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Trade Liberalization, Nature of Mergers and Employment

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ABSTRACT *This paper develops a simple two-country model in which each economy consists of two sectors: a competitive non-tradable sector and an oligopolistic tradable sector. We investigate two related issues that arise in response to trade liberalization. First, we examine the linkage between trade liberalization and the nature of merger incentives in the oligopolistic tradable sector. We find that trade liberalization changes the industry structure leading to cross border mergers. Next, we explore the impact of this change on the labour market of the competitive non-tradable sector. It is found that the employment and wage impacts of the fall in the price of tradable goods depend on the price elasticity of demand for tradable goods and non-tradable goods, and the share of the tradable intermediate goods in the total cost of production of non-tradables. As a result, the positive employment impact is certain only if the demand for tradable goods is inelastic, while labour and tradable intermediate goods are complements.*

KEY WORDS: Cross-border mergers, employment, non-tradable sector

1. Introduction

Over the last two decades, the world economy has experienced a large wave of mergers. One particular characteristic of this merger wave is the high incidence of cross-border mergers and acquisitions (M&As). In fact, international mergers and corporate takeovers have become an important vehicle for foreign direct investment (FDI) flows between developed countries. Cross-border merger activity involving developing countries, although quite small by the standards of developed ones, has also greatly expanded during the last 15 years.[1] Today, cross-border M&As constitute the dominant form of FDI, with profound effects on international industry structure.[2]

Over the same period, the world economy has experienced trade liberalization following the trade negotiations undertaken within the

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auspices of the General Agreement of Tariffs and Trade (GATT), now subsumed by the World Trade Organization (WTO). The link between trade liberalization and the high incidence of cross border merger activities has not been captured properly. Despite the increase in cross-border M&As, the literature on international trade and FDI has paid little attention to this phenomenon.[3] Instead, the focus has been the international location decisions of firms. In this literature, firms typically face a trade-off between the fixed cost of an additional plant in the export market and the benefit of economizing on tariffs and trade costs.[4] Moreover, as international economic integration has progressed, the employment effects of trade liberalization have become an important concern among policy makers.

The two main issues related to the effects of trade liberalization in labour markets are wage inequality and unemployment.[5] In the empirical literature, the impact of trade liberalization on employment is ambiguous. Grossman (1987) finds that the effect of tariff changes on employment levels is significant in a few industries in the United States while Freeman and Katz (1991) present evidence that international trade has a significant short-term impact in the inter-industry structure of employment. Gaston and Trefler (1997) show that the Canada-US Free Trade Agreement (FTA) accounted for 15 per cent of the Canadian job losses during the period of 1989 – 1993. Feliciano (2001) shows that tariff reductions in Mexico had no significant effect on employment. Moreira and Najberg (2000) find that trade liberalization had a negative short-term impact on employment in Brazil over the period of 1990 – 1997.

A number of theoretical papers have also explored the link between trade liberalization and employment. For instance, Chao and Yu (1997) examine an oligopolistically competitive economy with unemployment. They show that trade liberalization lowers the price of imported goods, raises firms' output and reduces unemployment when the economy suffers from sector-specific unemployment. Agenor and Aizenman (1996) analyse a model in a two-sector, three-goods economy in which labour is imperfectly mobile across sectors. They show that a reduction in tariffs lowers wages and has an ambiguous effect on unemployment. The unemployment rate may rise or fall depending on whether the elasticity of wages in the export sector with respect to wages in the non-tradable sector is lower or greater than unity.

The present paper considers an economy with two sectors: an *oligopolistic tradable sector* and a *competitive non-tradable sector*. It aims to contribute to the existing literature in two ways. First, we examine the impacts of bilateral trade liberalization on industry restructuring in the oligopolistic tradable sector in which firms sell differentiated goods in two segmented markets (home and foreign).[6] Second, we examine the indirect impacts of trade liberalization on the labour market in the non-tradable sector via industry restructuring in the tradable sector.

In order to determine industry structure, we employ the endogenous merger formation approach developed by Horn and Persson (2001a). An

important feature of the model is that the origin of firms is crucial. If asset owners from different countries merge, the resulting firm is international in nature and has the advantage of avoiding tariff levels in both markets. By contrast, national firms face a tariff disadvantage while exporting. Two effects are found to be important in merger formation: the *protection gain* and the *tariff savings*. The first effect represents the anti-competitive impact of trade policy that arises when firms are national units. The *tariff savings* effect simply captures the incentive to avoid the trade cost by merging with a firm in the export market. An analysis of these two effects shows that, as trade gets bilaterally liberalized, the resulting equilibrium market structure is the one with international mergers. This result is consistent with the fact that global trade liberalization has been accompanied by an increase in cross-border merger activities.

Given these changes in the nature of merger incentives in the tradable sector, next we examine how the labour market of a competitive non-tradable sector is affected. Due to the fact that international firms save on trade costs, a high incidence of cross-border mergers reduces the price of the tradable goods. We treat the tradable goods in two distinct ways. First, they are treated as final goods ready for consumption so that the fall in the price of tradables changes the budget constraint of a representative worker in the non-tradable sector. Second, they enter into the production of non-tradables as intermediate goods. This has an impact on the profit maximization decision of the firms in the non-tradable sector. In order to isolate the impacts of trade liberalization on the oligopolistic tradable sector, we assume that the utility function is separable in its arguments. Utility maximization of a representative worker in the non-tradable sector yields a labour supply function that increases in the share of income spent on the non-tradables. In other words, if the price elasticity of demand for tradables is inelastic (elastic), labour supply in the non-tradable sector increases (decreases). On the other hand, the direction of change in the labour demand depends on the complementarity between the labour and the intermediate goods (tradable goods) used in the production of non-tradables. It is shown that if the price elasticity of demand for non-tradable goods and the share of the tradable intermediate goods in the cost of production of non-tradables are high enough, labour and tradable intermediate goods are gross complements; otherwise, they are gross substitutes.

Once we combine the labour supply and labour demand analyses, it can be argued that the indirect employment and wage impacts of the change in the nature of mergers in the tradable sector, due to trade liberalization, are ambiguous. The positive employment (wage, respectively) impact is certain only if the demand for tradable goods is inelastic (elastic, respectively), while the demand for non-tradable goods is elastic and the share of tradable intermediate goods in the total cost of production of non-tradables is high enough.

The rest of the paper is organized as follows. Section 2 introduces an endogenous merger formation model in a concentrated international oligopoly with differentiated products. The model is employed in Section 3 to determine the equilibrium market structure following bilateral trade liberalization. Given these changes in the industry structure of tradables, the impacts on the labour market of the non-tradable sector are discussed in Section 4. Section 5 contains the concluding discussion. Finally, the appendix contains derivations and a proof.

2. Model

The model is a two country partial equilibrium set-up in which countries are indexed by k, where $k = h$ (home country), f (foreign country). Countries are identical with respect to market size and demand. In each exporting country, there are two industries. The first industry produces tradable goods, and is characterized as a minimal symmetric oligopoly that consists of two firms that produce symmetrically differentiated products. The second industry is perfectly competitive and produces non-tradable goods. Firms in the tradable sectors are indexed by $i = 1, 2, 3, 4$ where 1 and 2 (3 and 4) denote home (foreign) firms and their assets are located in the home country and foreign country respectively. Firms own the exclusive technology for their particular brand. The marginal cost of production for all firms is constant ($c \geqslant 0$).

Following Shubik (1980), the demand function for each market is as follows:[7]

$$q_i(p_1, \ldots, p_N) = \frac{1}{N}\left(\alpha - p_i - \gamma\left(p_i - \frac{1}{N}\sum_{j=1, j\neq i}^{N} p_j\right)\right) \tag{1}$$

where p_i denotes the price charged by firm i, q_i its sales and N is the number of firms in the market. The parameter γ is a measure of the substitutability of the goods. When γ approaches zero, goods become unrelated and as it approaches inffinity, goods become perfect substitutes. Note that the degree of product differentiation between any two goods is the same.

Since the focus is on the effects of trade liberalization on the nature of merger incentives, we first analyse the strategic game between firms in the industry of tradables. The interaction among firms takes place in two stages. In the first stage, industry structure is determined: firms decide whether to merge domestically or internationally or stay as competing units. In the second stage, firms formed in the first stage compete non-cooperatively in Bertrand fashion in two countries' markets.

The effects of bilateral trade liberalization on the equilibrium market structure can be examined by assuming common exogenous tariff levels faced by exporting firms and then lowering those tariffs. Given these tariff levels and trade costs, the origin of firms becomes crucial. If asset owners

from different countries merge, the resulting firm is an international firm having the advantage of avoiding tariff levels in both markets. By contrast, national firms (either non-merged units or a firm constructed by merging owners from the same country) have trade protection in their own country but face a tariff disadvantage while exporting. Throughout the paper, we exclude prohibitive tariff levels since such tariffs are rarely witnessed under the trade environment today. Basically, we examine a situation where countries cannot completely shut out foreign firms from their markets.

Since markets are segmented, firms' decisions concerning one market do not affect their decisions in other markets. We first take the industry structure of tradables as given and proceed to analyse the equilibrium in the product market (second stage of the game) for home firms. The same optimization procedures will follow for foreign firms by replacing 1 and 2 with 3 and 4. Note that tariff levels in the home country and foreign country are denoted by t_h and t_f respectively.[8]

In a fully decentralized market structure (no mergers), each non-merging home firm chooses its price to maximize its profit taking other firms' prices as given:[9]

$$\max_{\{pi\}} \Pi_i(p_1, \ldots, p_4) = \frac{1}{4} p_i \left(\alpha - p_i - \gamma \left(p_i - \frac{1}{4} \sum_{j=1}^{4} p_j \right) \right) \tag{2}$$

When merging, firms are allowed to shut down the operation of some plants, but may not alter the characteristics of their products. Each nationally merging home firm in its own market solves the following problem:[10]

$$\max_{\{p_1, p_2\}} \Pi(p_1, \ldots, p_4) = \sum_{i=1}^{2} \frac{1}{4} p_i \left(\alpha - p_i - \gamma \left(p_i - \frac{1}{4} \sum_{j=1}^{4} p_j \right) \right) \tag{3}$$

The tariff cost can be avoided by merging with local producers in the export market. Thus, internationally merged firms (for example: firm 1 and firm 3) solve the same problem in both markets:

$$\max_{\{p_1, p_3\}} \Pi(p_1, \ldots, p_4) = \sum_{i=1,3} \frac{1}{4} p_i \left(\alpha - p_i - \gamma \left(p_i - \frac{1}{4} \sum_{j=1}^{4} p_j \right) \right) \tag{4}$$

Thus far, we have taken the industry structure as given. We now turn to the first stage of interaction. In determining industry structure, our model is built on the endogenous merger formation approach developed by Horn and Persson (2001a).[11] Based upon the earlier literature on mergers, and on actual observations of firm behaviour, they take the view that merger formation can be treated as a cooperative game since parties involved in the formation process are free to communicate and sign binding contracts. This approach is a generalization of the traditional merger analysis since

comparisons are made between all feasible market structures rather than two exogenously given market structures, one of which is a strict concentration of the other.

In this model, there are two important concepts: *Dominance Relation* and *Decisive Firms*. The dominance relation implies that if a market structure M^j is dominated by another market structure M^i, the former will not be the outcome of the merger formation since it is in the interest of firms who have the power of enforcing M^i over M^j. These firms are called 'decisive firms' and they are directly involved in the process of merger formation and break-up.[12] Two assumptions are made in the merger formation process. First, any payments between coalitions are not allowed. Second, when forming a merger, participating firms can choose any payoff distribution among themselves subject to the constraint that the total payoff distributed be exactly equal to the merged unit's total profit in the second stage of the game.

The idea behind these concepts can be seen more clearly in the following example in which there are four firms and two market structures: $M^A = \{\{12\}; \{3\}; \{4\}\}$, $M^B = \{\{13\}; \{2\}; \{4\}\}$. Firm 4 does not change its behaviour in M^A and M^B in the sense that it stays as a competing unit in both market structures. Since payments between coalitions are not allowed, firm 4 cannot influence the ranking of market structures M^A and M^B. Alternatively stated, firm 4 is not 'decisive' with respect to these two market structures. Now turn to firms 1, 2 and 3. If the market structure M^A is formed, firm 3 will not participate in any merger. In order to prevent this, if firm 3's profit is higher under market structure M^B, it may offer to firm 1 a larger share of payoff of the merger under the market structure M^B. On the other hand, firm 2 may make a counter-offer to induce a merger with firm 1 if its profit is higher under M^A. As a result, by being linked to firm 1 in the market structure M^B, firm 3 is able to bargain with firm 2 over firm 1's participation in a merger. This bargaining process implies that firms 1, 2 and 3 have the ability to affect the ranking of market structures M^A and M^B. Therefore, these firms are 'decisive' with respect to these two market structures.[13]

Given the definition of the concept of decisive firms, dominance relations work as follows: if there is only one decisive group of firms between two market structures M^i and M^j, M^i dominates M^j if and only if the combined profit of the decisive group D^{ij} is larger in M^i than in M^j. If there are two decisive groups of firms, it is required that domination holds for each of them. It is important to note that the dominance relation is not transitive if decisive group(s) of firms is (are) not the same. Furthermore, it is clear that M^i and M^j cannot dominate each other simultaneously. As a result, the dominance relation is asymmetric.

Having identified the decisive firms and described how we rank any pair of market structures using the dominance relation, the next question is: how can we find equilibrium market structure? *The equilibrium market structure is defined to be the one that is undominated.*

The model has the feature that firms merge all the way to monopoly, if permitted. This is because the combined profits of all firms in other market structures are smaller than monopoly profits and all parties are involved in the merger formation process. Since the focus is on the distinction between national and international mergers, highly concentrated market structures (monopoly and the duopoly with the international merger of three firms) will be excluded within the equilibrium market structures.[14] The symmetry of the model indicates that there are ten possible ownership structures that can be represented by five market structures:

(1) No mergers: $\mathrm{M}^{O} = \{\{1\}, \{2\}, \{3\}, \{4\}\}$
(2) Triopolies with one national merger: $\mathrm{M}^{H} = \{\{12\}, \{3\}, \{4\}\}$, $\mathrm{M}^{F} = \{\{1\}, \{2\}, \{34\}\}$
(3) Triopolies with one international merger (M^{1I}): $\mathrm{M}^{1I} = \{\{13\}, \{2\}, \{4\}\}$ $\mathrm{M}^{1I'} = \{\{1\}, \{23\}, \{4\}\}$, $\mathrm{M}^{1I''} = \{\{14\}, \{2\}, \{3\}\}$ and $\mathrm{M}^{1I'''} = \{\{1\}, \{24\}, \{3\}\}$
(4) The duopoly with two national mergers: $\mathrm{M}^{N} = \{\{12\}, \{34\}\}$
(5) Duopolies with two international mergers (M^{I}): $\mathrm{M}^{Ia} = \{\{13\}, \{24\}\}$, $\mathrm{M}^{Ib} = \{\{14\}, \{23\}\}$

In order to save on notation, each market structure will be referred to by its first ownership structure as far as this is possible.

3. Industry Structure and Trade Liberalization

In this section, we highlight how the nature of merger incentives is influenced by tariff levels. In order to guarantee the the market access, we exclude prohibitive tariff levels. Basically, we examine a situation where countries cannot shut out their markets to foreign firms in any market structure. As we rank the prohibitive tariff levels in each market structure, the lowest one is obtained under international triopoly ($\bar{t}^{1I}$):[15]

$$\bar{t}^{1I} = \frac{4\alpha(3\gamma + 4)(7\gamma + 8)}{23\gamma^3 + 152\gamma^2 + 256\gamma + 128} \tag{5}$$

3.1 Decisive Forces in Merger Formation

There are two counteracting effects in the merger formation stage. The first effect is the *protection gain* that represents the anti-competitive impact of the trade policy and arises when firms are national units (competing or merging). The second effect is the *tariff savings* that identifies firms' tariff jumping incentives to merge internationally in order to avoid tariffs in the export market. The equilibrium market structure characterization depends on the balance between these two effects.

In order to capture the idea behind these two effects, we define the relative attractiveness of international mergers, $g^{I\&N}(t)$, as the difference of the combined profits of decisive firms under international duopoly (M^I) and national duopoly (M^N). There is only one decisive group composed of all four firms with respect to these two market structures. Therefore, industry profit levels are compared under these market structures. It is obvious that the industry profits under international duopoly (M^I) do not depend on tariffs since firms avoid tariffs by merging internationally, whereas the tariffs affect industry profit under the national duopoly (M^N). It implies that any profit difference is due tariffs:[16]

Aggregate profits earned by home national merger can be written as follows:[17]

$$\pi_{12}^N(t) = \pi_{12}^N(t=0) + \int_0^t \frac{\partial \pi_{12}^N(t)}{\partial t} - t(q_{12}^e) \tag{6}$$

where q_{12}^e represents the amount of output exported by a home merger.

The first term in equation (6) represents the home merger's profit under free trade while the second term measures the change in the home merger's aggregate profits net of tariff payment relative to free trade. Tariff protection leads to an increase in the home and foreign merger's price level. It is important to note that, unless products are very highly differentiated, aggregate profits in both countries net of tariff burden increase in tariffs. As a result, the second term has a positive sign and represents the *protection gain* that captures the anti-competitive impact of tariffs. Finally, the last term in equation (6) measures the tariff payment of a national merger that becomes the *tariff savings* under international merger.

Since $\pi_i^N(t=0) = \pi_j^I(t=0)$, the relative gain from international mergers ($g^{I\&N}(t)$) is found as follows:

$$g^{I\&N}(t) = tq_{34}^e + tq_{12}^e - \int_0^t \sum_{i=12,34} \frac{\partial \pi_i^N(t)}{\partial t}\, dt \tag{7}$$

Whether M^I dominates M^N depends on the balance between the *tariff savings* incentive of firms to form international duopoly (M^I) and the *protection gain* incentives to form national duopoly (M^N). The former incentive is captured by the first two terms in equation (7), while the latter is captured by the last term in equation (7).

It is important to emphasize that the degree of product differentiation is also an important determinant of the relative strengths of these two counteracting effects. The level of competition among firms is directly affected by the substitutability level (γ) among products. When products are close substitutes, competition is severe and firms are close to the Bertrand paradox. In that case, tariff protection provides room for national firms to enjoy profits in a highly competitive trade environment so that the *protection gain* is more pronounced.

On the other hand, for highly differentiated products, firms have some market power resulting from different characteristics of their products so that the marginal benefit of tariff protection is relatively low. As a result, if one examines the relative attractiveness of international mergers, it is positive for all tariffs when products are highly differentiated. However, when products are close substitutes, it is found to be positive under a liberal trade environment only. This result provides the main framework for the following analysis.

3.2 Bilateral Trade Liberalization

The following result supports the idea that cross-border mergers become a major mode of industry restructuring as trade gets bilaterally liberalized:[18]

Proposition 1

Given that the home and foreign tariff levels are equal to t ($t_h = t_f = t$), the set of the equilibrium market structures (EMS) is as follows:

(i) International duopoly (M^I) is the EMS if $\gamma < 5.88$ for all t.
(ii) International duopoly (M^I) is the EMS if $\gamma > 5.88$ and $t < t_{cr}^{I\&N}$.
(iii) National duopoly (M^N) is the EMS if $\gamma > 7.12$ and $t_{cr}^{I\&N} < t < \bar{t}^{1I}$, where $t_{cr}^{I\&N}$ represents the critical tariff level which makes decisive firms indifferent between M^I and M^N:

$$t_{cr}^{I\&N} = \frac{4(3\gamma + 4)^2}{\gamma^4 + 10\gamma^3 + 42\gamma^2 + 64\gamma + 32}$$

and $\bar{t}^{1I}$ represents the upper limit of non-prohibitive tariff levels given in equation (5).

This proposition points to two important features. First, the set of the equilibrium market structures is non-empty for almost all tariff levels. The only exception occurs when substitutability levels (γ) are in the intermediate range and trade policy is restrictive. The intransitiveness of the dominance relationship becomes important for this range of tariff and substitutability levels ($7.12 > \gamma > 5.88$ and $t_{cr}^{I\&N} < t < \bar{t}^{1I}$). It can be shown that M^N dominates M^I where i = O,H,F,I in this given region. But it is also the case that, for the same region, M^N is dominated by M^{1I} which is dominated by M^I for all tariff and substitutability levels. Therefore, there is no equilibrium market structure in this region.

Secondly, the proposition seems to provide the opposite intuition to the tariff jumping argument in the FDI literature since higher protection yields nationally concentrated firms for close substitutes. This counterintuitive result is due to the endogeneity of the merger formation model. In the FDI literature, the tariff jumping argument is made for a single firm by focusing

on two alternatives: export or FDI. These two options are compared under the given trade policy regime without changing the concentration level in the market. However, it is important to note that, in our model, FDI occurs via an international merger and all decisive firms involved in the merger formation process benefit from tariff savings and lose from tariff protection in their domestic markets. In the FDI literature, on the other hand, firms investing in the foreign country directly enjoy tariff savings without losing their gains from protection.

Finally, our proposition supports the idea that following bilateral trade liberalization, international firms arise as the new modes of industry structure irrespective of substitutability levels. This result fits well with the fact that global trade liberalization has been accompanied by an increase in cross border merger activity. The next section examines how the changes in the industry structure of the tradable sectors due to trade liberalization affect the labour market of the non-tradable sector.

4. Labour Market in the Non-Tradable Sector

Given the above equilibrium market structures, we can examine the impacts of trade liberalization on the labour market in the non-tradable sector by focusing on the average price level realized under these two market structures. As stated above, when the trade environment is restrictive and products are close substitutes, the resulting equilibrium market structure in the tradable sector is the national duopoly (M^N). Since firms face tariff disadvantage while exporting, the higher the tariff level the higher is the average equilibrium price level. On the other hand, as trade gets liberalized, cross-border mergers become the mode of the industry structure for all substitutability levels. As a result, the presence of a tariff implies that the average price level under national duopoly (M^N) is higher than the price level under international duopoly (M^I). The difference in the price level under these two market structures, z (t, γ), decreases as the tariff level falls, but increases in the level of the substitutability between products:

$$z(t,\gamma) = P^N - P^I = \frac{t(\gamma+2)}{2(\gamma+4)} \leq 0 \tag{8}$$

The industry of non-tradable products is characterized as perfectly competitive. It is assumed that labour is imperfectly mobile across tradable and non-tradable sectors. Any structural change in the industry of tradables leads to a change in the labour market of the competitive non-tradable sector through the changes in the price level of tradables. We treat the tradable goods in two distinct ways. First, they are treated as final goods ready for consumption so that the fall in the price of tradables changes the

budget constraint of a representative worker in the non-tradable sector. Second, they enter into the production of non-tradables as intermediate goods. This has an impact on the profit maximization decision of the firms in the non-tradable sector. Next, we will isolate and analyse the labour supply and the labour demand.

4.1 Labour Supply

We assume that the utility function of a representative worker in the non-tradable sector is separable in its arguments in order to isolate our analysis of the oligopolistic tradable sector above. The labour supply in the non-tradable sector is derived from the typical utility maximization problem of a representative worker:

$$\begin{aligned} \max U(C_T, C_{NT}, N_{NT}) &= C_{NT}^{\beta} + V(C_T) - AN_{NT} \\ s.t. P_{NT}C_{NT} + P_T C_T &= W_{NT}N_{NT} \end{aligned} \tag{9}$$

where C_{NT} represents the quantity and P_{NT} represents the price of non-tradable goods, while C_T is the consumption profile of tradable-goods: $C_T = \{q_1, q_2, q_3, q_4\}$ and P_T is the corresponding price vector of tradable goods. Note that W_{NT} is the nominal wage, N_{NT} is the employment level in the non-tradable sector, and the parameter β lies in the unitary interval: $0 < \beta < 1$. The term $V(C_T)$ is Shubik's (1980) utility function for the tradable goods:

$$V(C_T) = \alpha \sum_{i=1}^{4} q_i - \frac{1}{2}\left(\sum_{i=1}^{4} q_i\right)^2 - \frac{2}{(\gamma+1)}\left[\sum_{i=1}^{4} q_i^2 - \frac{\left(\sum_{i=1}^{4} q_i\right)^2}{4}\right] \tag{10}$$

Without loss of generality, P_{NT} is assumed to be 1 and the budget constraint becomes:

$$C_{NT} = W_{NT}N_{NT} - P_T C_T \Rightarrow C_{NT} = \delta(P_T, C_T) W_{NT} N_{NT} \tag{11}$$

where $1 > \delta(P_T, C_T) > 0$ is the share of the non-tradable sector worker's income that is spent in non-tradable goods. Note that if the demand for tradable goods is price-inelastic (price-elastic), as the price of tradable goods falls, it increases (decreases) the share of the income spent on non-tradables:

$$If |\varepsilon_{D_T}^{P}| < 1 (> 1) \Rightarrow \delta'(P_T) < 0 (> 0) \tag{12}$$

By solving the utility maximization in equation (9) for N_{NT}, we derive the labour supply function in the non-tradable sector:

$$N_{NT}^{s} = \left[\frac{\beta(\delta(P_T, C_T)W_{NT})^{\beta}}{A}\right]^{\frac{1}{1-\beta}} \tag{13}$$

In order to analyse the impact of the fall in the price of tradables on the labour supply, we differentiate N_{NT}^{s} w.r.t. p_T:

$$\frac{\partial N_{NT}^{s}}{\partial P_T} = \left(\frac{\beta}{A}\right)^{\frac{1}{1-\beta}} \frac{\beta}{1-\beta} W_{NT}^{\frac{\beta}{1-\beta}} \delta(P_T, C_T)^{\frac{2\beta-1}{1-\beta}} \delta'(P_T) \tag{14}$$

and

$$\frac{\partial N_{NT}^{s}}{\partial P_T} < 0 (> 0) \; if \; \delta'(P_T) < 0 (> 0) \tag{15}$$

As a result, when the demand for the tradable goods is price-inelastic (elastic), labour supply in the non-tradable sector increases (decreases) as the price of tradable goods falls due to trade liberalization. Next, we will examine the same question from the labour demand point of view.

4.2 Labour Demand

As noted above, tradable goods enter into the production function of non-tradables as intermediate goods. The labour demand in the non-tradable sector is examined by solving the profit maximization problem of the representative firm in this sector:

$$Max \Pi(W_{NT}, r, P_T) = f(K, N_{NT}, Q_T) - W_{NT}N_{NT} - rK - P_T Q_T \tag{16}$$

Note that the profit function maps particular factor prices to the maximum profit levels achievable at those prices. Beside the usual properties of the profit function above, Hotelling's Lemma enables us to obtain the uncompensated labour demand function merely by the derivative of the profit function with respect to wage.[19] Moreover, the cost-minimization problem yields the same result as the profit-maximization problem when the given output level is the profit-maximizing output, Q_{NT}^{*}. As a result, using Hotelling's lemma and Shephard's lemma, the following is obtained:

$$N_{NT}^{DU}(W_{NT}, r, P_T) = N_{NT}^{DC}(Q_{NT}^{*}, W_{NT}, r, P_T) \tag{17}$$

In other words, the uncompensated and compensated factor demands are the same if the compensated factor demand is obtained from the cost-minimization at the profit-maximizing output level, Q_{NT}^{*}. In order to decompose the change in uncompensated labour demand with respect to a fall in the price of tradable goods, we take the derivative of the equality in equation (17) with respect to the price of the tradable goods:

$$\frac{\partial N_{NT}^{D^U}(W_{NT}, r, P_T)}{\partial P_T} = \frac{\partial N_{NT}^{D^C}(Q_{NT}^*, W_{NT}, r, P_T)}{\partial P_T} + \frac{\partial N_{NT}^{D^C}(Q_{NT}^*, W_{NT}, r, P_T)}{\partial Q_{NT}} \frac{\partial Q_{NT}^*}{\partial P_T} \tag{18}$$

The expression in equation (18) states that if the price of tradable goods falls, then it feeds into a change in labour demand via two main channels – the substitution effect, represented by the first term on the right-hand side of the expression (18), and the output effect, represented by the second term. The substitution effect establishes the effect of a fall in the price of tradable goods on the compensated labour demand and the sign is positive. On the other hand, the output effect simply states the change that would occur in the cost minimizing demand for labour if we increase the profit maximizing output level in response to a fall in the price of the tradable goods. Intuitively, a fall in the price of tradable goods reduces the marginal cost of output increasing the profit maximizing output level. This change in output level then feeds into a change in the demand for labour. Assuming that labour is a normal input, the sign of the output effect is negative. Thus, in total, the output effect says that a fall in the price of tradable goods leads to a rise in the demand for labour. In this multi-input scenario, if we assume constant returns to scale and output-market clearing, the elasticity of uncompensated demand for labour with respect to the price of the tradable intermediate goods can be derived as follows:[20]

$$\varepsilon_{N_{NT},P_T}^{U} = \varepsilon_{N_{NT},P_T}^{C} - s_{Q_T}\eta \tag{19}$$

where s_{Q_T} is the share of the tradable intermediate goods in the total cost of production of non-tradables, η represents the absolute value of the price elasticity of demand for non-tradable goods, and $\varepsilon_{N_{NT},P_T}^{C}$ denotes the elasticity of compensated demand for labour with respect to the price of tradable intermediate goods.

The intuitive explanation for the formula in equation (19) is as follows: if the share of the tradable intermediate goods, s_{Q_T}, is very large, then a fall in P_T affects the marginal cost of output tremendously, and a fall in the marginal cost in our competitive system feeds immediately into a fall in the output price. The more sensitive the demand is to the output price (the higher η), the greater is the rise in output. Thus, high s_{Q_T} and η imply a strong output effect.

As a result, if s_{Q_T} and η are high enough, labour (N_{NT}) and tradable goods (Q_{NT}) are gross complements in the production of non-tradables; otherwise, they are gross substitutes. Note also that the direction and the size of the change of the labour demand in the non-tradable sector depend on the degree of complementarity and substitutability of the tradable intermediate goods and the labour employed in that sector. Next, we combine our results

for labour demand and labour supply in order to examine the indirect employment and wage impacts of trade liberalization in the non-tradable sector.

4.3 Employment and Wage

Once we combine the labour supply and labour demand analyses above, it can be argued that the indirect employment and wage impacts of the change in the nature of mergers in the tradable sector, due to trade liberalization, are ambiguous. It depends on the sign and the size of the price elasticity of demand for tradable and non-tradable goods ($\varepsilon^P_{D_T}$, η, respectively), and the share of the tradable intermediate goods in the total cost of production of non-tradables (s_{Q_T}). Our results can be summarized in the following table:

	N_{NT} and Q_{NT} are complements	N_{NT} and Q_{NT} are substitutes
$\varepsilon^P_{D_T} < 1$	$N_{NT} \uparrow W_{NT}?$	$N_{NT}?\ W_{NT} \downarrow$
$\varepsilon^P_{D_T} > 1$	$N_{NT}?\ W_{NT} \uparrow$	$N_{NT} \downarrow W_{NT}?$

As seen in the above table, the positive employment (wage) impact is certain only if the demand for tradable goods is inelastic (elastic), while the elasticity of demand for non-tradable goods and the share of tradable intermediate goods in the total cost of production of non-tradables are high enough. In other cases, there is an ambiguity depending on the sign and size of these factors.

5. Concluding Remarks

This paper explores two related issues in response to trade liberalization. First, it examines the international linkages between industry structure and trade liberalization. The objective has been to ask how the industry of tradables restructures following trade liberalization. This is a meaningful question because over the last two decades the world economy has experienced the largest ever merger movement with a high incidence of cross border mergers and acquisitions. Second, following the changes in the market structure in the tradable sector, it is natural to ask: how is the labour market of the non-tradable sector affected by these changes?

We consider an economy with two sectors: a competitive non-tradable sector and an oligopolistic tradable sector. In determining industry structures following trade liberalization, two effects are found to be playing important roles: the *protection gain* and the *tariff savings*. The balance between these two effects leads to the result that trade liberalization changes the industry structure in the tradable sector, leading to cross-border mergers. This result is consistent with the fact that global trade liberalization has been accompanied by an increase in cross-border merger activities.

In order to examine the implications of trade liberalization for the labour market of the non-tradable sector, tradable goods are treated first as consumption goods and then as intermediate goods in the production of non-tradables. It is found that the indirect employment and wage impacts of the fall in the price of tradable goods depends on the sign and the size of the price elasticity of demand for tradable goods and non-tradable goods, and the share of the tradable intermediate goods in the total cost of production of non-tradables. The empirical testing of this linkage between tradable and non-tradable sectors following trade liberalization deserves attention for potential research.

This paper explores only one potential explanation for the high incidence of cross-border M&As: trade policy. However, it should be emphasized that investment policy, and competition policy towards cross-border M&As are not less important than trade policy in determining international industry structure. One of the weaknesses of the merger analysis in this paper is that we treat cross boder M&A as the only way of acquiring productive capacity in the export market. As an extension, greenfield entry should be permitted as well. Our analysis stays valid for situations where productive capacity is sufficiently costly so that greenfield entry is not an option. Moreover, our focus in the merger formation is on the market power incentives and we do not address cost synergies that stem from concentration or regulation costs of mergers. We intend to pursue these issues in future research.

Appendix

All supporting calculations and definitions not provided in text are given below.

Prohibitive Tariff Levels

Prohibitive tariff level under a given market structure equates the equilibrium quantity to zero:

$$\overline{t_h}^O = \overline{t_f}^O = \frac{2\alpha(7\gamma + 8)}{3\gamma^2 + 18\gamma + 16}$$

$$\overline{t_h}^H = \overline{t_f}^F = \frac{2\alpha(3\gamma + 4)}{\gamma^2 + 8\gamma + 8}, \overline{t_f}^H = \overline{t_h}^F = \frac{2\alpha(7\gamma + 8)}{3\gamma^2 + 18\gamma = 16}$$

$$\bar{t}_h^{1I} = \bar{t}_f^{1I} = \frac{4\alpha(3\gamma + 4)(7\gamma + 8)}{23\gamma^3 + 152\gamma^2 + 256\gamma + 128}$$

$$\bar{t}_h^N = \bar{t}_f^N = \frac{2\alpha(3\gamma + 4)}{\gamma^2 + 8\gamma + 8}$$

The ranking structure of prohibitive tariff levels is as follows:

$$\bar{t}_h^N = \bar{t}_f^N = \overline{t_h}^F = \overline{t}_f^H \geq \overline{t_h}^H = \overline{t}_f^F = \overline{t_h}^O = \overline{t}_f^O \geq \bar{t}_h^{1I} = \bar{t}_f^{1I}$$

Derivation of equation (19)

If we multiply both sides of equation (18) by $\frac{P_T}{N_{NT}^{D^U}(\cdot)}$ the term on the left side of the equation (18) becomes the elasticity of uncompensated demand for factor labour w.r.t. P_T:

$$\varepsilon^U_{N_{NT},P_T} = \frac{\partial N_{NT}^{D^U}(\cdot)}{P_T}\frac{P_T}{N_{NT}^{D^U}(\cdot)}$$

Similarly, recognizing that $N_{NT}^{D^U}(W_{NT}, r, P_T) = N_{NT}^{D^C}(Q^*_{NT}, W_{NT}, r, P_T)$, the first term on the right-hand side of equation (18) becomes the elasticity of compensated demand for labour w.r.t. P_T :

$$\varepsilon^C_{N_{NT},P_T} = \frac{\partial N_{NT}^{D^C}(\cdot)}{P_T}\frac{P_T}{N_{NT}^{D^C}(\cdot)}$$

The remaining term is the output effect (the second term on the right-hand side of equation (18)). Multiplying through by $\frac{Q^*_{NT}}{Q^*_{NT}}$, we obtain the multiplication of the elasticity of labour demand w.r.t $Q_{NT}(\varepsilon_{N_{NT},Q_{NT}})$ and the elasticity of output (Q_{NT}) w.r.t. $P_T(\varepsilon_{Q_{NT},P_T})$. As a result, the entire expression in equation (18) reduces to:

$$\varepsilon^U_{N_{NT},P_T} = \varepsilon^C_{N_{NT},P_T} + \varepsilon_{N_{NT},Q_{NT}}\varepsilon_{Q_{NT},P_T} \tag{20}$$

Recognizing that there are fixed factor proportions in the output effect, $\varepsilon_{N_{NT},Q_{NT}}$ is assumed to be 1. Moreover, we define the elasticity of supply as $\varepsilon_{Q_{NT},P_{NT}} = \frac{\partial Q_{NT} P_{NT}}{\partial P_{NT} Q_{NT}}$ and multiply the last term in expression (20) by $\frac{\varepsilon_{Q_{NT},P_{NT}}}{\varepsilon_{Q_{NT},P_{NT}}}$:

$$\varepsilon^U_{N_{NT},P_T} = \varepsilon^C_{N_{NT},P_T} + \varepsilon_{Q_{NT},P_{NT}}\frac{\varepsilon_{Q_{NT},P_{NT}}}{\varepsilon_{Q_{NT},P_{NT}}} \tag{21}$$

Making the relevant cancellations, using the definition of the cost function that $\frac{\partial Q_T(\cdot)}{\partial Q_{NT}} = \frac{\partial^2 C(\cdot)}{\partial Q_{NT}\partial P_T}$ and inserting $P_{NT} = MC$, the last term in

equation (21) is merely the elasticity of marginal cost w.r.t. P_T (ε_{MC,P_T}). As a result, we obtain the following:

$$\varepsilon^{U}_{N_{NT},P_T} = \varepsilon^{C}_{N_{NT},P_T} + \varepsilon_{Q_{NT},P_{NT}}\varepsilon_{MC,P_T} \tag{22}$$

Under constant returns to scale, we know that by Euler's Theorem:

$$Q_{NT} = f_{N_T}N_T + f_{Q_T}Q_T + f_K K \tag{23}$$

Using Euler's Theorem, multiplying through by P_{NT} and recalling that the price of each input equals the value of its marginal product (from the first order conditions for profit maximization), ε_{MC,P_T} can be written as follows:

$$\varepsilon_{MC,P_T} = \frac{P_T Q_T}{W_{NT}N_{NT} + P_T Q_T + rK} = s_{Q_T} \tag{24}$$

Assuming market clearing, we can reinterpret $\varepsilon_{Q_{NT},P_{NT}}$ as capturing the price elasticity of demand ($-\eta$) for that output. This completes our derivation of the formula in equation (19).

Proof of Proposition 1

(a) M^I & M^O: There are two distinct (completely symmetric) groups of decisive owners: {1, 3} and {2, 4}. It is found that:

M^I dominates M^O if $\gamma < 18.02$ for all t.

M^I dominates M^O if $\gamma > 18.02$ for all $t > t_{cr}^{I\&O}$.

M^O dominates M^I if $\gamma > 18.02$ for all $\bar{t}^{1I} > t > t_{cr}^{I\&O}$ where $t_{cr}^{I\&O}$ equates the profits of each decisive group.

(b) M^I & $M^H(M^F)$: The decisive group comprises all owners. Industry profit is compared:

M^I dominates $\mathrm{M}^H(\mathrm{M}^F)$ if $\gamma < 8.66$ for all t.

M^I dominates M^H (M^F) if $\gamma > 8.66$ for all $t < t_{cr}^{I\&H}$.

M^H (M^F) dominates M^I if $\gamma > 8.66$ for all $\bar{t}^{1I} > t > t_{cr}^{I\&H}$ where $t_{cr}^{I\&H}$ equates the industry profit under these two market structures.

(c) M^I & M^{1I}: The decisive group comprises two owners: {2,4}

M^I dominates M^{1I} for all t and γ.

(d) M^I *&* M^N*:* The decisive group comprises all owners. Industry profit is compared under these two market structures. It is found that:

M^I dominates M^N if $\gamma < 5.88$ for all t.

M^I dominates M^N if $\gamma > 5.88$ and $t < t_{cr}^{I\&N}$.

M^N dominates M^I if $\gamma > 5.88$ for all $\bar{t}^{1I} > t > t_{cr}^{I\&N}$.

Where $t_{cr}^{I\&N}$ is the critical tariff level that equates $d^{I\&N}(t)$ to zero.

$$t_{cr}^{I\&N} = \frac{4\alpha(3\gamma+4)^2}{\gamma^4+10\gamma^3+42\gamma^2+64\gamma+32}$$

The next step is to show that M^N dominates all possible market structures other than M^I for the region specified in the proposition:

(e) M^N *&* M^O*:* Since there are two completely symmetric groups of decisive owners, there are two symmetric dominance groups: {1, 2} and {3, 4}. It is found that M^N dominates M^O for all t and values:

$$\Pi_{12}^N > \Pi_1^O + \Pi_2^O \textit{ and } \Pi_{34}^N > \Pi_3^O + \Pi_4^O \textit{ for all } t < \bar{t}^{1I}$$

(f) M^N *&* $M^{H(MF)}$*:* The decisive group comprises two owners. Tariff level can be seen as a constant marginal cost. In this dominance relationship, movement from M^H to M^N implies a single concentrative merger which is always profitable under price competition.

(g) M^N *&* M^{1I} *:* The decisive group comprises all owners.

M^N dominates M^{1I} if $\gamma > 7.123$ for all t.

M^{1I} dominates M^N if $7.123 > \gamma > 5.88$ if $t_{cr}^{N\&1I} < t < \bar{t}^{1I}$ where $t_{cr}^{N\&1I}$ equates the industry profit under these two market structures.

This completes the proof of the last part and thus the proof of proposition.

Notes

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[1] UNCTAD (1999) carried out a more detailed analysis of the incidence of cross-border M&As in developing countries. It found that the share of M&As in the accumulated FDI rises from 22 per cent on average during 1988–91 to 72 per cent during 1992–97 (China is excluded).

[2] An interesting feature of the current wave of cross-border M&As is that it is truly international, as opposed to the previous waves, which involved primarily US firms. Measured by dollar value, takeovers involving at least one US party have declined from 88% worldwide in 1985 to 53 per cent in 1999. Consequently, it no longer makes sense to see takeover booms and busts as national phenomena.

[3] This literature includes papers by Dunning (1977), Markusen (1984), Horstmann and Markusen (1992), Markusen and Venables (1995). Markusen (1995) surveyed the theoretical literature on FDI and multinational enterprises (MNE).

[4] Linkages between trade policy regime and FDI go back to Bhagwati (1973).

[5] As in Lee (1996), Ghose (2000), and Arbache (2002), the increasing internationalization of economies has been blamed as one of the main factors behind the increase in the dispersion of wages and unemployment.

[6] Our paper is related to Horn and Persson (2001b) who apply the endogenous merger formation approach to international trade and determine the equilibrium ownership structure of an international oligopoly. They show that the international pattern of ownership depends on trade and production costs.

[7] Unlike much of the literature on mergers in international markets, we follow Deneckere and Davidson's (1985) approach and utilize price competition in the product market. Since Salant *et al.* (1983) it is well known that under quantity competition, firms can actually lose from a merger since the merged unit loses market share to outside firms.

[8] In our computations we assume that $c = 0$. This is without loss of generality, as we can always transform variables as follows: $\alpha^* = \alpha - c$, $p^* = p - c$:

[9] While exporting, each non-merging home firm faces the tariff t_f .

[10] Nationally merging firms face a tariff disadvantage when serving their export market.

[11] To endogenize merger formation, there are two main alternative approaches: Kamien and Zang (1990) offered an acquisition process modelled as follows: each owner makes offers or bids for every other firm and announces an asking price for her own simultaneously. This approach applies to situations where there are many firms and owners and no negotiations between firms. In contrast, our focus is on minimal symmetric oligopoly model where firms are able to communicate and sign binding contracts. Chatterjee *et al.* (1993) and Ray and Vohra (1999) treat the merger formation as a non-cooperative bargaining game and also belong to this literature.

[12] Formal definition of a decisive group and further detailed discussion can be found in Horn and Persson (2001a).

[13] Note that there may be more than one group of decisive firms. Consider now the ranking of these two market structures: $\mathrm{M}^C = \{\{1\}, \{2\}, \{3\}, \{4\}\}$ and $\mathrm{M}^D = \{\{12\}, \{34\}\}$: Firms 1 and 2 participate in a merger under M^D as do firms 3 and 4, even though they are competing units under M^C . Therefore all four firms are decisive with respect to these two market structures. However, merger formation processes are not linked so that there are two decisive groups of firms. The first decisive group is composed of firm 1 and firm 2 and the second one includes firm 3 and firm 4.

[14] We can rule out these market structures simply by assuming that the competition authority sets a maximum of the Herfindahl-Hirschman index (HHI) level.

[15] Hereafter, $\bar{t}^{IJ}$ indicates the upper limit of tariff protection. The comparison of prohibitive tariff levels can be found in the appendix.

[16] Since the focus is on the bilateral trade liberalization, the same tariff rate is assumed in both markets: $t_h = t_f = t$.

[17] Similarly, foreign merger's profit can be written as follows:

$$\pi_{34}^N(t) = \pi_{34}^N(t=0) + \int_0^t \frac{\partial \pi_{34}^N(t)}{\partial t} dt - tq_{34}^e$$

where q_{34}^e represents the amount of output exported by a foreign merger.

[18] For the sake of simplicity, the market size (α) is assumed to be 1.

[19] Usual properties are as follows: π (P_{NT}, W_{NT} , r, P_T) is non-decreasing (non-increasing, respectively) in P_{NT} (W_{NT} , r, P_T , respectively) while it is convex, continuous and homogeneous of degree 1 in P_{NT} , W_{NT} , r, P_T .

[20] You may find the explicit derivation of the equality in equation (19) in the appendix.

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