. The reason is that when a merger occurs, the merged firm produces less than the combined output before merger. Thus, the industry price increases and, as a consequence, non-merging firms increase their output. This strategic output response by non-merging firms is large enough to make mergers unprofitable. This also gives rise to a positive externality from mergers since merging firms cannot fully capture the profits that result from their merger. This is what Pepall, Richards, and Norman (2002) refer to as the "merger paradox"–a merger does not guarantee larger profits for the merged firm compared with their combined pre-merger profits. In fact, Salant, Switzer, and Reynolds (1983) show that in an oligopolistic industry with homogeneous goods, linear demand and constant marginal costs, a horizontal merger is never profitable unless it includes more than 80% of the industry firms. Subsequent papers have shown, however, that mergers are profitable if Cournot competition is extended to allow for cost synergies (Farrell and Shapiro, 1990), increasing marginal costs (Perry and Porter, 1985), and differentiated products (Lommerud and Sorgard, 1997).

Despite their importance, cross-border mergers have received little attention in the IO and international trade literature. The existing studies investigate the incentives for and profitability of cross-border mergers under different scenarios. For example, Qiu and Zhou (2006) show that information sharing about domestic demand increases the profitability of a merger between a domestic and a foreign firm. Bjorvatn (2004) looks at the effect of economic integration on the profitability of cross-border mergers. In this context, economic integration may increase pre-merger competition and the reservation price of the target firm. This, in turn, increases the profitability of a cross-border merger. Long and Vousden (1995) examine the effect of trade liberalization on the profitability of cross-border mergers. They find that the effect depends on whether trade liberalization is unilateral or bilateral and on the magnitude of cost savings generated from mergers. Horn and Persson (2001) examine the effect of trade costs on mergers. Using a coalition formation approach they show that high trade costs may be conducive to national mergers, while low trade costs may favour international mergers. Neary (2007) is another study of the impact of trade liberalization on cross-border mergers. In a general equilibrium model he shows that bilateral mergers in which low-cost firms buy out higher-cost foreign firms are profitable. Trade liberalization, in this context, can trigger international merger waves which serve as instruments of comparative advantage. Nocke and Yeaple (2007) also use a general equilibrium model with firm heterogeneity with respect to their capabilities. Firm capabilities differ in their degree of international mobility and firms participate in the merger market to exploit complementarities between capabilities. Their results suggest that in industries where firms vary mainly in their mobile capabilities, the most efficient firms will engage in cross-border mergers, while in industries where firms vary mainly in their country-specific non-mobile capabilities, the least efficient firms will engage in cross-border mergers.

Our paper contributes to the literature in several ways. First, it examines the profitability and social desirability of both domestic and foreign mergers in a spatial competition model. Another important contribution is the possibility of hollowing-out following a merger. In this framework, we determine firms' equilibrium locations, the impact of mergers on firms' profits, and the impact of mergers on social welfare. Matsushima (2001b) and Cosnita (2005) also analyze the profitability of mergers in a spatial competition model, but they do not examine cross-border mergers, the incentive for hollowing out, or the welfare implications of mergers.

We consider two alternative scenarios for firms' location choice. In one scenario, domestic firms choose their location first followed by foreign firms. We refer to this scenario as the *sequential location choice* model. This set-up describes an industry where foreign firms face barriers to entry. A removal of these barriers may induce firms to enter the domestic market either by foreign direct investment (FDI) or by merging with a local firm. In the case of FDI, the foreign firm may later decide to merge with a domestic firm. We examine this case in Section 3.

In the alternative scenario, we assume domestic and foreign firms choose their location simultaneously after which mergers may occur. We refer to this scenario as the *simultaneous location choice* model. This model is well fitted to describe an industry where domestic firms compete with subsidiaries of foreign firms and cross-border mergers have been restricted. A change in regulation may create incentives for cross-border mergers. We analyze this scenario in Section 4.

Our analysis shows that mergers have ambiguous effects on the profitability of merged firms and on social welfare. On the one hand, mergers reduce competition–“competition effect”–and result in cost savings–“cost effect.” On the other hand, non-merged firms respond strategically by raising output–“strategic effect.” The overall profitability of a merger thus depends on which effects dominate, that is, the competition and cost effects versus the strategic effect. The effect of a merger on social welfare depends on whether or not the cost savings and strategic effects dominate the competition effect. If the cost savings and strategic effects dominate, the merger increases social welfare and should be encouraged. If, on the other hand, the competition effect dominates, the merger reduces social welfare and should be discouraged. Which effects dominate depends critically on the location equilibrium and the market size and concentration. Our numerical simulations identify cases when a merger can be both profitable and socially beneficial, profitable but socially detrimental, unprofitable but socially beneficial.

With regards to hollowing-out, this occurs in very few instances in our framework. One such instance is the case of firms located side-by-side in the same cluster and only if it is very costly to transfer the more efficient technology of the acquirer to the domestic target firm. This happens regardless of the origin of the acquirer, domestic or foreign. We can, however, provide examples when a cross-border merger with hollowing out is not profitable but it increases social welfare.

2 The Basic Model

The model we employ is similar to those found in the circular city literature (see, for example, Gupta (2004)). There are an infinite number of consumers located uniformly on a circle with perimeter equal to 1. There are $n+2$ domestic firms and one foreign firm. We index firms by $i \in \{0, 1, 2, F\}$. Firms are assumed to employ different technologies with the foreign firm employing the most efficient one. n domestic firms have identical constant marginal cost of production equal to c_0 and the remaining two domestic firms have marginal costs c_1 and c_2. The foreign firm has constant marginal cost c_F. In order to set ideas, we assume $c_F < c_1 < c_2 < c_0$. The linear market demand at each point x on the circle is given by $p(x) = a - bQ(x)$, where $a > 0$ and $b > 0$ are constant, and $Q(x)$ is the aggregate quantity supplied at point x and $p(x)$ is the market price at x. Denote by x_i the location of firm

i on the circle. Firms incur a transportation cost $t_i > 0$ per unit of length. Thus, a firm located at x_i incurs a cost $t_i|x - x_i|$ to ship a unit of the product from its own location to a consumer located at point x on the circle, where $|x - x_i|$ is the distance between x and x_i. We assume that domestic firms have the same unit transportation cost; that is, $t_i = t$, for $i = 0, 1, 2$. The foreign firm, however, has a higher unit tranportation cost so that $t_F = t + \varepsilon$, $\varepsilon > 0$. This assumption captures the idea that domestic firms are typically more familiar with the local market, such as consumer tastes, culture, advertising, distribution, regulation etc. The assumed higher transportation cost could reflect, for example, higher advertising costs paid out by the foreign firm (Institute for Competitiveness and Prosperity, 2008).[2] We also assume, as is typical in circular city models, that all firms serve the entire market, thus quantities are positive at each point on the circle.

We analyze two versions of the model. In one version, the foreign firm chooses its location on the circle after the domestic firms have chosen their location. We refer to this version as the *sequential location choice model.* In the second version, all firms choose their location simultaneously. We refer to the second version as the *simultaneous location choice model.*

The sequence of events for the two versions is as follows.

Sequential Location Choice Model

Stage 0: Domestic firms incur set-up costs and choose their location on the circle.

Stage 1: The foreign firm enters the domestic market and chooses its location on the circle.

Stage 2: Mergers (domestic or cross-border) may take place.

Stage 3: Firms compete in quantities (Cournot competition).

Simultaneous Location Choice Model

Stage 1: All firms choose their location on the circle.

Stages 2 and 3 are the same as in the sequential location choice case.

There are two alternative assumptions regarding the technology transfer that we make in each of the two models. One assumption is that following a merger, it is costless to transfer technology of the low-cost firm to the high-cost firm. The alternative assumption is the polar opposite one for which it is prohibitively costly to transfer the technology of the low-cost firm to the high-cost firm. Therefore, under the latter assumption, following a merger the

[2]Others, such as Horn and Persson, (2001) also assume that foreign firms incur higher per unit transport costs when serving a local market.

target firm continues to use the high-cost production.

We determine the subgame perfect Nash equilibrium (SPNE) of the game by backward induction.

2.1 Pre-merger Cournot Competition (Stage 4)

Before we solve for the equlibrium with mergers, we consider the pre-merger equlibrium. We start at the last stage, with firms competing in quantities at each point in the market, taking firm locations determined at the previous stages as given. At this stage, all firms (domestic and foreign) have already chosen their location either simultaneously or sequentially. At each point, x, on the circle, firm i chooses $q_i(x)$ to maximize profits:

$$\pi_i(x) = q_i(x)[a - bQ(x) - t_i|x - x_i| - c_i] \tag{1}$$

for $i = 0, 1, 2, F$. We can easily obtain the equilibrium quantities, $q_i(x)$, by simultaneously solving the first-order conditions:

$$a - bQ(x) - t_i|x - x_i| - c_i - bq_i(x) = 0, \tag{2}$$

for $i \in \{0, 1, 2, F\}$, to obtain

$$q_i(x) = \frac{1}{b(n+4)}\Big[a - (n+3)(t_i|x - x_i| + c_i) + \sum_{j \neq i}(t_j|x - x_j| + c_j)\Big], \tag{3}$$

for $i \in \{0, 1, 2, F\}$. Note that the equilibrium quantities, $q_i(x)$, depend on the location chosen by firms at the previous stages. The aggregate output at point x is then

$$Q(x) = \frac{1}{(n+4)b}\Big[(n+3)a - \sum_i (t_i|x - x_i| + c_i)\Big]. \tag{4}$$

Using the first-order conditions, it can be easily shown that under Cournot competition profits at point x on the circle are proportional to the square of the quantity delivered to that point; that is, $\pi_i(x) = bq_i(x)^2$. This, together with (3), gives:

$$\pi_i(x) = \frac{1}{(n+4)^2 b}\Big[a - (n+3)(t_i|x - x_i| + c_i) + \sum_{j \neq i}(t_j|x - x_j| + c_j)\Big]^2 \tag{5}$$

$$= \frac{1}{(n+4)^2 b}\Big[k_i^2 + \frac{1}{2}k_i g_i + \frac{1}{12}g_i^2\Big], \tag{6}$$

where $k_i = a + \sum_{j \neq i} c_j - (n+3)c_i + (1/2)t_F$ and $g_i = -(2t + t_F)$, and $k_F = a + \sum_{j \neq F} c_j - (n+3)c_F - (1/2)(n+3)t_F$ and $g_F = (n+2)t + (n+3)t_F$, and $Q(x) = nq_0(x) + q_1(x) + q_2(x) + q_F(x)$. Firm i's equilibrium aggregate profits then are:

$$\Pi_i(x) = \int_0^1 \pi_i(x)dx, \tag{7}$$

for $i \in \{0, 1, 2, F\}$.

Let $SW(x)$ denote social surplus at market point x on the circle. Then

$$\begin{aligned} SW(x) = & \int_0^{Q(x)} (a - bm)dm - \sum_i (t_i|x - x_i| + c_i)q_i \\ = & a\frac{(n+3)a - \sum_i (t_i|x - x_i| + c_i)}{(n+4)b} - \frac{b}{2}\left[\frac{(n+3)a - \sum_i (t_i|x - x_i| + c_i)}{(n+4)b}\right]^2 \\ & - \sum_i (t_i|x - x_i| + c_i)q_i. \end{aligned} \tag{8}$$

The aggregate social surplus is then

$$SW = \int_0^1 SW(x)dx. \tag{9}$$

We now turn to the location equilibrium. An equilibrium location vector $x^* = (\underbrace{x_0^*, .., x_0^*}_{n}, x_1^*, x_2^*, x_F^*)$ is such that x_i^* maximizes (7) for $i \in \{0, 1, 2, F\}$. We consider the simultaneous and sequential location choice models in turn. In the simultaneous location choice case, all firms choose their location simultaneously (stage 1). In the sequential location choice case, domestic firms first choose their location on the circle (stage 0) and then, the foreign firm chooses its location taking the location of the domestic firms as given (stage 1). Before we turn to each of these two cases, we introduce some preliminary notation and results.

In order to characterize the SPNE locations we follow Gupta et al (2004) and Gupta (2004). For every point, x, on the circle we denote by $\hat{x}$ the point diametrically opposite. Let $L(x)$ denote the half circle from x to $\hat{x}$ (not including $\hat{x}$) in the clockwise direction and $R(x)$ the half circle from x to $\hat{x}$ in the counter-clockwise direction. The following two definitions in Gupta, Lai, Pal, Sarkar, and Yu (2004) are useful in characterizing the location equilibrium.

Definition 1 *(Gupta, Lai, Pal, Sarkar, and Yu, 2004) x is a quantity median for firm i if and only if the aggregate quantity supplied by firm i in $L(x)$ equals the aggregate quantity supplied in $R(x)$, i.e.,*

$$\int_{x\in L(x)} q_i(x)dx = \int_{x\in R(x)} q_i(x)dx. \tag{10}$$

Definition 2 *(Gupta, Lai, Pal, Sarkar, and Yu, 2004) x is a competitors' aggregate cost median for firm i if and only if the aggregate delivered marginal cost of all other firms in $L(x)$ equals the aggregate delivered marginal cost of all other firms in $R(x)$, i.e.,*

$$\int_{x\in L(x)} |\sum_{j\neq i} t_j|x-x_j|dx| = \int_{x\in R(x)} |\sum_{j\neq i} t_j|x-x_j|dx|.^{3} \tag{11}$$

It is straightforward to show that x is a firm's quantity median if and only if it is also the firm's competitors' aggregate cost median (Lemma 1 in Gupta et al, 2004). The following result characterizes the SPNE locations.

Proposition 1 *(Gupta, Lai, Pal, Sarkar, and Yu, 2004) Given the locations of its competitors, firm i maximizes its profits only if it locates at its competitors' aggregate cost median (or at its quantity median).*

The intuition behind Propozition 1 is straightforward. The first-order condition for profit maximization requires that, at the equilibrium location, x, the change in profits in $L(x)$ must equal the change in profits in $R(x)$. Since, under Cournot competition, profits at each point on the circle are proportional to the quantity delivered to that point, it also follows that the change in profits on each half circle is prortional to the quantity served on that half circle. Thus, the quantities delivered on each half circle must be equal. It follows that the quantity median property is satisfied. Since in a circular city model the quantity median property is equivalent to the competitors' aggregate cost median property, the latter is also satisfied in equilibrium.

One important implication of the result above is that the location equilibrium is independent of firms' marginal costs of production. This is so because firms' marginal cost of production cancel out of the aggregate cost median condition, (11).

[3]The competitors' aggregate median condition in our framework is, in fact, $\int_{x\in L(x)} |\sum_{j\neq i} t_j|x-x_j|| + \sum_{j\neq i} c_j dx = \int_{x\in R(x)} |\sum_{j\neq i} t_j|x-x_j|| + \sum_{j\neq i} c_j dx$. Cancelling out $\sum_{j\neq i} c_j$, yields (11).

3 Sequential Location Choice

In this version of the model, domestic firms choose their location on the circle in the intitial stage 0. Domestic firms' locations are thus fixed for all subsequent stages. In stage 1, the foreign firm enters the domestic market and chooses its location on the circle. This decision sequence of the sequential game is both a realistic one and allows for location equilibria for domestic firms that are independent of the foreign firm's transport cost differential.

We can again appeal to Proposition 1 to determine the location equilibria of the domestic firms at stage 0. Given that the domestic firms have identical transport costs, there are infinitely many location equilibria, as shown in Gupta, Lai, Pal, Sarkar, and Yu (2004). Without loss of generality and for an interesting comparison to the simultaneous choice case, we focus on the SPNE in which firms agglomerate at the two ends of the diameter from $x = 0$ to $x = 1/2$. This allows for a comparison of the one-cluster and two-cluster scenarios. A possible two-cluster equilibrium is one where $(n/2)$ type 0 firms and the type 1 firm locate at $x = 0$, while the remaining firms locate at $x = 1/2$.[4] The only location equilibrium for the foreign firm that satisfies the competitors' cost median condition stipulated in Proposition 1 is either $x = 0$ or $x = 1/2$. Without loss of generality we can assume that the foreign firm locates at $x = 0$. In what follows, we index type 0 domestic firms by $s = 0, 1/2$ to distinguish between a type 0 firm located at $x = 0$ and a type 0 firm located at $x = 1/2$. Figure 1 below illustrates this equilibrium.

3.1 Pre-merger Outcome

We begin by determining the equilibrium outcome after the foreign firm enters the domestic market but before any merger takes place. All firms engage in Cournot competition, which results in a Cournot output equilibrium similar to that outlined in sections 2.1 but with the location selections outlined above. Thus, equilibrium quantities are given by (3), equilibrium

[4] Other combinations can also be supported as equilibria. For example, n_1 type 0 firms and type i firm located at $x = 0$, n_2 type 0 firms and type j firm located at $x = 1/2$, with $n_1 + n_2 = n$, $i, j = 1, 2$, $i \neq j$, is also a possible equilibrium. The one-cluster equilibrium, with n_1 type 0 firms and types 1 and 2 firms located at $x = 0$ and n_2 type 0 firms located at $x = 1/2$ is also a location equilibrium. We choose to focus on the one above because it allows us to analyze cases of mergers that are different from the ones identified in the simultaneous location choice case. Furthermore, we do not lose any generality by assuming that $n_1 = n_2 = n/2$, while somewhat simplifying the derivations.

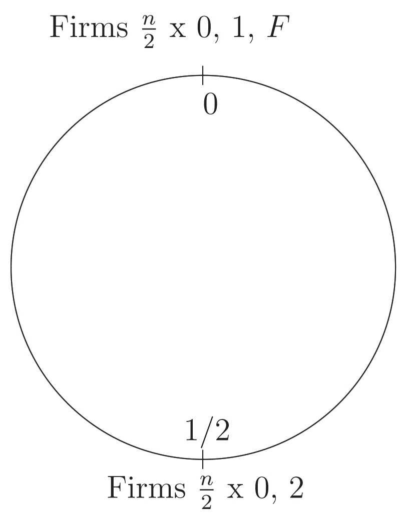

Figure 1: Two-cluster location equilibrium

profits are given by (7), and social welfare is given by (8). This pre-merger outcome serves as the benchmark for comparison purposes when determining whether firms have an incentive to merge and whether social welfare is harmed or enhanced by mergers.

3.2 Mergers

We now turn to stage 2 where mergers may occur. We examine in turn possible mergers, their profitability, and their implication for social welfare. Mergers have ambiguous effects on the joint profits of merging firms (see, for example, Salant, Switzer, and Reynolds (1983)). The incentives to merge arise from the reduction in competition (the "competition effect") amongst member firms and any cost reductions (the "cost effect") that result if merged firms are all able to adopt the technology of the most efficient firm. Taking competitors' outputs as given, the merged firm responds to merging by reducing its collective output since it internalizes the negative impact of members' decisions on what were once competitors. This serves to raise market price. The remaining competing firms respond to this reduction in output by raising their own output. This "strategic response" by competing firms can be large enough to result in losses from mergers. Furthermore, the cost effect of merger elicits a strategic response of non-merger firms in reducing their collective output. These varying effects of merger have ambiguous results for profits of all firms and for social welfare.

We consider two cases regarding technology transfer after a merger takes place. In one case, we assume technology transfer is costless; that is, the merged firm adopts the more efficient technology at both plants. In the opposite case we assume technology transfer from the low-cost to the high-cost firm is very costly, and, consequently, the target firm continues to use the high-cost technology. We consider the following possible mergers: (i) domestic merger of firms 1 and 2 located at opposite ends; (ii) cross-border merger of side-by-side firms F and 1; (iii) cross-border merger of firms F and 2 located at opposite ends. Each of these types of mergers may give rise to hollowing-out, and we therefore examine this outcome as well.

3.3 Domestic Merger with Costless Technology Transfer

In this case the merging firms are domestic firms 1 and 2, which are located at $x = 0$ and $x = 1/2$, respectively. Since technology transfer is costless, the merged firm operates

Table 1: Profitability of Domestic Merger with Costless Technology Transfer, $\pi_M^D - (\pi_1 + \pi_2)$

Demand size (a)	Number of firms (n) 2	4	6	8	10
10	-0.3686	-0.5695	-0.8113	-1.0949	-1.420
11	-0.5294	-0.7605	-1.0314	-1.3436	-1.6978
12	-0.7293	-0.9911	-1.2912	-1.6321	-2.0148
13	-0.9685	-1.2612	-1.5907	-1.9605	-2.3717
14	-1.2469	-1.5710	-1.9301	-2.3287	-2.7684
15	-1.5645	-1.9204	-2.3092	-2.7367	-3.2051
16	-1.9213	-2.3093	-2.7280	-3.1846	-3.6816
17	-2.3172	-2.7379	-3.1866	-3.6723	-4.1980
18	-2.7524	-3.2060	-3.6849	-4.1999	-4.7543
19	-3.2268	-3.7137	-4.2230	-4.7672	-5.3504

Table 2: Effect of Domestic Merger with Costless Technology Transfer on Social Welfare, $SW_M^D - SW$

Demand size (a)	Number of firms (n) 2	4	6	8	10
10	1.8254	3.6979	6.2054	9.3476	13.1245
11	2.9076	5.8609	9.8098	14.7536	20.6921
12	4.2332	8.5072	14.2172	21.3624	29.9425
13	5.8022	11.6365	19.4276	29.1742	40.8758
14	7.6147	15.2491	25.4410	38.1889	53.4920
15	9.6705	19.3448	32.2575	48.4065	67.7910
16	11.9697	23.9237	39.8770	59.8271	83.7729
17	14.5123	28.9858	48.2995	72.4506	101.4377
18	17.2983	34.5310	57.5251	86.2771	120.7853
19	20.3278	40.5593	67.5537	101.3064	141.8158

both plants because both can use the more efficient production technology of firm 1 and the firm can save on transport costs for delivery to consumers located closest to their respective plants. The domestic merger of firms 1 and 2 is profitable if the profits of the merged firm exceed the combined pre-merger profits; that is, if $\Delta\pi^D = \pi_M^D - (\pi_1 + \pi_2) > 0$, and is welfare improving if $\Delta SW = SW_M^D - SW > 0$. Details of profits and social welfare are provided in Appendix A. Given the complexity of the profit and social welfare functions, we use numerical simulations to gain insight into whether firms have an incentive to merge and whether doing so improves social welfare. Tables 1 and 2 give the results of the numerical simulation for the change in profits and social welfare from pre- to post-merger.

The simulations calculate profit and welfare differentials for different values of the demand parameter a and the number of domestic firms n. We vary these two parameters because of their importance to the magnitude of the "competition effect" of merger and the strategic behaviour of competing firms. All other paramters are held constant at the values $b = 1$, $c_F = 0$, $c_1 = 0.1$, $c_2 = 0.3$, $c_0 = 1$, $t = 1$, and $\varepsilon = 0.3$. From the tables we can observe that for the parameter values selected, domestic mergers decrease profits of merging firms but increase social welfare. The results in Table 1 show that, as a increases, profits from merger fall relative to those in the pre-merger case. The parameter a is a demand parameter that enters proportionately into the competing firms' reaction functions. The higher is a, the greater is the marginal profit to competing firms from raising their output in response to merger. This strategic effect can become dominant for high a. Thus, the profit differential becomes negative and the social welfare differential becomes more positive. Turning to the effect of the number of domestic firms n, note that the higher is n, the greater the number of competing domestic firms. A higher n lowers the marginal benefit from a strategic increase in output for an individual firm, but the collective increase in output is higher. Thus, a higher n can either increase or decrease the magnitude of the strategic response to merger. In this case, the strategic response to merger serves to reduce merger profits relative to pre-merger. Social welfare rises with a greater number of competing firms.

3.3.1 Domestic Merger with Very Costly Technology Transfer

In this section, we assume that it is very costly to transfer the technology of the low-cost firm 1 to the high-cost firm 2. In this case, the merged firm can either continue to operate both plants to lower its transportation costs but incur higher production costs at plant 2, or it can shut down plant 2 and incur higher transportation cost by delivering to all its consumers from plant 1. The former option is that of no hollowing-out, while the latter option is that of hollowing-out the less efficient plant. We analyze the profitability of each type of domestic merger–with no hollowing-out (NH) and with hollowing-out (H)–in turn, and then determine which case arises in equilibrium by comparing the profits of the merged firm under the two scenarios. In analyzing the hollowing-out case, we make the simplifying assumption that hollowing out itself is costless. In reality, there are costs incurred with shutting down a firm; including those associated with liquidating and disposing of physical capital, the cancellation of contracts, etc. Including these costs in our model would have the implication of making hollowing out less profitable. With our assumption of zero hollowing out costs and in scenarios where hollowing out is indeed profitable, we can then determine the maximum level of costs such that hollowing out would become unprofitable.

3.3.2 Domestic Merger with No Hollowing-Out (NH)

In this case, the merged firm operates both plants. The merged firm will deliver to a location x on the circle from plant 1 as long as profits from delivering from plant 1 exceed those from delivering from plant 2. The merged firm is indifferent between delivering from either plant if profits are equal. The indifference condition is giving the cut-off location x^D_{NH}:

$$x^D_{NH} = \frac{c_2 - c_1}{2t} + \frac{1}{4}. \qquad (12)$$

The details of calculations are given in Appendix A. The merged firm will thus service consumers located on $(0, x^D_{NH})$ and $(1 - x^D_{NH}, 1)$ from plant 1 and consumers located on $(x^D_{NH}, 1 - x^D_{NH})$ from plant 2.

A domestic merger with no hollowing-out is then profitable if it yields higher profits than the two firms combined; that is, if $\pi^D_{M,NH} > \pi_1 + \pi_2$. A simulation of the profitability of merger and its impact on social welfare is provided in the following tables. We see that for the parameter values selected, such a merger is not profitable and it decreases social welfare. This implies that the "competition effect" in combination with the strategic response of competing non-merger firms are dominant effects.

3.3.3 Domestic Merger with Hollowing-Out (H)

In the case of domestic merger of firms 1 and 2 with hollowing-out the high-cost plant 2 is shut down and the merged firm delivers to consumers from plant 1. The domestic merger with hollowing-out is profitable if it results in higher profits than the sum of pre-merger profits so that $\pi^D_{M,H} > \pi_1 + \pi_2$.

In equilibrium a domestic merger with no hollowing-out occurs if the merger is profitable and gives higher profits than the one with hollowing-out; that is, $\pi^D_{M,NH} > \pi_1 + \pi_2$ and $\pi^D_{M,NH} > \pi^D_{M,H}$ must be both satisfied. The following tables provide the results of a simulation of this case. Here we find the interesting result that a domestic merger with hollowing-out is not profitable for merging firms but it is socially desirable. The strategic behaviour of

Table 3: Profitability of domestic merger with costly technology transfer and NH: $\pi_D^{NH} - (\pi_1 + \pi_2)$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	-0.3705	-0.5713	-0.8131	-1.0966	-1.4224
6	-0.5315	-0.7625	-1.0333	-1.3455	-1.6996
7	-0.7318	-0.9933	-1.2933	-1.6341	-2.0167
8	-0.9712	-1.2637	-1.5930	-1.9626	-2.3737
9	-1.2498	-1.5736	-1.9325	-2.3310	-2.7706
10	-1.5677	-1.9232	-2.3117	-2.7391	-3.2073
11	-1.9247	-2.3123	-2.7307	-3.1871	-3.6840
12	-2.3209	-2.7411	-3.1895	-3.6750	-4.2005
13	-2.7564	-3.2094	-3.6880	-4.2027	-4.7569
14	-3.2310	-3.7173	-4.2262	-4.7702	-5.3532

Table 4: Effect of domestic merger with costly technology transfer with NH on social welfare: $SW_D^{NH} - SW$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	-1.8392	-3.7261	-6.2519	-9.4163	-13.2192
6	-2.9290	-5.9004	-9.8708	-14.8400	-20.8077
7	-4.2639	-8.5596	-14.2947	-21.4687	-30.0813
8	-5.8437	-11.7038	-19.5237	-29.3024	-41.0398
9	-7.6686	-15.3331	-25.5576	-38.3411	-53.6834
10	-9.7384	-19.4473	-32.3965	-48.5848	-68.0120
11	-12.0532	-24.0466	-40.0404	-60.0335	-84.0255
12	-14.6131	-29.1308	-48.4893	-72.6872	-101.7241
13	-17.4179	-34.7001	-57.7432	-86.5459	-121.1076
14	-20.4678	-40.7543	-67.8021	-101.6096	-142.1762

Table 5: Profitability of domestic merger with costly technology transfer and H: $\pi_D^H-(\pi_1+\pi_2)$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	-0.3715	-0.5723	-0.8140	-1.0975	-1.4233
6	-0.5327	-0.7636	-1.0343	-1.3464	-1.7005
7	-0.7330	-0.9944	-1.2943	-1.6352	-2.0177
8	-0.9726	-1.2649	-1.5942	-1.9637	-2.3748
9	-1.2514	-1.5750	-1.9337	-2.3321	-2.7717
10	-1.5694	-1.9247	-2.3131	-2.7404	-3.2085
11	-1.9266	-2.3139	-2.7321	-3.1885	-3.6852
12	-2.3229	-2.7428	-3.1910	-3.6764	-4.2018
13	-2.7585	-3.2112	-3.6896	-4.2041	-4.7582
14	-3.2333	-3.7192	-4.2279	-4.7717	-5.3546

Table 6: Effect of domestic merger with costly technology transfer and H on social welfare: $SW_D^H - SW$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	1.8895	3.7753	6.3005	9.4646	13.2674
6	3.0028	5.9724	9.9419	14.9106	20.8780
7	4.3661	8.6594	14.3933	21.5666	30.1787
8	5.9794	11.8365	19.6547	29.4325	41.1693
9	7.8427	15.5036	25.7261	38.5085	53.8500
10	9.9560	19.6606	32.6075	48.7944	68.2207
11	12.3193	24.3077	40.2989	60.2904	84.2813
12	14.9326	29.4448	48.8003	72.9963	102.0320
13	17.7959	35.0719	58.1116	86.9123	121.4726
14	20.9092	41.1889	68.2330	102.0382	142.6033

competing firms is strong enough to make merger unprofitable (see Appendix B), and when combined with the cost savings from having only the most efficient firm produce, we have a strong positive effect of merger on social welfare.

3.4 Cross-border Merger with Costless Technology Transfer

We now consider a merger between the foreign firm and a domestic firm. Recall that the foreign firm is assumed to have located itself at point 0 on the circle. Given all firms' location choices at previous stages, we consider two possible types of cross-border merger. One possibility is a merger between the foreign firm F and the type 1 domestic firm, both

Table 7: Profitability of a Type I Merger with Costless Technology Transfer, $\pi_M^I - (\pi_1 + \pi_F)$

Demand size (a)	Number of firms (n) 2	4	6	8	10
5	0.0582	0.1307	0.2239	0.3379	0.4726
6	0.0322	0.1117	0.2119	0.3329	0.4746
7	-0.0138	0.0727	0.1799	0.3079	0.4566
8	-0.0798	0.0137	0.1279	0.2629	0.4186
9	-0.1658	-0.0653	0.0559	0.1979	0.3606
10	-0.2718	-0.1643	-0.0361	0.1129	0.2826
11	-0.3978	-0.2833	-0.1481	0.0079	0.1846
12	-0.5438	-0.4223	-0.2801	-0.1171	0.0666
13	-0.7098	-0.5813	-0.4321	-0.2621	-0.0714
14	-0.8958	-0.7603	-0.6041	-0.4271	-0.2294

located at $x = 0$. We refer to this case as the type I cross-border merger. Another possibility is a merger between the foreign firm F and the type 2 domestic firm, located at opposite ends of the diameter. We refer to the latter case as the type II cross-border merger. We examine the profitability of each type of merger in turn in order to determine whether either type may arise in equilibrium. We also examine whether each type of merger is socially desirable.

3.4.1 Cross-border merger of firms F and 1 (Type I)

For this case, both parties to the merger are located side-by-side at $x = 0$. Given that the domestic firm is able to costlessly adopt the foreign firm's more efficient production technology, the merged firm is indifferent between shutting down one plant (hollowing-out) and keeping both plants open (no hollowing-out). In either case, the merged firm acts as one firm. Quantities and profits are therefore similar to those outlined in section 2.1, except that now there are one fewer firms and marginal production cost for the merged firm is c_F and unit transport cost is t.

A type I cross-border merger is profitable if the profits of the merged firm are above the combined profits of the two firms prior to merging; that is, it is profitable if $\Delta\pi^I = \pi_M^I - (\pi_1 + \pi_F) > 0$ and raises social welfare if $\Delta SW^I = SW_M^I - SW > 0$. The details of the profit and social welfare calculations are provided Appendix A. Tables 7 and 8 give us an example of the profit and social welfare differentials between pre-and post-merger for a selection of parameter values.

Table 8: Effect of a Type I Merger with Costless Technology Transfer on Social Welfare, $SW_M^I - SW$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	0.6582	0.9609	1.2637	1.5664	1.8692
6	1.0542	1.5369	2.0197	2.5024	2.9852
7	1.5402	2.2429	2.9457	3.6484	4.3512
8	2.1162	3.0789	4.0417	5.0044	5.9672
9	2.7822	4.0449	5.3077	6.5704	7.8332
10	3.5382	5.1409	6.7437	8.3464	9.9492
11	4.3842	6.3669	8.3497	10.3324	12.3152
12	5.3202	7.7229	10.1257	12.5284	14.9312
13	6.3462	9.2089	12.0717	14.9344	17.7972
14	7.4622	10.8249	14.1877	17.5504	20.9132

As was true for a domestic merger, the results show that an increase in the demand parameter a reduces the benefit to member firms from merging because it increases the strategic response of competiting firms to the merger (see Appendix B). This effect serves to lower the benefits to firms from merging and to raise social welfare from mergers. We also observe that, contrary to a domestic merger, cross-border mergers are more profitable the larger is the number of domestic firms, n. This arises because the larger is n the smaller is the marginal benefit to competing firms from strategically raising their output. At the same time, the larger is n, the greater the collective output and thus the greater is social welfare.

3.4.2 Cross-border merger of firms F and 2 (Type II)

For this type of merger, the foreign firm located at $x = 0$ merges with the domestic firm of type 2 located at the opposite end of the diameter at $x = 1/2$. With costless technology transfer, the domestic firm adopts the more efficient technology of the foreign firm and produces at marginal cost c_F. At the same time, the foreign firm adopts the lower transport cost, t, of the domestic firm. Quantities, profits, and social welfare are thus straightforward adaptations of those laid-out in section 2.1.

An advantage of a type II merger compared to a type I merger is the savings in transport costs for delivery to consumers located closest to each plant. Therefore, there is no incentive for hollowing out of the domestic firm. It is straightforward to show that the merged firm will deliver its product to consumers located on the $(0, 1/4)$ and $(3/4, 1)$ portions of the

Table 9: Profitability of Type II Merger with Costless Technology Transfer, $\pi_M^{II} - (\pi_2 + \pi_F)$

Demand size (a)	Number of firms (n) 2	4	6	8	10
5	-0.7636	-1.2119	-1.7587	-2.4050	-3.1511
6	-1.0231	-1.5346	-2.1436	-2.8515	-3.6590
7	-1.3218	-1.8970	-2.5682	-3.3379	-4.2069
8	-1.6597	-2.2990	-3.0326	-3.8641	-4.7946
9	-2.0369	-2.7405	-3.5368	-4.4302	-5.4223
10	-2.4532	-3.2217	-4.0807	-5.0361	-6.0898
11	-2.9087	-3.7424	-4.6643	-5.6818	-6.7971
12	-3.4034	-4.3027	-5.2877	-6.3673	-7.5444
13	-3.9373	-4.9026	-5.9509	-7.0927	-8.3316
14	-4.5105	-5.5421	-6.6538	-7.8579	-9.1586

Table 10: Effect of Type II Merger with Costless Technology Transfer on Social Welfare, $SW_M^{II} - SW$

Demand size (a)	Number of firms (n) 2	4	6	8	10
5	1.8870	3.7519	6.2293	9.3174	13.0154
6	2.9998	5.9486	9.8705	14.7631	20.6259
7	4.3626	8.6353	14.3216	21.4189	29.9263
8	5.9754	11.8121	19.5827	29.2846	40.9168
9	7.8382	15.4788	25.6538	38.3603	53.5973
10	9.9510	19.6355	32.5349	48.6461	67.9677
11	12.3138	24.2822	40.2260	60.1418	84.0282
12	14.9266	29.4189	48.7271	72.8475	101.7786
13	17.7894	35.0456	58.0382	86.7632	121.2191
14	20.9022	41.1623	68.1593	101.8890	142.3496

circle from plant F and to consumers located on portion $(1/4, 3/4)$ from plant 2. A type II merger is profitable if the profits of the merged firm are above the combined pre-merger profits of the two firms participating in the merger; that is, $\Delta^{II} = \pi_M^{II} - (\pi_2 + \pi_F) > 0$, and is socially beneficial if $\Delta SW^{II} = SW_M^{II} - SW > 0$. In equilibrium, a type I cross-border merger arises if the merger is both profitable and yields higher profits than a type II merger; that is, $\pi_M^I > \pi_1 + \pi_F$ and $\pi_M^I > \pi_M^{II}$ are satisfied. The details of the profit and social welfare equations are provided in Appendix A. Numerical simulations of the differentials between pre- and post-merger profits and social welfare are provided in Tables 9 and 10.

Note that for these parameter values, a type II merger is not profitable but is socially desirable. This occurs because, for a type II merger, the strategic response of competing firms to a merger is strong enough to dominate the benefits from reducing competition and from lowering costs (see Appendix B).

Comparing the profitability of a type I merger with that of a type II given in Tables 7 and 9, we expect a type II merger would not occur. Given a choice between merging with domestic firm 1 or 2, the foreign firm would choose to merge with firm 1 if technology transfer is costless.

3.5 Cross-border Merger with Very Costly Technology Transfer

We now consider the situation where it is very costly to transfer technology from the low-cost foreign firm to the high-cost domestic firm. We only consider this situation for a type II merger because a type I merger with costly technology transfer would simply result in closing down the type 1 plant and giving rise to hollowing-out, given that the two plants are located side-by-side. For the type of merger considered here, the merged firm faces two choices. It can either keep both plants open and save on transport costs but also incur higher production costs at plant 2, or it can shut down the least efficient plant 2 but have more costly transportation. The former is the no hollowing-out case and the latter is the hollowing-out case. We determine the profitability of each case in turn to determine whether either scenario can arise in equilibrium.

3.5.1 Cross-border Merger with no Hollowing-Out (NH)

In this case, the merged firm operates both plants–the lower cost plant F and the higher cost plant 2. The benefit to member firms from such a merger is the reduction in competition and the reduction in transport costs when the foreign firm branch delivers the product using the domestic firm unit transport cost advantage. The merged firm will deliver to a location x on the circle from plant F as long as the profits from delivering to that location exceed the profits from delivering from plant 2. The merged firm is indifferent between delivering to x from either plant if profits are equal. Setting profits equal gives the cutoff location $x^{CB}_{M,NH}$:

$$x^{CB}_{M,NH} = \frac{c_2 - c_F}{2t} + \frac{1}{4}. \tag{13}$$

Table 11: Profitability of Type II Merger with Costly Technology Transfer and No Hollowing-out, $\pi^{II}_{M,NH} - (\pi_2 + \pi_F)$

Demand	Number of firms (n)				
size (a)	2	4	6	8	10
5	-0.7646	-1.2129	-1.7597	-2.4060	-3.1520
6	-1.0243	-1.5358	-2.1447	-2.8526	-3.6601
7	-1.3232	-1.8982	-2.5694	-3.3390	-4.2080
8	-1.6612	-2.3003	-3.0339	-3.8653	-4.7958
9	-2.0385	-2.7420	-3.5381	-4.4315	-5.4235
10	-2.4550	-3.2232	-4.0821	-5.0374	-6.0911
11	-2.9106	-3.7441	-4.6659	-5.6832	-6.7985
12	-3.4055	-4.3045	-5.2894	-6.3688	-7.5458
13	-3.9395	-4.9045	-5.9526	-7.0943	-8.3330
14	-4.5128	-5.5442	-6.6556	-7.8596	-9.1601

Since $c_2 - c_F > 0$, $x^{CB}_{M,NH} > 1/4$. The merged firm will thus service consumers located on $(0, x^{CB}_{M,NH})$ and $(1 - x^{CB}_{M,NH}, 1)$ from plant F and consumers located on $(x^{CB}_{M,NH}, 1 - x^{CB}_{M,NH})$ from plant 2. The details for calculating firm profits are provided in Appendix A. A type II cross-border merger with no hollowing-out is profitable if $\pi^{CB}_{M,NH} > \pi_2 + \pi_F$. The results of a simulation for this type II merger with no hollowing out are provided in Tables 11 and 12.

As we observe for the parameter values selected, merging is not profitable but it does increase social welfare. This is not surprising given the results obtained from the simulation of a type II merger with costless technology transfer. By comparison, here there is no production cost advantage to merging, and so the profit differential is even more negative than it is when technology transfer is costless. This also yields a smaller social welfare differential.

3.5.2 Cross-border Merger with Hollowing-Out (H)

Here the merged firm shuts down the high-cost domestic plant 2 and services the entire market from the low-cost foreign plant F. We thus have the full benefit of production cost savings. There is also a cost advantage to using the domestic firm's lower transport cost, but there is a cost disadvantage to delivering only from one plant. A type II cross-border merger with hollowing-out is profitable if $\pi^{CB}_{M,H} > \pi_2 + \pi_F$. In equilibrium, a type II cross-border merger with no hollowing-out occurs if the following two conditions are satisfied: (i)

Table 12: Effect of Type II Merger with Costly Technology Transfer and No Hollowing-out on Social Welfare, $SW^{II}_{M,NH} - SW$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	1.8870	3.7519	6.2293	9.3174	13.0154
6	2.9998	5.9486	9.8705	14.7631	20.6259
7	4.3626	8.6353	14.3216	21.4189	29.9263
8	5.9754	11.8121	19.5827	29.2846	40.9168
9	7.8382	15.4788	25.6538	38.3603	53.5973
10	9.9510	19.6355	32.5349	48.6461	67.9677
11	12.3138	24.2822	40.2260	60.1418	84.0282
12	14.9266	29.4189	48.7271	72.8475	101.7786
13	17.7894	35.0456	58.0382	86.7632	121.2191
14	20.9022	41.1623	68.1593	101.8890	142.3496

$\pi^{CB}_{M,NH} > \pi_2 + \pi_F$ and (ii) $\pi^{CB}_{M,NH} > \pi^{CB}_{M,H}$. The results of a simulation of the hollowing out case are provided in Tables 13 and 14.

We see that hollowing out is not profitable, for all parameter values we considered. As expected, the cost savings from hollowing out serve to increase the welfare differential from merger.

4 Simultaneous Location Choice

In this version of the model, all firms, domestic and foreign, choose their location on the unit circle simultaneously. In the case of identical transportation costs for all firms, Gupta, Lai, Pal, Sarkar, and Yu (2004) show that there are infinitely many location equilibria. However, for non-identical transportation costs, Gupta (2004) shows that there exists only an equilibrium where firms agglomerate at opposite ends of the same diameter. Since in our framework it is assumed that the foreign firm has a higher unit transportation cost, we can rule out all other location equilibria except the agglomeration equilibrium. There are two such equilibria depending on the magnitude of the transport cost differential ε relative to t. The location equilibrium is characterized by:

Proposition 2 *(i) One-cluster equilibrium: All domestic firms located at $x = 0$ and the foreign firm located at $x = 1/2$ can be supported as a SPNE if and only if $t \leq \varepsilon$.*

Table 13: Profitability of Type II Merger with Costly Technology Transfer and Hollowing-out, $\pi_{M,H}^{II} - (\pi_2 + \pi_F)$

Demand size (a)	Number of firms (n) 2	4	6	8	10
5	-0.2818	-0.4003	-0.5372	-0.6926	-0.8665
6	-0.3958	-0.5353	-0.6932	-0.8696	-1.0645
7	-0.5298	-0.6903	-0.8692	-1.0666	-1.2825
8	-0.6838	-0.8653	-1.0652	-1.2836	-1.5205
9	-0.8578	-1.0603	-1.2812	-1.5206	-1.7785
10	-1.0518	-1.2753	-1.5172	-1.7776	-2.0565
11	-1.2658	-1.5103	-1.7732	-2.0546	-2.3545
12	-1.4998	-1.7653	-2.0492	-2.3516	-2.6725
13	-1.7538	-2.0403	-2.3452	-2.6686	-3.0105
14	-2.0278	-2.3353	-2.6612	-3.0056	-3.3685

Table 14: Effect of Type II Merger with Costly Technology Transfer and Hollowing-out on Social Welfare, $SW_{M,H}^{II} - SW$

Demand size (a)	Number of firms (n) 2	4	6	8	10
5	0.9658	2.2326	3.9916	6.2429	8.9865
6	1.6118	3.8246	6.8896	10.8069	15.5765
7	2.4178	5.8166	10.5076	16.4909	23.7665
8	3.3838	8.2086	14.8456	23.2949	33.5565
9	4.5098	11.0006	19.9036	31.2189	44.9465
10	5.7958	14.1926	25.6816	40.2629	57.9365
11	7.2418	17.7846	32.1796	50.4269	72.5265
12	8.8478	21.7766	39.3976	61.7109	88.7165
13	10.6138	26.1686	47.3356	74.1149	106.5065
14	12.5398	30.9606	55.9936	87.6389	125.8965

(ii) *Two-cluster equilibrium: If n is even, $n/2$ type 0 domestic firms and the type 2 domestic firm located at $x = 0$ and $n/2$ type 0 domestic firms, the type 1 domestic firm, and the foreign firm located at $x = 1/2$ can be supported as a SPNE if and only if $t \geq \varepsilon$.*[5]

Proposition 2 is the generalization of Proposition 4 in Gupta (2004), which considers only 4 firms. In the one-cluster equilibrium, all domestic firms cluster at one end of the diameter and the foreign firm, which is the firm with the highest transportation cost, locates by itself at the other end of the diameter. This equilibrium arises if the transport cost differential is large enough so that $t \leq \varepsilon$. Thus, in this equilibrium, domestic firms maximize their profits by clustering away from the foreign firm because it has a substantial cost disadvantage in delivering its product to consumers. This holds despite the fact that the foreign firm has the most efficient technology since it is only transportation costs that enter the location equilibrium condition.

In the two-cluster equilibrium, firms locate at the two ends of the diameter as illustrated in Figure 2. This equilibrium arises when the transport cost differential is not too large so that $t \geq \varepsilon$. The analysis for the two-cluster equilibrium is identical to the one in the sequential location choice case examined in Section 3, which can also be interpreted as the simultaneous location choice with two-clusters.

4.1 Domestic Mergers

Consider now the merger of domestic firms 1 and 2 in comparison to the pre-merger outcome outlined in Section 2.1. First suppose that it is costless to transfer the technology of the low-cost plant 1 to the high-cost plant 2. The merged firm therefore continues to operate both plants. If, however, technology transfer is very costly, the domestic merger results in hollowing-out as the merged firm shuts down the least efficient plant 2. In either case, the merged firm acts as one firm and produces at the lowest marginal cost, $c_M = c_1$. The merger of firms 1 and 2 gives rise to an industry with $n + 2$ firms, $n + 1$ domestic and one foreign.

[5] Other two-cluster equilibria are also possible. For example, n_1 type 0 domestic firms and the type i domestic firm located at $x = 0$ and n_2 type 0 domestic firms, the type j domestic firm, and foreign firm located at $x = 1/2$, with $n_1 + n_2 = n$, and $i, j = 1, 2$, $i \neq j$, can also be supported as a SPNE. Also, n_1 type 0 domestic firms and type 1 and 2 domestic firms located at $x = 0$ and n_2 type 0 domestic firms, and the foreign firm located at $x = 1/2$ is also a location equilibrium. To fix ideas, we choose to work with (ii).

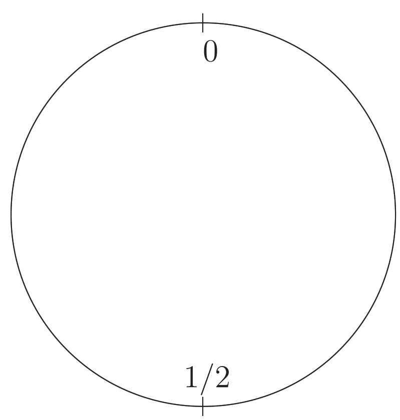

Figure 2: One-cluster location equilibrium

Table 15: Profitability of domestic merger: $\pi_M^D - (\pi_1 + \pi_2)$

Demand			Number of	firms (n)				
size (a)	1	2	3	4	5	6	7	8
4	0.0823	0.0449	0.0256	0.0146	0.0077	0.0032	0.0001	-0.0022
5	0.0888	0.0298	0.0037	-0.0089	-0.0154	-0.0189	-0.0207	-0.0215
6	0.0603	-0.0165	-0.0442	-0.0541	-0.0567	-0.0562	-0.0544	-0.0522
7	-0.0032	-0.0938	-0.1182	-0.1209	-0.1160	-0.1088	-0.1013	-0.0940
8	-0.1017	-0.2022	-0.2184	-0.2094	-0.1935	-0.1768	-0.1611	-0.1472
9	-0.2352	-0.3418	-0.3446	-0.3196	-0.2892	-0.2600	-0.2341	-0.2115
10	-0.4037	-0.5125	-0.4968	-0.4515	-0.4030	-0.3586	-0.3201	-0.2872

Solving the Cournot game at the last stage, we can determine firm profits:

$$\pi_i^D = \frac{1}{(n+3)^2 b}\Big[(k_i^D)^2 + \frac{1}{2}(k_i^D)(g_i^D) + \frac{1}{12}(g_i^D)^2\Big], \tag{14}$$

for $i = 0, M, F$, where $k_i^D = a + \sum_{j \neq i,2} c_j - (n+2)c_i + (1/2)t_F$, $g_i^D = -(2t + t_F)$ for $i = 0, M$, and $k_F^D = a + \sum_{j \neq F,2} c_j - (n+2)c_F - (1/2)(n+2)t_F$ and $g_F^D = (n+1)t + (n+2)t_F$.

It is worth noting that firms have no incentives to change their location after the domestic merger takes place. Thus, the pre-merger location equilibrium is also the only post-merger location equilibrium.

The domestic merger of firms 1 and 2 is profitable if it results in higher profits than the two firms combined prior to merging; that is, $\pi_M^D > \pi_1 + \pi_2$. As was done in the sequential model, we will perform simulations to gain insight into the profitability of mergers and their impact on social welfare. Table 15 gives the change in profits as a result of merger for the merging firms measured as the difference between the profits of the merged firm and the sum of pre-merger profits for parameters $b = 1$, $c_F = 0$, $c_1 = 0.1$, $c_2 = 0.9$, $c_0 = 1$, $t = 0.3$, and $\varepsilon = 0.7$, and by the varying market size, a, and the number of firms in the industry, n. As far as the demand size parameter, a, is concerned we restrict our attention to those parameter values for which all firms deliver to all consumers on the circle; that is quantities are positive at each location.

As Table 15 illustrates, the domestic merger of firms 1 and 2 is profitable only if the demand is not too high and the market is concentrated. It is interesting to also look at the effect of the domestic merger on the profits of non-merging firms; i.e. type 0 domestic firms and the foreign firm, F. Numerical simulations show that the profits of non-merging firms

Table 16: Social Welfare: Domestic vs Pre-merger, $SW^D - SW$

Demand			Number of	firms (n)				
size (a)	1	2	3	4	5	6	7	8
4	0.0846	-0.1528	-0.7611	-2.1420	-4.8835	-9.7541	-17.7019	-29.8545
5	0.1086	-0.1356	-0.7489	-2.1334	-4.8774	-9.7499	-17.6991	-29.8527
6	0.1101	-0.1305	-0.7440	-2.1296	-4.8747	-9.7481	-17.6980	-29.8522
7	0.0891	-0.1377	-0.7465	-2.1305	-4.8752	-9.7486	-17.6987	-29.8531
8	0.0456	-0.1571	-0.7564	-2.1363	-4.8790	-9.7514	-17.7011	-29.8553
9	-0.0204	-0.1887	-0.7737	-2.1468	-4.8861	-9.7566	-17.7052	-29.8587
10	-0.1089	-0.2325	-0.7983	-2.1621	-4.8964	-9.7642	-17.7111	-29.8635

always increase following the domestic merger, as shown in Tables 23 and 24 in Appendix B. Interestingly, such a domestic merger is socially beneficial for a very narrow range of parameter values. Table 16 shows the change in social welfare after a domestic merger takes place relative to the pre-merger case.

Social welfare increases relative to the pre-merger case if $n = 1$ and $a \in [4, 8]$. Thus, a domestic merger should be encouraged only if the market is very concentrated and the demand is not very high. There are cases when the domestic merger is privately profitable, but not socially desirable ($a = 4$ and $n \in \{1, .., 7\}$), and also cases when the merger is not privately profitable, but it is socially beneficial ($n = 1$ and $a \in [7, 8]$).

4.2 Cross-border Mergers with Costless Technology Transfer

In this section, we examine firm F's incentives to merge with domestic firm 1 when it is costless for the domestic target firm 1 to adopt the more efficient technology of the foreign acquirer F. The two firms contemplating merging are located at opposite ends of the diameter. The merged firm produces at marginal cost $c_M = c_F$. After the merger takes place the merged firm gains access to the transportation technology/network of its domestic target, t. Firm profits after the merger occurs are:

$$\pi_i^{CB} = \frac{1}{2(n+3)^2 b}\Big[({}_u k_i^{CB})^2 + \frac{1}{4}({}_u k_i^{CB})({}_u g_i^{CB}) + \frac{1}{48}({}_u g_i^{CB})^2 + ({}_\ell k_i^{CB})^2 + \frac{3}{4}({}_\ell k_i^{CB})({}_\ell g_i^{CB}) + \frac{7}{48}({}_\ell g_i^{CB})^2\Big], \tag{15}$$

for $i = 0, 2, M$, where ${}_u k_i^{CB} = a + \sum_{j \neq i, F} c_j - (n+2)c_i$, ${}_u g_i^{CB} = -t$, for $i = 0, 2, M$ ${}_\ell k_i^{CB} = a + \sum_{j \neq i, 1} c_j - (n+2)c_i + (1/2)t$, ${}_\ell g_i^{CB} = -3t$, for $i = 0, 2$, and ${}_\ell k_M^{CB} = a + \sum_{j \neq F, 1} c_j - (n+2)c_F - (1/2)(n+2)t$, ${}_\ell g_M^{CB} = (2n+3)$.

Table 17: Profitability of costless cross-border merger: $\pi_M^{CB} - (\pi_1 + \pi_F)$

Demand size (a)	1	2	3	Number of firms (n) 4	5	6	7	8
4	6.4127	5.5298	4.9802	4.6067	4.3370	4.1335	3.9745	3.8470
5	8.6854	7.1690	6.2484	5.6346	5.1981	4.8726	4.6210	4.4209
6	11.2982	9.0172	7.6572	6.7633	6.1348	5.6705	5.3144	5.0331
7	14.2509	11.0742	9.2066	7.9928	7.1472	6.5272	6.0548	5.6836
8	17.5437	13.3400	10.8965	9.3230	8.2351	7.4427	6.8421	6.3724
9	21.1764	15.8148	12.7271	10.7540	9.3987	8.4169	7.6763	7.0996
10	25.1492	18.4985	14.6982	12.2858	10.6378	9.4498	8.5575	7.8651

Table 18: Social Welfare: Costless Cross-border vs pre-merger, $SW^{CB} - SW$

Demand size (a)	1	2	3	Number of firms (n) 4	5	6	7	8
4	-4.2782	-8.1818	-14.5424	-23.8002	-36.5628	-53.6098	-75.8961	-104.5535
5	-5.7530	-10.4796	-17.7245	-27.9005	-41.6021	-59.6019	-82.8505	-112.4770
6	-7.2504	-12.7895	-20.9139	-32.0056	-46.6448	-65.5964	-89.8066	-120.4019
7	-8.7702	-15.1117	-24.1107	-36.1155	-51.6907	-71.5932	-96.7644	-128.3280
8	-10.3125	-17.4461	-27.3148	-40.2302	-56.7399	-77.5923	-103.7240	-136.2555
9	-11.8773	-19.7927	-30.5264	-44.3496	-61.7924	-83.5938	-110.6853	-144.1843
10	-13.4647	-22.1515	-33.7453	-48.4738	-66.8482	-89.5977	-117.6484	-152.1144

The cross-border merger of firms 1 and F is profitable if $\pi_M^{CB} > \pi_1 + \pi_F$, which means the merged firm earns higher profits than the two firms together before merger. Tables 17 shows that for $b = 1$, $c_F = 0$, $c_1 = 0.1$, $c_2 = 0.9$, $c_0 = 1$, $t = 0.3$, and $\varepsilon = 0.7$, the cross-border merger of firms 1 and F is profitable. The profits of the non-merged firms also increase after a merger for the entire range of the demand and competition parameters as shown in Appendix B.

Although the cross-border merger of firms 1 and F is privately profitable if technology transfer is costless, it is not socially beneficial. Table 18 shows that social welfare decreases after the merger takes place relative to the pre-merger case.

4.3 Cross-border Mergers with Very Costly Technology Transfer

Here we assume that it is prohibitively costly to transfer the more efficient technology of the foreign acquirer F to the domestic target firm 1. In this case, the merged firm must choose between operating both plants, 1 and F, thus saving on transportation costs but incurring higher production costs at plant 1, or shutting down the least efficient plant, 1, but incurring higher transportation costs. We refer to the former case as no hollowing-out (NH) and to the latter as hollowing-out (H). We examine each of the two cases in turn.

4.3.1 No Hollowing-Out (NH)

In this case, the merged firm continues to operate both plant 1 at $x = 0$ and plant F at $x = 1/2$. The merged firm faces a trade-off between saving on transportation costs and higher production costs at plant 1. The merged firm delivers to consumers on the circle from both locations. Thus, profits from delivering to location x on the half circle $(0, 1/2)$ from plant 1 are

$$ {}_u\pi_M^{NH}(x) = \frac{1}{(n+3)^2 b}[{}_uk_1^{CB} +_u g_1^{CB} x], \tag{16} $$

and profits from delivering to location x from plant F are

$$ {}_\ell\pi_M^{NH}(x) = \frac{1}{(n+3)^2 b}[{}_\ell k_F^{CB} +_\ell g_F^{CB} x]. \tag{17} $$

The firm is indifferent between delivering from plant 1 or F if

$$ {}_u\pi_M^{NH}(x) =_\ell \pi_M^{NH}(x). \tag{18} $$

Condition (18) gives the cutoff location $\hat{x}$:

$$ \hat{x} = \frac{c_F - c_1}{2t} + \frac{1}{4}. \tag{19} $$

Since $c_F - c_1 < 0$ it follows that $\hat{x} < 1/4$. Invoking symmetry we can easily determine the cutoff location $1 - \hat{x} > 3/4$ on the $(1/2, 1)$ half circle. The merged firm will deliver to consumers on $(0, \hat{x})$ and $(1 - \hat{x}, 1)$ from plant 1 and to consumers on $(\hat{x}, 1 - \hat{x})$ from plant F.

Firm profits after merger can be shown to be

$$ \begin{aligned} \pi_i^{NH} = \frac{2}{(n+3)^2 b}\Big\{ & \Big[({}_uk_i^{NH})^2\hat{x} + ({}_uk_i^{NH})({}_ug_i^{NH})\hat{x}^2 + \frac{1}{3}({}_ug_i^{NH})^2\hat{x}^3\Big] \\ & -\Big[({}_\ell k_i^{NH})^2\hat{x} + ({}_\ell k_i^{NH})({}_\ell g_i^{NH})\hat{x}^2 + \frac{1}{3}({}_\ell g_i^{NH})^2\hat{x}^3\Big] \\ & +\frac{1}{2}\Big[({}_\ell k_i^{NH})^2 + \frac{1}{2}({}_\ell k_i^{NH})({}_\ell g_i^{NH}) + \frac{1}{12}({}_\ell g_i^{NH})^2\Big]\Big\}, \end{aligned} \tag{20} $$

where ${}_uk_i^{NH} =_u k_i^{CB}$, ${}_ug_i^{NH} =_u g_i^{CB}$, ${}_\ell k_i^{NH} = {}_\ell k_i^{CB}$, and ${}_\ell g_i^{NH} = {}_\ell g_i^{CB}$, for $i = 0, 2, M$.

4.3.2 Hollowing-Out (H)

In this case, the merged firm shuts down plant 1 and services the entire circle from the more efficient plant, F. After-merger firm profits can be easily determined:

$$\pi_i^H = \frac{1}{(n+3)^2 b}\Big[(\,k_i^H)^2 + \frac{1}{2}(\,k_i^H)(g_i^H) + \frac{1}{12}(\,g_i^H)^2\Big], \tag{21}$$

for $i = 0, 2, M$, where $k_i^H = a + \sum_{j \neq i,F} c_j - (n+2)c_i$, $g_i^H = -t$, for $i = 0, 2, M$ and $k_M^H = a + \sum_{j \neq F,1} c_j - (n+2)c_F - (1/2)(n+2)t$, $g_M^H = (2n+3)$.

A cross-border merger with no hollowing-out occurs if

$$\pi_M^{NH} > \pi_1 + \pi_F \quad \text{and} \quad \pi_M^{NH} > \pi_M^H, \tag{NH}$$

must be satisfied. Thus, operating both plants after the merger must yield higher profits than the two firms together prior to the merger and must be more profitable than closing down the least efficient plant. Similarly, a merger with hollowing-out occurs if

$$\pi_M^H > \pi_1 + \pi_F \quad \text{and} \quad \pi_M^H > \pi_M^{NH} \tag{H}$$

are satisfied. Consequently, operating only the most efficient plant after the merger must yield higher profits than the two firms combined before merger and must also be more profitable than operating both plants.

Tables 19 and 20 show that a cross-border merger, with or without hollowing-out, is never profitable when technology transfer is very costly. At the same time, either type of merger increases the profits of non-merged firms, types 0's and 2's, as shown in Tables 27–30. Also, a merger with hollowing-out increases profits of non-merged firms by more than a merger with no hollowing-out.

Thus, firms do not have incentives to engage in cross-border mergers if technology transfer is very costly. However, as Table 21 shows, a cross-border merger with no hollowing-out is socially beneficial for the considered range of the demand size parameter if the market is not very competitive. The cross-border merger with hollowing-out of the domestic firm reduces social welfare relative to the pre-merger case and should not be encouraged, as shown in Table 22.

Table 19: Profitability of costly cross-border merger with no hollowing-out: $\pi_M^{NH} - (\pi_1 + \pi_F)$

Demand				Number of	firms (n)			
size (a)	1	2	3	4	5	6	7	8
4	-0.2363	-0.3386	-0.3936	-0.4265	-0.4476	-0.4619	-0.4720	-0.4794
5	-0.3901	-0.5041	-0.5534	-0.5761	-0.5863	-0.5904	-0.5913	-0.5904
6	-0.5789	-0.7006	-0.7393	-0.7474	-0.7432	-0.7343	-0.7236	-0.7127
7	-0.8028	-0.9283	-0.9513	-0.9404	-0.9183	-0.8934	-0.8690	-0.8462
8	-1.0616	-1.1871	-1.1893	-1.1550	-1.1115	-1.0679	-1.0274	-0.9909
9	-1.3554	-1.4769	-1.4535	-1.3914	-1.3228	-1.2577	-1.1990	-1.1469
10	-1.6842	-1.7979	-1.7437	-1.6494	-1.5522	-1.4628	-1.3835	-1.3142

Table 20: Profitability of costly cross-border merger with hollowing-out: $\pi_M^{H} - (\pi_1 + \pi_F)$

Demand				Number of	firms (n)			
size (a)	1	2	3	4	5	6	7	8
4	-0.2450	-0.3472	-0.4021	-0.4348	-0.4558	-0.4701	-0.4801	-0.4875
5	-0.4003	-0.5140	-0.5631	-0.5855	-0.5955	-0.5994	-0.6001	-0.5992
6	-0.5907	-0.7118	-0.7501	-0.7578	-0.7533	-0.7441	-0.7332	-0.7221
7	-0.8161	-0.9408	-0.9632	-0.9518	-0.9293	-0.9041	-0.8794	-0.8563
8	-1.0765	-1.2010	-1.2024	-1.1675	-1.1234	-1.0794	-1.0386	-1.0017
9	-1.3718	-1.4922	-1.4677	-1.4048	-1.3356	-1.2700	-1.2108	-1.1584
10	-1.7022	-1.8145	-1.7591	-1.6639	-1.5659	-1.4759	-1.3962	-1.3264

Table 21: Social Welfare: NH vs Pre-merger, $SW^{NH} - SW$

Demand				Number of	firms (n)			
size (a)	1	2	3	4	5	6	7	8
4	3.0697	2.4572	-0.6704	-6.6676	-16.1236	-29.8195	-48.7200	-73.9712
5	3.9429	3.5938	0.6395	-5.2348	-14.5989	-28.2234	-47.0669	-72.2715
6	4.7936	4.7182	1.9420	-3.8067	-13.0775	-26.6297	-45.4156	-70.5732
7	5.6218	5.8304	3.2372	-2.3834	-11.5593	-25.0384	-43.7660	-68.8761
8	6.4276	6.9303	4.5250	-0.9649	-10.0444	-23.4494	-42.1181	-67.1804
9	7.2108	8.0181	5.8054	0.4488	-8.5328	-21.8627	-40.4720	-65.4860
10	7.9715	9.0936	7.0785	1.8577	-7.0245	-20.2784	-38.8276	-63.7929

Table 22: Social Welfare: H vs Pre-merger, $SW^H - SW$

Demand size (a)	Number of firms (n) 1	2	3	4	5	6	7	8
4	-0.8804	-1.0840	-1.6733	-3.0424	-5.7760	-10.6410	-18.5847	-30.7342
5	-1.1064	-1.2588	-1.8166	-3.1644	-5.8824	-10.7356	-18.6699	-30.8117
6	-1.3549	-1.4457	-1.9674	-3.2912	-5.9922	-10.8325	-18.7568	-30.8906
7	-1.6259	-1.6449	-2.1254	-3.4228	-6.1052	-10.9318	-18.8455	-30.9708
8	-1.9194	-1.8563	-2.2909	-3.5591	-6.2215	-11.0334	-18.9359	-31.0523
9	-2.2354	-2.0799	-2.4637	-3.7002	-6.3411	-11.1374	-19.0280	-31.1351
10	-2.5739	-2.3157	-2.6439	-3.8462	-6.4639	-11.2437	-19.1219	-31.2192

5 Conclusions

Our paper has examined the profitability and social desirability of mergers, both domestic and cross-border. Mergers can be profitable in our set-up if reductions in competition and reductions in production and transport costs outweigh the strategic response of competing non-merging firms. Mergers can also be socially beneficial in the presence of strong strategic behaviour of non-merging firms in combination with cost induced increases in output. We have also identified circumstances where mergers are not privately profitable but they increase social welfare. This may give rise to a role for public policy to encourage mergers that are socially beneficial.

The results of our model are dependent on its underlying assumptions. Future work could explore the robustness of the results to changes in these assumptions. For example, an extension would be to explore different production technologies that can give rise to increasing or decreasing returns to scale. A further extension would be to use a different demand function. In our model, we made two alternative assumptions regarding the cost of technology transfer. One assumption is that it is costless for the acquirer to transfer its more efficient technology to the target firm. The opposite assumption is that technology transfer is prohibitively costly and the target firm continues to produce using its high-cost technology following a merger. It would be interesting to consider the case where technology transfer is costly, but not prohibitively so. This would allow us to determine the effect of this cost on merger profitability and the decision of the merged firm to hollow out the domestic target.

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Appendices

A Sequential Location Choice

A.1 Pre-Merger Outcome

Firm profits are given by:

$$\pi_0^s = \frac{1}{(n+4)^2 b}\Big[(k_0^s)^2 + \frac{1}{2}(k_0^s)(g_0^s) + \frac{1}{12}{g_0^s}^2\Big], \tag{A.1}$$

$$\pi_i = \frac{1}{(n+4)^2 b}\Big[(k_i)^2 + \frac{1}{2}(k_i)(g_i) + \frac{1}{12}{g_i}^2\Big], \tag{A.2}$$

Using the expressions in section 2.1 for the location equilibrium identified above, we can determine firm profits as:for $s = 0, 1/2$ and $i = 1, 2, F$ where

$$k_0^0 = a + \sum_{j\neq 0} c_j - 4c_0 + \frac{n+2}{4}t, \tag{A.3}$$

$$g_0^0 = t_F - (n+4)t, \tag{A.4}$$

$$k_0^{1/2} = a + \sum_{i\neq 0} c_i - 4c_0 - \frac{n+6}{4}t, \tag{A.5}$$

$$g_0^{1/2} = t_F + (n+4)t, \tag{A.6}$$

$$k_1 = a + \sum_{j\neq 1} c_j - (n+3)c_1 + \frac{n+1}{4}t, \tag{A.7}$$

$$g_1 = g_0^0, \tag{A.8}$$

$$k_F = a + \sum_{j\neq F} c_j - (n+3)c_F + \frac{n+2}{4}t, \tag{A.9}$$

$$g_F = -(n+3)t_F, \tag{A.10}$$

$$k_2 = a + \sum_{j\neq 2} c_j - (n+3)c_2 - \frac{n+6}{4}t, \tag{A.11}$$

$$g_2 = g_0^{1/2}. \tag{A.12}$$

A.2 Domestic Merger with Costless Technology Transfer

Domestic firm profits are given by:

$$\pi_0^{s,D} = \frac{1}{2(n+3)^2 b}\Big[({}_u k_0^{s,D})^2 + \frac{1}{4}({}_u k_0^{s,D})({}_u g_0^{s,D}) + \frac{1}{48}({}_u g_0^{s,D})^2 + ({}_\ell k_0^{s,D})^2 + \frac{3}{4}({}_\ell k_0^{s,D})({}_\ell g_0^{s,D}) + \frac{7}{48}({}_\ell g_0^{s,D})^2\Big], \tag{A.13}$$

$$\pi_i^D = \frac{1}{2(n+3)^2 b}\Big[({}_u k_i^D)^2 + \frac{1}{4}({}_u k_i^D)({}_u g_i^D) + \frac{1}{48}({}_u g_i^D)^2 + ({}_\ell k_i^D)^2 + \frac{3}{4}({}_\ell k_i^D)({}_\ell g_i^D) + \frac{7}{48}({}_\ell g_i^D)^2\Big], \tag{A.14}$$

$$
\begin{aligned}
{}_u k_0^{0,D} &= a + \sum_{j\neq 0} c_j - 3c_0 + \frac{n}{4}t, && \text{(A.15)}\\
{}_u g_0^{0,D} &= t_F - (n+2)t, && \text{(A.16)}\\
{}_u k_0^{1/2,D} &= a + \sum_{j\neq 0} c_j - 3c_0 - \frac{n+6}{4}t, && \text{(A.17)}\\
{}_u g_0^{1/2,D} &= t_F + (n+4)t, && \text{(A.18)}\\
{}_\ell k_0^{0,D} &= a + \sum_{j\neq 0} c_j - 3c_0 + \frac{n+2}{4}t, && \text{(A.19)}\\
{}_\ell g_0^{0,D} &= t_F - (n+4)t, && \text{(A.20)}\\
{}_\ell k_0^{1/2,D} &= a + \sum_{j\neq 0} c_j - 3c_0 - \frac{n+4}{4}t, && \text{(A.21)}\\
{}_\ell g_0^{1/2,D} &= t_F + (n+3)t, && \text{(A.22)}\\
{}_u k_i^{D} &= a + \sum_{j\neq i} c_j - (n+2)c_i + \frac{n}{4}t, \quad \text{for} \quad i = M, F && \text{(A.23)}\\
{}_u g_F^{D} &= t - (n+2)t_F, && \text{(A.24)}\\
{}_u g_M^{D} &= t_F - (n+2)t, && \text{(A.25)}\\
{}_\ell k_F^{D} &= a + \sum_{j\neq F} c_j - (n+2)c_F + \frac{n+2}{4}t, && \text{(A.26)}\\
{}_\ell g_F^{D} &= -[t + (n+2)t_F], && \text{(A.27)}\\
{}_\ell k_M^{D} &= a + \sum_{j\neq 1} c_j - (n+2)c_1 - t, && \text{(A.28)}\\
{}_\ell g_M^{D} &= t_F + (n+2)t. && \text{(A.29)}
\end{aligned}
$$

A.3 Domestic Merger with Very Costly Technology Transfer and No Hollowing-Out

The merged firm's profits from delivering to a location x from plant 1 and 2 respectively are:

$$
\begin{aligned}
{}_u\pi_{M,NH}^{D}(x) &= \frac{1}{(n+3)^2 b}[{}_u k_{M,NH}^{D} + {}_u\, g_{M,NH}^{D}], && \text{(A.30)}\\
{}_\ell\pi_{M,NH}^{D}(x) &= \frac{1}{(n+3)^2 b}[{}_\ell k_{M,NH}^{D} + {}_\ell\, g_{M,NH}^{D}], && \text{(A.31)}
\end{aligned}
$$

where

$$
\begin{aligned}
{}_u k^D_{M,NH} &= a + \sum_{j \neq 1,1} c_j - (n+2)c_1 + \frac{nt}{4}, && \text{(A.32)}\\
{}_u g^D_{M,NH} &= t_F - (n+2)t, && \text{(A.33)}\\
{}_\ell k^D_{M,NH} &= a + \sum_{j \neq 1,1} c_j - (n+2)c_2 + \frac{nt}{4}, && \text{(A.34)}\\
{}_\ell g^D_{M,NH} &= t_F + (n+2)t. && \text{(A.35)}
\end{aligned}
$$

The indifference condition

$$
{}_u\pi^{NH}_M(x) =_\ell \pi^{NH}_M(x) \tag{A.36}
$$

gives the cutoff location x^D_{NH}:

$$
x^D_{NH} = \frac{c_2 - c_1}{2t} + \frac{1}{4}. \tag{A.37}
$$

The merged firm will thus service consumers located on $(0, x^D_{NH})$ and $(1-x^D_{NH}, 1)$ from plant 1 and consumers located on $(x^D_{NH}, 1 - x^D_{NH})$ from plant 2.

Firm profits can then be shown to be:

$$
\begin{aligned}
\pi^{s,D}_{0,NH} = \frac{2}{(n+3)^2 b} \Big\{ & \Big[({}_u k^{s,D}_{0,NH})^2 x^D_{NH} + ({}_u k^{s,D}_{0,NH})({}_u g^{s,D}_{0,NH})(x^D_{NH})^2 + \frac{1}{3}({}_u g^{s,D}_{0,NH})^2 (x^D_{NH})^3 \Big] \\
& - \Big[({}_\ell k^{0,D}_{0,NH})^2 x^D_{NH} + ({}_\ell k^{0,D}_{0,NH})({}_\ell g^{s,D}_{0,NH})(x^D_{NH})^2 + \frac{1}{3}({}_\ell g^{s,D}_{0,NH})^2 (x^D_{NH})^3 \Big] \\
& + \frac{1}{2}\Big[({}_\ell k^{s,D}_{0,NH})^2 + \frac{1}{2}({}_\ell k^{s,D}_{0,NH})({}_\ell g^{s,D}_{0,NH}) + \frac{1}{12}({}_\ell g^{s,D}_{0,NH})^2 \Big] \Big\},
\end{aligned} \tag{A.38}
$$

$$
\begin{aligned}
\pi^{D}_{i,NH} = \frac{2}{(n+3)^2 b} \Big\{ & \Big[({}_u k^{D}_{i,NH})^2 x^D_{NH} + ({}_u k^{D}_{i,NH})({}_u g^{D}_{i,NH})(x^D_{NH})^2 + \frac{1}{3}({}_u g^{D}_{i,NH})^2 (x^D_{NH})^3 \Big] \\
& - \Big[({}_\ell k^{D}_{i,NH})^2 x^D_{NH} + ({}_\ell k^{D}_{i,NH})({}_\ell g^{D}_{i,NH})(x^D_{NH})^2 + \frac{1}{3}({}_\ell g^{D}_{i,NH})^2 (x^D_{NH})^3 \Big] \\
& + \frac{1}{2}\Big[({}_\ell k^{D}_{i,NH})^2 + \frac{1}{2}({}_\ell k^{D}_{i,NH})({}_\ell g^{NH}_{i}) + \frac{1}{12}({}_\ell g^{NH}_{i})^2 \Big] \Big\},
\end{aligned} \tag{A.39}
$$

for $s = 0, 1/2$ and $i = F, M$, where

$$
\begin{aligned}
{}_u k_{0,NH}^{0,D} &= a + \sum_{j \neq 0,2} c_j - 3c_0 + \frac{nt}{4}, && \text{(A.40)} \\
{}_u g_{0,NH}^{0,D} &= t_F - (n+2)t, && \text{(A.41)} \\
{}_\ell k_{0,NH}^{0,D} &= a + \sum_{j \neq 0,1} c_j - 3c_0 + \frac{n+2}{4}t, && \text{(A.42)} \\
{}_\ell g_{0,NH}^{0,D} &= t_F - (n+4)t, && \text{(A.43)} \\
{}_u k_{0,NH}^{1/2,D} &= a + \sum_{j \neq 0,2} c_j - 3c_0 - \frac{n+6}{4}t, && \text{(A.44)} \\
{}_u g_{0,NH}^{1/2,D} &= t_F + (n+4)t, && \text{(A.45)} \\
{}_\ell k_{0,NH}^{1/2,D} &= a + \sum_{j \neq 0,1} c_j - 3c_0 - \frac{n+4}{4}t, && \text{(A.46)} \\
{}_\ell g_{0,NH}^{1/2,D} &= t_F + (n+2)t, && \text{(A.47)} \\
{}_u k_{F,NH}^{D} &= a + \sum_{j \neq F,2} c_j - (n+2)c_F + \frac{nt}{4}, && \text{(A.48)} \\
{}_u g_{F,NH}^{D} &= t - (n+2)t_F, && \text{(A.49)} \\
{}_\ell k_{F,NH}^{D} &= a + \sum_{j \neq 1,F} c_j - (n+2)c_F + \frac{n+2}{4}t, && \text{(A.50)} \\
{}_\ell g_{F,NH}^{D} &= -[t + (n+2)t_F], && \text{(A.51)} \\
{}_u k_{M,NH}^{D} &= a + \sum_{j \neq 1,2} c_j - (n+2)c_1 + \frac{nt}{4}, && \text{(A.52)} \\
{}_u g_{M,NH}^{D} &= t_F - (n+2)t, && \text{(A.53)} \\
{}_\ell k_{M,NH}^{D} &= a + \sum_{j \neq 1,2} c_j - (n+2)c_2 - \frac{n+4}{4}t, && \text{(A.54)} \\
{}_\ell g_{M,NH}^{D} &= t_F + (n+2)t. && \text{(A.55)}
\end{aligned}
$$

A.4 Domestic Merger with Very Costly Technology Transfer and Hollowing-Out

Firm profits in this case are:

$$
\begin{aligned}
\pi_{0,H}^{s,D} &= \frac{1}{(n+3)^2 b}\Big[(k_{0,H}^{s,D})^2 + \frac{1}{2}(k_{0,D}^{s,D})(g_{0,H}^{s,D}) + \frac{1}{12}(g_{0,H}^{s,D})^2\Big], && \text{(A.56)} \\
\pi_{i,H}^{D} &= \frac{1}{(n+3)^2 b}\Big[(k_{i,H}^{D})^2 + \frac{1}{2}(k_{i,H}^{D})(g_{i,H}^{D}) + \frac{1}{12}(g_{i,H}^{D})^2\Big], && \text{(A.57)}
\end{aligned}
$$

for $s = 0, 1/2$ and $i = 1, M$, where

$$k_{0,H}^{0,D} = a + \sum_{j \neq 0,2} c_j - 3c_0 + \frac{nt}{4}, \tag{A.58}$$

$$g_{0,H}^{0,D} = t_F - (n+2)t, \tag{A.59}$$

$$k_{0,H}^{1/2,D} = a + \sum_{j \neq 0,2} c_j - 3c_0 - \frac{n+6}{4}t, \tag{A.60}$$

$$g_{0,H}^{1/2,D} = t_F + (n+4)t, \tag{A.61}$$

$$k_{i,H}^{D} = a + \sum_{j \neq i,2} c_j - (n+2)c_i + \frac{nt}{4}, \tag{A.62}$$

$$g_{i,H}^{D} = t - (n+2)t_F, \tag{A.63}$$

for $i = F, M$.

A.5 Type I Cross-Border Merger with Costless Technology Transfer

Firm profits after the type I cross-border merger takes place are:

$$\pi_0^{s,I} = \frac{1}{(n+3)^2 b}\Big[(k_0^{s,I})^2 + \frac{1}{2}(k_0^{s,I})(g_0^{s,I}) + \frac{1}{12}(g_0^{s,I})^2\Big], \tag{A.64}$$

$$\pi_i^{I} = \frac{1}{(n+3)^2 b}\Big[(k_i^{I})^2 + \frac{1}{2}(k_i^{I})(g_i^{I}) + \frac{1}{12}(g_i^{I})^2\Big], \tag{A.65}$$

for $s = 0, 1/2$ and $i = M, 2$ where

$$k_0^{0,I} = a + \sum_{j \neq 0} c_j - 3c_0 + \frac{n+2}{4}t, \tag{A.66}$$

$$g_0^{0,I} = -(n+3)t, \tag{A.67}$$

$$k_0^{1/2,I}, = a + \sum_{i \neq 0} c_i - 3c_0 - \frac{n+4}{4}t, \tag{A.68}$$

$$g_0^{1/2,I} = (n+3)t, \tag{A.69}$$

$$k_M^{I} = a + \sum_{j \neq F} c_j - (n+2)c_F + \frac{n+2}{4}t, \tag{A.70}$$

$$g_M^{I} = -(n+3)t_F, \tag{A.71}$$

$$k_2^{I} = a + \sum_{j \neq 2} c_j - (n+2)c_2 - \frac{n+4}{4}t, \tag{A.72}$$

$$g_2^{I} = g_0^{1/2,I}. \tag{A.73}$$

A.6 Type II Cross-Border Merger with Costless Technology Transfer

Firm profits after this type II merger takes place can be derived as:

$$\pi_0^{s,II} = \frac{1}{2(n+3)^2 b}\Big[({}_uk_0^{s,II})^2 + \frac{1}{4}({}_uk_0^{s,II})({}_ug_0^{s,II}) + \frac{1}{48}({}_ug_0^{s,II})^2 + ({}_\ell k_0^{s,II})^2 + \frac{3}{4}({}_\ell k_0^{s,II})({}_\ell g_0^{s,II}) + \frac{7}{48}({}_\ell g_0^{s,II})^2\Big], \tag{A.74}$$

$$\pi_i^{II} = \frac{1}{2(n+3)^2 b}\Big[({}_uk_i^{II})^2 + \frac{1}{4}({}_uk_i^{II})({}_ug_i^{II}) + \frac{1}{48}({}_ug_i^{II})^2 + ({}_\ell k_i^{II})^2 + \frac{3}{4}({}_\ell k_i^{II})({}_\ell g_i^{II}) + \frac{7}{48}({}_\ell g_i^{II})^2\Big], \tag{A.75}$$

for $s = 0, 1/2$ and $i = 1, M$, where

$$ {}_uk_0^{0,II} = a + \sum_{j\neq 0} c_j - 3c_0 + \frac{nt}{4}, \tag{A.76}$$

$$ {}_ug_0^{0,II} = -(n+1)t, \tag{A.77}$$

$$ {}_\ell k_0^{0,II} = a + \sum_{j\neq 0} c_j - 3c_0 + \frac{n+2}{4}t, \tag{A.78}$$

$$ {}_\ell g_0^{0,II} = -(n+3)t, \tag{A.79}$$

$$ {}_uk_0^{1/2,II} = a + \sum_{j\neq 0} c_j - 3c_0 - \frac{n+2}{2}t, \tag{A.80}$$

$$ {}_ug_0^{1/2,II} = (n+3)t, \tag{A.81}$$

$$ {}_\ell k_0^{1/2,II} = a + \sum_{j\neq 0} c_j - 3c_0 - \frac{n+1}{2}t, \tag{A.82}$$

$$ {}_\ell g_0^{1/2,II} = (2n+1)t, \tag{A.83}$$

$$ {}_uk_1^{II} = a + \sum_{j\neq 1} c_j - (n+2)c_1 + \frac{nt}{4}, \tag{A.84}$$

$$ {}_ug_1^{II} = -(n+1)t, \tag{A.85}$$

$$ {}_\ell k_1^{II} = a + \sum_{j\neq 1} c_j - (n+2)c_1 + \frac{n+2}{4}t, \tag{A.86}$$

$$ {}_\ell g_1^{II} = -(n+3)t, \tag{A.87}$$

$$ {}_uk_M^{II} = a + \sum_{j\neq F} c_j - (n+2)c_F + \frac{nt}{4}, \tag{A.88}$$

$$ {}_ug_M^{II} = -(n+1)t, \tag{A.89}$$

$$ {}_\ell k_M^{II} = a + \sum_{j\neq F} c_j - (n+2)c_F - \frac{n+4}{4}t, \tag{A.90}$$

$$ {}_\ell g_M^{II} = (n+3)t. \tag{A.91}$$

A.7 Type II Cross-Border Merger with No Hollowing-Out

Profits from delivering to x from plants F and 1 respectively are

$$
\begin{aligned}
{}_u\pi_M^{NH}(x) &= \frac{1}{(n+3)^2 b}[{}_u k_M^{II} +_u g_M^{II}], && \text{(A.92)}\\
{}_\ell\pi_M^{NH}(x) &= \frac{1}{(n+3)^2 b}[{}_\ell k_M^{II} +_\ell g_M^{II}]. && \text{(A.93)}
\end{aligned}
$$

The indifference condition is given by

$$
{}_u\pi_M^{NH}(x) =_\ell \pi_M^{NH}(x) \tag{A.94}
$$

$$
\begin{aligned}
\pi_{0,Nh}^{s,CB} = \frac{2}{(n+3)^2 b}\Big\{ &\Big[({}_u k_{0,NH}^{s,CB})^2 x_{M,NH}^{CB} + ({}_u k_{0,NH}^{s,CB})({}_u g_{0,NH}^{s,CB})(x_{M,NH}^{CB})^2 + \frac{1}{3}({}_u g_{0,NH}^{s,CB})^2 (x_{M,NH}^{CB})^3\Big] \\
&-\Big[({}_\ell k_{0,NH}^{0,CB})^2 x_{M,NH}^{CB} + ({}_\ell k_{0,NH}^{0,CB})({}_\ell g_{0,NH}^{s,CB})(x_{M,NH}^{CB})^2 + \frac{1}{3}({}_\ell g_{0,NH}^{s,CB})^2 (x_{M,NH}^{CB})^3\Big] \qquad \text{(A.95)}\\
&+\frac{1}{2}\Big[({}_\ell k_{0,NH}^{s,CB})^2 + \frac{1}{2}({}_\ell k_{0,NH}^{s,CB})({}_\ell g_{0,NH}^{s,CB}) + \frac{1}{12}({}_\ell g_{0,NH}^{s,CB})^2\Big]\Big\},
\end{aligned}
$$

$$
\begin{aligned}
\pi_{i,NH}^{CB} = \frac{2}{(n+3)^2 b}\Big\{ &\Big[({}_u k_{i,NH}^{CB})^2 x_{M,NH}^{CB} + ({}_u k_{i,NH}^{CB})({}_u g_{i,NH}^{CB})(x_{M,NH}^{CB})^2 + \frac{1}{3}({}_u g_{i,NH}^{CB})^2 (x_{M,NH}^{CB})^3\Big] \\
&-\Big[({}_\ell k_{i,NH}^{CB})^2 x_{M,NH}^{CB} + ({}_\ell k_{i,NH}^{CB})({}_\ell g_{i,NH}^{CB})(x_{M,NH}^{CB})^2 + \frac{1}{3}({}_\ell g_{i,NH}^{CB})^2 (x_{M,NH}^{CB})^3\Big] \qquad \text{(A.96)}\\
&+\frac{1}{2}\Big[({}_\ell k_{i,NH}^{CB})^2 + \frac{1}{2}({}_\ell k_{i,NH}^{CB})({}_\ell g_{i,NH}^{CB}) + \frac{1}{12}({}_\ell g_{i,NH}^{CB})^2\Big]\Big\},
\end{aligned}
$$

for $s = 0, 1/2$ and $i = 1, M$, where

$$
\begin{aligned}
{}_u k_{0,NH}^{0,CB} &= a + \sum_{j \neq 0,2} c_j - 3c_0 + \frac{nt}{4}, && \text{(A.97)} \\
{}_u g_{0,NH}^{0,CB} &= -(n+1)t, && \text{(A.98)} \\
{}_\ell k_{0,NH}^{0,CB} &= a + \sum_{j \neq 0,F} c_j - 3c_0 + \frac{n+2}{4} t, && \text{(A.99)} \\
{}_\ell g_{0,NH}^{0,CB} &= -(n+3)t, && \text{(A.100)} \\
{}_u k_{0,NH}^{1/2,CB} &= a + \sum_{j \neq 0,2} c_j - 3c_0 - \frac{n+6}{4} t, && \text{(A.101)} \\
{}_u g_{0,NH}^{1/2,CB} &= (n+5)t, && \text{(A.102)} \\
{}_\ell k_{0,NH}^{1/2,CB} &= a + \sum_{j \neq 0,F} c_j - 3c_0 - \frac{n+4}{4} t, && \text{(A.103)} \\
{}_\ell g_{0,NH}^{1/2,CB} &= (n+3)t, && \text{(A.104)} \\
{}_u k_{1,NH}^{CB} &= a + \sum_{j \neq 1,2} c_j - (n+2)c_1 + \frac{nt}{4}, && \text{(A.105)} \\
{}_u g_{1,NH}^{CB} &= -(n+1)t, && \text{(A.106)} \\
{}_\ell k_{1,NH}^{CB} &= a + \sum_{j \neq 1,F} c_j - (n+2)c_1 + \frac{n+2}{4} t, && \text{(A.107)} \\
{}_\ell g_1^{NH} &= -(n+3)t, && \text{(A.108)} \\
{}_u k_{M,NH}^{CB} &= a + \sum_{j \neq F,2} c_j - (n+2)c_F - \frac{nt}{4}, && \text{(A.109)} \\
{}_u g_M^{NH} &= -(n+1)t, && \text{(A.110)} \\
{}_\ell k_{M,NH}^{CB} &= a + \sum_{j \neq F,2} c_j - (n+2)c_2 - \frac{n+4}{4} t, && \text{(A.111)} \\
{}_\ell g_{M,NH}^{CB} &= (n+3)t. && \text{(A.112)}
\end{aligned}
$$

A.8 Type II Cross-border Merger with Hollowing Out

Profits are given by:

$$
\begin{aligned}
\pi_{0,H}^{s,CB} &= \frac{1}{(n+3)^2 b}\Big[(\,k_{0,H}^{s,CB})^2 + \frac{1}{2}(\,k_{0,H}^{s,CB})(g_{0,H}^{s,CB}) + \frac{1}{12}(\,g_{0,H}^{s,CB})^2\Big], && \text{(A.113)} \\
\pi_{i,H}^{CB} &= \frac{1}{(n+3)^2 b}\Big[(\,k_{i,H}^{CB})^2 + \frac{1}{2}\,k_{i,H}^{CB} g_{i,H}^{CB} + \frac{1}{12}(\,g_{i,H}^{CB})^2\Big], && \text{(A.114)}
\end{aligned}
$$

for $s = 0, 1/2$ and $i = 1, M$, where

$$k_{0,H}^{0,CB} = a + \sum_{j\neq 0,1} c_j - 3c_0 + \frac{nt}{4}, \tag{A.115}$$

$$g_{0,H}^{0,CB} = -(n+1)t, \tag{A.116}$$

$$k_{0,H}^{1/2,CB} = a + \sum_{j\neq 0,2} c_j - 3c_0 - \frac{n+6}{4}t, \tag{A.117}$$

$$g_{0,H}^{1/2,CB} = (n+5)t, \tag{A.118}$$

$$k_{i,H}^{CB} = a + \sum_{j\neq i,2} c_j - (n+2)c_i + \frac{nt}{4}, \tag{A.119}$$

$$g_{i,H}^{CB} = -(n+1)t, \tag{A.120}$$

B Profits of Non-Merged Firms

B.1 Simultaneous location choice

Table 23: Impact of merger on firm 0 profits: domestic vs pre-merger, $\pi_0^D - \pi_0$

Demand				Number of	firms (n)			
size (a)	1	2	3	4	5	6	7	8
4	0.0428	0.0246	0.0157	0.0107	0.0077	0.0058	0.0045	0.0036
5	0.1273	0.0718	0.0448	0.0301	0.0214	0.0158	0.0120	0.0094
6	0.2568	0.1433	0.0887	0.0591	0.0415	0.0304	0.0231	0.0180
7	0.4313	0.2393	0.1473	0.0976	0.0683	0.0498	0.0376	0.0291
8	0.6508	0.3598	0.2207	0.1457	0.1016	0.0739	0.0555	0.0429
9	0.9153	0.5046	0.3088	0.2033	0.1414	0.1026	0.0770	0.0594
10	1.2248	0.6740	0.4116	0.2706	0.1878	0.1360	0.1019	0.0784

Table 24: Impact of merger on firm F profits: domestic merger vs pre-merger, $\pi_F^D - \pi_F$

Demand				Number of	firms (n)			
size (a)	1	2	3	4	5	6	7	8
4	0.1705	0.1153	0.0843	0.0652	0.0524	0.0433	0.0367	0.0317
5	0.3375	0.2174	0.1528	0.1140	0.0889	0.0716	0.0593	0.0500
6	0.5495	0.3439	0.2359	0.1724	0.1320	0.1046	0.0853	0.0711
7	0.8065	0.4949	0.3338	0.2404	0.1816	0.1423	0.1148	0.0947
8	1.1085	0.6704	0.4465	0.3180	0.2379	0.1847	0.1477	0.1210
9	1.4555	0.8703	0.5739	0.4051	0.3006	0.2318	0.1842	0.1499
10	1.8475	1.0946	0.7160	0.5018	0.3700	0.2836	0.2241	0.1815

B.2 Sequential location choice

Table 25: Impact of merger on firm 0 profits: cross-border merger vs pre-merger, $\pi_0^{CB} - \pi_0$

Demand				Number of	firms (n)			
size (a)	1	2	3	4	5	6	7	8
4	0.7376	0.4693	0.3245	0.2376	0.1814	0.1430	0.1157	0.0954
5	1.7533	1.1124	0.7675	0.5611	0.4279	0.3370	0.2722	0.2245
6	3.1891	2.0200	1.3920	1.0166	0.7746	0.6097	0.4922	0.4057
7	5.0448	3.1920	2.1978	1.6041	1.2217	0.9611	0.7757	0.6392
8	7.3206	4.6284	3.1850	2.3236	1.7690	1.3913	1.1227	0.9249
9	10.0163	6.3293	4.3537	3.1751	2.4167	1.9003	1.5331	1.2628
10	13.1321	8.2946	5.7037	4.1587	3.1647	2.4881	2.0070	1.6529

Table 26: Impact of merger on firm 2 profits: cross-border merger vs pre-merger, $\pi_2^{CB} - \pi_2$

Demand				Number of	firms (n)			
size (a)	1	2	3	4	5	6	7	8
4	1.0811	0.7486	0.5614	0.4444	0.3657	0.3099	0.2687	0.2371
5	2.2568	1.5184	1.1092	0.8571	0.6899	0.5727	0.4870	0.4222
6	3.8526	2.5526	1.8384	1.4019	1.1145	0.9143	0.7689	0.6595
7	5.8683	3.8513	2.7490	2.0787	1.6393	1.3347	1.1142	0.9490
8	8.3041	5.4144	3.8410	2.8875	2.2644	1.8338	1.5230	1.2908
9	11.1598	7.2420	5.1144	3.8283	2.9899	2.4117	1.9952	1.6848
10	14.4356	9.3340	6.5692	4.9012	3.8156	3.0683	2.5310	2.1310

Table 27: Impact of merger on firm 0 profits: cross-border merger with no hollowing-out vs pre-merger, $\pi_0^{NH} - \pi_0$

Demand				Number of	firms (n)			
size (a)	1	2	3	4	5	6	7	8
4	0.1576	0.0981	0.0667	0.0482	0.0364	0.0285	0.0229	0.0188
5	0.3197	0.1949	0.1304	0.0930	0.0695	0.0538	0.0428	0.0349
6	0.5268	0.3161	0.2087	0.1473	0.1090	0.0838	0.0663	0.0537
7	0.7790	0.4618	0.3018	0.2111	0.1552	0.1185	0.0932	0.0751
8	1.0761	0.6319	0.4097	0.2845	0.2079	0.1579	0.1236	0.0991
9	1.4182	0.8265	0.5323	0.3675	0.2671	0.2019	0.1574	0.1258
10	1.8053	1.0455	0.6696	0.4601	0.3329	0.2507	0.1948	0.1552

Table 28: Impact of merger on firm 0 profits: cross-border merger with hollowing-out vs pre-merger, $\pi_0^H - \pi_0$

Demand				Number of	firms (n)			
size (a)	1	2	3	4	5	6	7	8
4	0.1587	0.0988	0.0672	0.0486	0.0367	0.0287	0.0230	0.0189
5	0.3213	0.1959	0.1311	0.0935	0.0699	0.0541	0.0431	0.0351
6	0.5289	0.3175	0.2097	0.1479	0.1096	0.0842	0.0666	0.0539
7	0.7816	0.4635	0.3030	0.2120	0.1558	0.1190	0.0936	0.0754
8	1.0792	0.6339	0.4111	0.2856	0.2087	0.1585	0.1241	0.0996
9	1.4218	0.8288	0.5339	0.3687	0.2680	0.2026	0.1580	0.1263
10	1.8094	1.0481	0.6715	0.4615	0.3340	0.2515	0.1954	0.1557

Table 29: Impact of merger on firm 2 profits: no hollowing-out vs pre-merger, $\pi_2^{NH} - \pi_2$

Demand				Number of	firms (n)			
size (a)	1	2	3	4	5	6	7	8
4	0.2047	0.1343	0.0960	0.0728	0.0575	0.0470	0.0393	0.0335
5	0.3768	0.2377	0.1644	0.1211	0.0933	0.0745	0.0611	0.0512
6	0.5939	0.3656	0.2475	0.1789	0.1357	0.1067	0.0863	0.0715
7	0.8560	0.5180	0.3454	0.2464	0.1846	0.1436	0.1151	0.0944
8	1.1631	0.6947	0.4580	0.3234	0.2401	0.1852	0.1473	0.1200
9	1.5152	0.8960	0.5854	0.4099	0.3021	0.2315	0.1829	0.1482
10	1.9123	1.1216	0.7274	0.5060	0.3707	0.2825	0.2221	0.1790

Table 30: Impact of merger on firm 2 profits: cross-border merger with hollowing-out vs pre-merger, $\pi_2^H - \pi_2$

Demand				Number of	firms (n)			
size (a)	1	2	3	4	5	6	7	8
4	1.4125	1.3231	1.2654	1.2249	1.1948	1.1717	1.1533	1.1383
5	1.9226	1.7149	1.5840	1.4937	1.4276	1.3771	1.3372	1.3048
6	2.4777	2.1311	1.9173	1.7722	1.6670	1.5872	1.5245	1.4739
7	3.0779	2.5718	2.2654	2.0602	1.9129	1.8020	1.7153	1.6457
8	3.7230	3.0369	2.6283	2.3578	2.1654	2.0215	1.9096	1.8201
9	4.4131	3.5265	3.0059	2.6649	2.4244	2.2456	2.1074	1.9971
10	5.1482	4.0405	3.3982	2.9816	2.6900	2.4745	2.3086	2.1768

Table 31: Impact of domestic merger with costless technology transfer on firm 0 ($x = 0$) profits: $\pi_0^{0,D} - \pi_0^0$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
10	-0.0251	-0.0296	-0.0352	-0.0423	-0.0510
11	-0.0644	-0.0700	-0.0760	-0.0833	-0.0922
12	-0.1229	-0.1299	-0.1366	-0.1442	-0.1532
13	-0.2006	-0.2095	-0.2169	-0.2250	-0.2342
14	-0.2976	-0.3087	-0.3170	-0.3255	-0.3350
15	-0.4137	-0.4275	-0.4369	-0.4459	-0.4557
16	-0.5490	-0.5658	-0.5765	-0.5861	-0.5963
17	-0.7036	-0.7237	-0.7358	-0.7462	-0.7567
18	-0.8773	-0.9013	-0.9149	-0.9261	-0.9371
19	-1.0702	-1.0984	-1.1138	-1.1258	-1.1373

Table 32: Impact of domestic merger with costless technology transfer on firm 0 ($x = 1/2$) profits: $\pi_0^{1/2,D} - \pi_0^{1/2}$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
10	-0.0382	-0.0473	-0.0575	-0.0691	-0.0823
11	-0.0776	-0.0877	-0.0983	-0.1102	-0.1235
12	-0.1362	-0.1477	-0.1589	-0.1711	-0.1846
13	-0.2140	-0.2273	-0.2393	-0.2518	-0.2655
14	-0.3109	-0.3265	-0.3394	-0.3524	-0.3664
15	-0.4271	-0.4453	-0.4592	-0.4728	-0.4871
16	-0.5625	-0.5837	-0.5989	-0.6130	-0.6277
17	-0.7171	-0.7417	-0.7582	-0.7731	-0.7882
18	-0.8909	-0.9192	-0.9373	-0.9530	-0.9685
19	-1.0838	-1.1164	-1.1362	-1.1527	-1.1687

Table 33: Impact of domestic merger with costless technology transfer on firm F profits: $\pi_F^D - \pi_F$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
10	-0.2724	-0.4524	-0.6754	-0.9417	-1.2516
11	-0.3494	-0.5512	-0.7954	-1.0828	-1.4136
12	-0.4360	-0.6598	-0.9254	-1.2339	-1.5857
13	-0.5322	-0.7782	-1.0652	-1.3948	-1.7676
14	-0.6380	-0.9064	-1.2149	-1.5657	-1.9595
15	-0.7534	-1.0443	-1.3744	-1.7465	-2.1613
16	-0.8784	-1.1921	-1.5439	-1.9372	-2.3731
17	-1.0130	-1.3497	-1.7232	-2.1378	-2.5948
18	-1.1572	-1.5171	-1.9124	-2.3483	-2.8264
19	-1.3110	-1.6942	-2.1115	-2.5688	-3.0680

Table 34: Impact of domestic merger with costly technology transfer and NH on firm 0 ($x = 0$) profits: $\pi_0^{0,NH} - \pi_0^0$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	-0.0251	-0.0296	-0.0352	-0.0423	-0.0510
6	-0.0644	-0.0700	-0.0760	-0.0834	-0.0922
7	-0.1229	-0.1299	-0.1366	-0.1442	-0.1532
8	-0.2006	-0.2095	-0.2169	-0.2250	-0.2342
9	-0.2975	-0.3087	-0.3170	-0.3255	-0.3350
10	-0.4136	-0.4274	-0.4369	-0.4459	-0.4557
11	-0.5490	-0.5658	-0.5765	-0.5861	-0.5963
12	-0.7035	-0.7237	-0.7358	-0.7462	-0.7568
13	-0.8772	-0.9012	-0.9149	-0.9261	-0.9371
14	-1.0701	-1.0984	-1.1138	-1.1258	-1.1373

Table 35: Impact of domestic merger with costly technology transfer and NH on firm 0 ($x = 1/2$) profits: $\pi_0^{1/2,NH} - \pi_0^{1/2}$

Demand size (a)	Number of firms (n) 2	4	6	8	10
5	-0.0380	-0.0472	-0.0574	-0.0691	-0.0823
6	-0.0773	-0.0876	-0.0982	-0.1101	-0.1235
7	-0.1358	-0.1476	-0.1588	-0.1710	-0.1845
8	-0.2136	-0.2271	-0.2391	-0.2517	-0.2655
9	-0.3105	-0.3263	-0.3392	-0.3523	-0.3663
10	-0.4266	-0.4450	-0.4591	-0.4727	-0.4870
11	-0.5619	-0.5834	-0.5987	-0.6129	-0.6276
12	-0.7164	-0.7413	-0.7580	-0.7729	-0.7880
13	-0.8901	-0.9189	-0.9371	-0.9528	-0.9684
14	-1.0831	-1.1160	-1.1360	-1.1526	-1.1686

Table 36: Impact of domestic merger with costly technology transfer on firm F profits: $\pi_F^{NH} - \pi_F$

Demand size (a)	Number of firms (n) 2	4	6	8	10
5	-0.4175	-0.6762	-0.9927	-1.3678	-1.8019
6	-0.5520	-0.8458	-1.1964	-1.6051	-2.0725
7	-0.7056	-1.0350	-1.4198	-1.8622	-2.3631
8	-0.8785	-1.2438	-1.6629	-2.1391	-2.6735
9	-1.0705	-1.4722	-1.9258	-2.4359	-3.0038
10	-1.2818	-1.7202	-2.2085	-2.7525	-3.3540
11	-1.5123	-1.9877	-2.5109	-3.0889	-3.7240
12	-1.7619	-2.2749	-2.8331	-3.4452	-4.1140
13	-2.0308	-2.5816	-3.1750	-3.8213	-4.5238
14	-2.3188	-2.9079	-3.5366	-4.2172	-4.9535

Table 37: Impact of domestic merger with costly technology transfer and H on firm 0 ($x = 0$) profits: $\pi_0^{0,H} - \pi_0^0$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	-0.0250	-0.0296	-0.0352	-0.0423	-0.0510
6	-0.0643	-0.0699	-0.0760	-0.0833	-0.0922
7	-0.1228	-0.1299	-0.1366	-0.1442	-0.1532
8	-0.2004	-0.2094	-0.2169	-0.2249	-0.2342
9	-0.2973	-0.3086	-0.3170	-0.3255	-0.3350
10	-0.4134	-0.4273	-0.4368	-0.4459	-0.4557
11	-0.5487	-0.5656	-0.5764	-0.5861	-0.5962
12	-0.7032	-0.7236	-0.7357	-0.7461	-0.7567
13	-0.8768	-0.9011	-0.9148	-0.9260	-0.9371
14	-1.0697	-1.0982	-1.1136	-1.1257	-1.1373

Table 38: Impact of domestic merger with costly technology transfer and H on firm 0 ($x = 1/2$) profits: $\pi_0^{1/2,H} - \pi_0^{1/2}$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	-0.0379	-0.0471	-0.0574	-0.0690	-0.0823
6	-0.0772	-0.0875	-0.0982	-0.1101	-0.1234
7	-0.1356	-0.1474	-0.1587	-0.1709	-0.1845
8	-0.2133	-0.2270	-0.2391	-0.2517	-0.2654
9	-0.3102	-0.3261	-0.3391	-0.3522	-0.3662
10	-0.4263	-0.4449	-0.4590	-0.4726	-0.4869
11	-0.5616	-0.5832	-0.5985	-0.6128	-0.6275
12	-0.7160	-0.7411	-0.7579	-0.7728	-0.7880
13	-0.8897	-0.9186	-0.9370	-0.9527	-0.9683
14	-1.0826	-1.1157	-1.1358	-1.1524	-1.1685

Table 39: Impact of domestic merger with costly technology transfer and H on firm F profits: $\pi_F^H - \pi_F$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	-0.4173	-0.6761	-0.9926	-1.3677	-1.8018
6	-0.5517	-0.8457	-1.1962	-1.6050	-2.0724
7	-0.7053	-1.0348	-1.4196	-1.8621	-2.3630
8	-0.8781	-1.2436	-1.6628	-2.1390	-2.6734
9	-1.0702	-1.4720	-1.9257	-2.4357	-3.0037
10	-1.2814	-1.7199	-2.2083	-2.7523	-3.3539
11	-1.5118	-1.9875	-2.5107	-3.0888	-3.7239
12	-1.7614	-2.2746	-2.8329	-3.4450	-4.1139
13	-2.0302	-2.5813	-3.1748	-3.8211	-4.5237
14	-2.3183	-2.9076	-3.5364	-4.2171	-4.9534

Table 40: Impact of type I cross-border merger with costless technology transfer and on firm 0 ($x = 0$) profits: $\pi_0^{0,I} - \pi_0^0$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	0.0292	0.0297	0.0303	0.0309	0.0315
6	0.0437	0.0442	0.0448	0.0454	0.0460
7	0.0582	0.0587	0.0593	0.0599	0.0605
8	0.0727	0.0732	0.0738	0.0744	0.0750
9	0.0872	0.0877	0.0883	0.0889	0.0895
10	0.1017	0.1022	0.1028	0.1034	0.1040
11	0.1162	0.1167	0.1173	0.1179	0.1185
12	0.1307	0.1312	0.1318	0.1324	0.1330
13	0.1452	0.1457	0.1463	0.1469	0.1475
14	0.1597	0.1602	0.1608	0.1614	0.1620

Table 41: Impact of type I cross-border merger with costless technology transfer on firm 0 ($x = 1/2$) profits: $\pi_0^{1/2,I} - \pi_0^{1/2}$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	0.0198	0.0176	0.0153	0.0131	0.0108
6	0.0343	0.0321	0.0298	0.0276	0.0253
7	0.0488	0.0466	0.0443	0.0421	0.0398
8	0.0633	0.0611	0.0588	0.0566	0.0543
9	0.0778	0.0756	0.0733	0.0711	0.0688
10	0.0923	0.0901	0.0878	0.0856	0.0833
11	0.1068	0.1046	0.1023	0.1001	0.0978
12	0.1213	0.1191	0.1168	0.1146	0.1123
13	0.1358	0.1336	0.1313	0.1291	0.1268
14	0.1503	0.1481	0.1458	0.1436	0.1413

Table 42: Impact of type I cross-border merger with costless technology transfer on firm 2 profits: $\pi_2^I - \pi_2$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	-0.0054	-0.0069	-0.0085	-0.0100	-0.0116
6	-0.0049	-0.0064	-0.0080	-0.0095	-0.0111
7	-0.0044	-0.0059	-0.0075	-0.0090	-0.0106
8	-0.0039	-0.0054	-0.0070	-0.0085	-0.0101
9	-0.0034	-0.0049	-0.0065	-0.0080	-0.0096
10	-0.0029	-0.0044	-0.0060	-0.0075	-0.0091
11	-0.0024	-0.0039	-0.0055	-0.0070	-0.0086
12	-0.0019	-0.0034	-0.0050	-0.0065	-0.0081
13	-0.0014	-0.0029	-0.0045	-0.0060	-0.0076
14	-0.0009	-0.0024	-0.0040	-0.0055	-0.0071

Table 43: Impact of type II cross-border merger with costless technology transfer and on firm 0 ($x = 0$) profits: $\pi_0^{0,II} - \pi_0^0$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	-0.0254	-0.0298	-0.0353	-0.0424	-0.0510
6	-0.0650	-0.0702	-0.0762	-0.0835	-0.0922
7	-0.1237	-0.1303	-0.1368	-0.1444	-0.1533
8	-0.2016	-0.2100	-0.2172	-0.2251	-0.2343
9	-0.2987	-0.3093	-0.3174	-0.3257	-0.3351
10	-0.4150	-0.4281	-0.4373	-0.4462	-0.4559
11	-0.5506	-0.5666	-0.5769	-0.5864	-0.5965
12	-0.7053	-0.7246	-0.7363	-0.7465	-0.7570
13	-0.8792	-0.9022	-0.9155	-0.9265	-0.9374
14	-1.0723	-1.0995	-1.1144	-1.1262	-1.1376

Table 44: Impact of type II cross-border merger with costless technology transfer and on firm 0 ($x = 0$) profits: $\pi_0^{0,II} - \pi_0^0$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	-0.0254	-0.0298	-0.0353	-0.0424	-0.0510
6	-0.0650	-0.0702	-0.0762	-0.0835	-0.0922
7	-0.1237	-0.1303	-0.1368	-0.1444	-0.1533
8	-0.2016	-0.2100	-0.2172	-0.2251	-0.2343
9	-0.2987	-0.3093	-0.3174	-0.3257	-0.3351
10	-0.4150	-0.4281	-0.4373	-0.4462	-0.4559
11	-0.5506	-0.5666	-0.5769	-0.5864	-0.5965
12	-0.7053	-0.7246	-0.7363	-0.7465	-0.7570
13	-0.8792	-0.9022	-0.9155	-0.9265	-0.9374
14	-1.0723	-1.0995	-1.1144	-1.1262	-1.1376

Table 45: Impact of type II cross-border merger with costless technology transfer on firm 0 ($x = 1/2$) profits: $\pi_0^{1/2,II} - \pi_0^{1/2}$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	-0.0386	-0.0475	-0.0576	-0.0692	-0.0824
6	-0.0781	-0.0880	-0.0985	-0.1103	-0.1236
7	-0.1368	-0.1481	-0.1591	-0.1712	-0.1847
8	-0.2148	-0.2278	-0.2395	-0.2520	-0.2657
9	-0.3119	-0.3270	-0.3397	-0.3526	-0.3665
10	-0.4282	-0.4459	-0.4596	-0.4730	-0.4873
11	-0.5637	-0.5843	-0.5992	-0.6133	-0.6279
12	-0.7184	-0.7424	-0.7587	-0.7734	-0.7884
13	-0.8924	-0.9200	-0.9378	-0.9533	-0.9687
14	-1.0855	-1.1172	-1.1367	-1.1531	-1.1690

Table 46: Impact of type II cross-border merger with costless technology transfer on firm 1 profits: $\pi_1^{II} - \pi_1$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	-0.0237	-0.0346	-0.0458	-0.0580	-0.0717
6	-0.0596	-0.0725	-0.0846	-0.0975	-0.1115
7	-0.1148	-0.1300	-0.1433	-0.1568	-0.1712
8	-0.1891	-0.2071	-0.2217	-0.2359	-0.2508
9	-0.2826	-0.3038	-0.3198	-0.3349	-0.3503
10	-0.3953	-0.4201	-0.4377	-0.4537	-0.4696
11	-0.5272	-0.5560	-0.5754	-0.5923	-0.6089
12	-0.6784	-0.7114	-0.7328	-0.7507	-0.7680
13	-0.8487	-0.8865	-0.9099	-0.9290	-0.9470
14	-1.0382	-1.0811	-1.1069	-1.1272	-1.1458

Table 47: Impact of cross-border merger with costly technology transfer and NH and on firm 0 ($x = 0$) profits: $\pi_{0,CB}^{0,NH} - \pi_0^0$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	-0.0254	-0.0297	-0.0353	-0.0424	-0.0510
6	-0.0649	-0.0702	-0.0762	-0.0834	-0.0922
7	-0.1235	-0.1303	-0.1368	-0.1444	-0.1533
8	-0.2014	-0.2099	-0.2172	-0.2251	-0.2343
9	-0.2985	-0.3092	-0.3173	-0.3257	-0.3351
10	-0.4148	-0.4280	-0.4372	-0.4461	-0.4558
11	-0.5503	-0.5664	-0.5768	-0.5864	-0.5965
12	-0.7050	-0.7245	-0.7362	-0.7465	-0.7569
13	-0.8788	-0.9021	-0.9154	-0.9264	-0.9373
14	-1.0719	-1.0993	-1.1143	-1.1262	-1.1376

Table 48: Impact of cross-border merger with costly technology transfer and NH on firm 0 ($x = 1/2$) profits: $\pi_{0,CB}^{1/2,NH} - \pi_0^{1/2}$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	-0.0385	-0.0475	-0.0576	-0.0692	-0.0824
6	-0.0780	-0.0879	-0.0985	-0.1103	-0.1236
7	-0.1367	-0.1480	-0.1591	-0.1712	-0.1847
8	-0.2146	-0.2277	-0.2395	-0.2519	-0.2656
9	-0.3116	-0.3269	-0.3396	-0.3525	-0.3665
10	-0.4279	-0.4457	-0.4595	-0.4730	-0.4872
11	-0.5634	-0.5842	-0.5991	-0.6132	-0.6278
12	-0.7181	-0.7422	-0.7585	-0.7733	-0.7883
13	-0.8920	-0.9198	-0.9377	-0.9532	-0.9687
14	-1.0851	-1.1170	-1.1366	-1.1530	-1.1689

Table 49: Impact of cross-border merger with costly technology transfer and NH on firm 1 profits: $\pi_{1,CB}^{NH} - \pi_1$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	0.0209	0.1041	0.2406	0.4322	0.6796
6	-0.0107	0.0732	0.2104	0.4025	0.6504
7	-0.0614	0.0228	0.1605	0.3530	0.6012
8	-0.1313	-0.0472	0.0908	0.2837	0.5322
9	-0.2205	-0.1369	0.0014	0.1946	0.4433
10	-0.3288	-0.2461	-0.1078	0.0855	0.3346
11	-0.4563	-0.3749	-0.2368	-0.0433	0.2059
12	-0.6031	-0.5233	-0.3855	-0.1920	0.0574
13	-0.7690	-0.6913	-0.5540	-0.3605	-0.1111
14	-0.9541	-0.8789	-0.7422	-0.5488	-0.2994

Table 50: Impact of cross-border merger with costly technology transfer and on firm 0 ($x = 0$) profits: $\pi_{0,CB}^{0,H} - \pi_0^0$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	0.0179	0.0168	0.0157	0.0146	0.0135
6	0.0284	0.0273	0.0262	0.0251	0.0240
7	0.0389	0.0378	0.0367	0.0356	0.0345
8	0.0494	0.0483	0.0472	0.0461	0.0450
9	0.0599	0.0588	0.0577	0.0566	0.0555
10	0.0704	0.0693	0.0682	0.0671	0.0660
11	0.0809	0.0798	0.0787	0.0776	0.0765
12	0.0914	0.0903	0.0892	0.0881	0.0870
13	0.1019	0.1008	0.0997	0.0986	0.0975
14	0.1124	0.1113	0.1102	0.1091	0.1080

Table 51: Impact of cross-border merger with costly technology transfer and H on firm 0 ($x = 1/2$) profits: $\pi_{0,CB}^{1/2,H} - \pi_0^{1/2}$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	0.0169	0.0163	0.0157	0.0151	0.0145
6	0.0274	0.0268	0.0262	0.0256	0.0250
7	0.0379	0.0373	0.0367	0.0361	0.0355
8	0.0484	0.0478	0.0472	0.0466	0.0460
9	0.0589	0.0583	0.0577	0.0571	0.0565
10	0.0694	0.0688	0.0682	0.0676	0.0670
11	0.0799	0.0793	0.0787	0.0781	0.0775
12	0.0904	0.0898	0.0892	0.0886	0.0880
13	0.1009	0.1003	0.0997	0.0991	0.0985
14	0.1114	0.1108	0.1102	0.1096	0.1090

Table 52: Impact of cross-border merger with costly technology transfer and H on firm F profits: $\pi^H_{F,CB} - \pi_F$

Demand		Number of	firms (n)		
size (a)	2	4	6	8	10
5	0.3959	0.6603	0.9895	1.3835	1.8423
6	0.4964	0.7968	1.1620	1.5920	2.0868
7	0.5969	0.9333	1.3345	1.8005	2.3313
8	0.6974	1.0698	1.5070	2.0090	2.5758
9	0.7979	1.2063	1.6795	2.2175	2.8203
10	0.8984	1.3428	1.8520	2.4260	3.0648
11	0.9989	1.4793	2.0245	2.6345	3.3093
12	1.0994	1.6158	2.1970	2.8430	3.5538
13	1.1999	1.7523	2.3695	3.0515	3.7983
14	1.3004	1.8888	2.5420	3.2600	4.0428