Reductions in Real versus Tariff Barriers: The Effects on Industry Concentration

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Abstract

Economic integration in Europe has had ambiguous effects on industry concentration. The literature has proposed various explanations of the empirical findings. The present paper provides an additional theoretical argument. We show that in a world of monopolistic competition, integration in it self (modelled as a reduction of trade barriers) generates opposing effects on industry concentration, depending on wether the barrier is a real (frictional) or a tariff cost. In particular, the Herfindahl index of industry concentration falls for a reduction in real costs, but rises for a reduction in tariff costs. The reason is that real barriers burn up resources, such that industry profitability is reduced, reducing entry, and resulting in fewer firms and higher concentration. Under a tariff barrier, the redistributed tariff revenue stabilises industry profitability, resulting in more firms and lower concentration.

Key Words: real costs, tariff costs, industry concentration, market structure, integration.
JEL: F12, F15, L11

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1. Introduction

Fifty years of Economic integration in Europe has not, as standard theory would suggest, resulted in a clear cut reduction of industry concentration. On the contrary, industry concentration has risen for several sectors and countries in the period around the establishment of the Internal Market in the EU (see e.g. EU-Commission (1996), EU-Commission (1997, chapter 4)). Here we refer to concentration in the sense of market structure, not in the sense of localisation of industry. Industry concentration is, in fact, the key element in market structure and a determinant of conduct and performance. Thus, given the lack of a clear reduction in concentration, part of the supposed welfare gains from integration have not been realised. The available explanations of this unexpected development point among other things at: a) the significant increase in mergers and acquisitions since the mid 80s; b) the existence of endogenous fixed costs (e.g. R&D and advertising costs), the importance of which tends to increase with an increase in market size, in turn resulting in an increase in firm size and concentration; c) diversification trends among large firms, such that aggregate concentration increases; d) developments in production processes like economies of distribution or other aspects of multi-plant operation. For these and other explanations as well as empirical investigations see Lyons et al. (2001), Hansen and Jørgensen (2001), Azzam (1997), Davies and Lyons (1996) and Sutton (1991). A recent investigation into comparable trends in US industry concentration is provided by Pryor (2001).

The present paper develops a theoretical point, arguing that economic integration in it self may generate opposing forces on industry concentration. The argument commences from the fact that economic integration can involve a reduction in real (frictional) costs and/or a reduction in tariff costs. Both these types of costs are trade costs that reduce import volumes. However, real (frictional) costs burn up resources, e.g. firms have to employ staff to deal with border formalities, transport is made costly by a deficient infrastructure, or costly safety and regulation requirements are imposed on a foreign supplier. On the other hand, tariff costs are like a tax that is imposed upon producers, again cutting import volumes, but eventually the tariff revenues is redistributed to consumers.[2] We establish- in a world with imperfect competition and intra-industry trade - that if integration occurs both as a reduction in tariff costs and a reduction in real costs, then the impact on industry concentration is ambiguous. In particular, industry concentration falls for a reduction in real costs, but rises for a reduction in tariff costs. Thus, the ambiguous empirical results on industry concentration are reconciled with theory .

The present paper develops a general equilibrium model of monopolistic competition. The formal model builds on Krugman (1980 and 1981). The present approach models two symmetric countries that engage in intra-industry trade, and where consumers care both about the consumption of home and imported goods. The model is novel in terms of incorporating a distinction between real and tariff barriers to trade. From a producers point

2. The distinction between real trade barriers and tariff trade barriers features also in the work of Baier and Bergstrand (2001). They estimate the relative effect of transport costs reductions and tariff reductions on the growth in world trade. Their finding is that both factors contribute significantly and substantially, yet, income growth is the main explanatory factor for the growth in trade. Also, the Single Market Program of the European Union is in fact the attempt to reduces real (frictional or non-tariff) barriers after the removal of tariff barriers had been achieved.

of view, both types of costs enter identically, i.e. producers do not care if the cost occurring to them stems from a real production costs or from a tariff. Yet, solving in general equilibrium, we find that there is a significant difference in the number of firms for the two types of costs. The reason is that since real (frictional) barriers burn up resources, they do not just induce each firm to produce less, but also industry profitability is reduced, which in turn reduces firm entry. On the other hand, under a tariff barrier, the tariff revenue is redistributed. The tariff still induces each firm to produce less, but industry profitability remains stable, attracting entry. Calculating the Herfindahl index of industry concentration, it is established that a reduction in real costs does indeed result in a reduction in concentration, while a reduction in tariff costs, will in fact increase industry concentration. Still, for both types of costs, it is true that welfare increases for a reduction in the barrier.

The paper is structured as follows. Section 2 introduces the formal model. In section 3 we derive the equilibria - quantities, prices and the number of firms - for the two types of trade costs. In section 4 several measures of concentration are calculated, and their reaction to a cut in trade barriers is examined. Finally, section 5 concludes the paper.

2. The Model

We develop a setting of Chamberlinian monopolistic competition in the spirit of Spence (1976) and Dixit and Stiglitz (1977). The particular starting point for our model is the application of this approach to international trade developed by Krugman (1980) and Krugman (1981).

Assumptions of the model

It is assumed that the world consists of two symmetric countries with firms producing in the same industry, i.e. we have intra-industry trade. In both countries market conditions are described by monopolistic competition, increasing returns to scale in production and differentiated goods. The industry has a large number of potential variants which enter symmetrically into demand. Variants at home and abroad are different. Each firm produces its variant for the home market and for the export market. Consumers care for the consumption of both home and foreign variants.

The present model adopts the utility function of Krugman (1981), where we reinterpret the original feature of two industries into a distinction into home and foreign products. Also, for both home and foreign products we apply the specific functional form utilised in Krugman (1980). As the two countries are completely identical we concentrate on the specification for the home country throughout the analysis. Foreign variables are indicated by *. All individuals are assumed to have the same utility function,

$$U = \ln \sum_{j=1}^{N_H} c_{H,j}^{\theta} + \ln \sum_{i^*=1}^{N_M} c_{M,i^*}^{\theta} \tag{1}$$

where $0<\theta<1$ and c_{M,i^*} is consumption of the i*th variant of imports and $c_{H,i}$ is consumption of the ith variant of home products. In this set-up the import (M) of one country equals the export (Z) of the other country and vise versa, even though it is different variants that cross the border. N_H and N_M define large numbers of potential variants in both home and foreign products. The number of variants actually produced n_H and n_M are assumed to be large, although smaller than N_H and N_M.

On the supply side we assume that there exists only one factor of production which is labour. Firms can produce their specific variant for the home market, the foreign market or both. Below we show that in fact each firm will choose to produce for both markets. Each firm produces with the same cost function given by:

$$l_i = \alpha + \beta x_{H,i} + \beta x_{Z,i} \qquad i = 1,\dots n_H \tag{2}$$

where l_i is labour used in the production of the ith variant of the home industry, $x_{H,,i}$ is output of that variant for the home market and $x_{Z,i}$ are the exports of that variant. This specification includes fixed costs α, which we assume to be some form of market specific access cost (marketing, advertising, distribution) and constant marginal costs β and hence average costs decline at a diminishing rate. This assumption secures that each variant is produced by only one firm. The cost function in (2) implies that the labour requirements are identical for every variant. Labour requirements are converted into nominal costs by multiplying (2) by the wage rate, w.

The market clearing condition demands that the output of each variant should be equal to the total world consumption of that variant; more precisely the markets for import and home goods have to clear. There will be assumed full equality between the number of workers and consumers. Hence, the market clearing condition gives that the consumption of a representative consumers times the labour force, *L*, must equal output. This gives rise to the following conditions:

$$x_{H,i} = Lc_{H,i}$$
$$x_{Z,i} = L^{*}c^{*}{}_{M,i} \qquad (3)$$

Due to symmetry we have $L = L^{*}$ and $c^{*}_{M,i} = c_{M,i^{*}}$. Also, labour market clearing demands $L = l_i n$ and $L^{*} = l_i^{*} n^{*}$. Since each variant behaves identically we can omit subscripts i and i* in the remainder of the paper.

Equilibrium with free trade

Finding equilibrium in this model without distortion follows the standard procedure assuming free entry and exit of firms, the zero-profit condition and labour market clearing at full employment (see e.g. Krugman 1980). The free trade equilibrium turns out to be:

$$x_H = x_Z = \frac{\theta\alpha}{2(1-\theta)\beta}$$

$$p_H = p_M = \frac{\beta w}{\theta} \tag{4}$$

$$n = n_H = n_M = \frac{(1-\theta)L}{\alpha}$$

Firms produce equal quantities for the home and the foreign market and imported and home goods have the same price. Realising that $n_M = n_Z$, (4) also shows that each firm will want to produce for both the home market and the foreign market.

3. Equilibrium with real and tariff trade costs

This section analyses the effect of the two different forms of tariff barriers on the market equilibrium. Because of the general equilibrium approach used, we have effects from the trade barrier on both the imported (exported) products as well as on the consumption and production of home products.

Market equilibrium - real (frictional) trade cost

Under the presents of a trade cost $\tilde{t}$, firms' cost function (2) changes. The cost is only encountered when exporting. We assume $\tilde{t}$ to be a real (frictional) cost, i.e. firms have to hire people to transport goods, have to hire people to do border formalities etc. The new cost function becomes:

$$\tilde{l} = \alpha + \beta \tilde{x}_H + (\beta + \tilde{t})\tilde{x}_Z \tag{5}$$

where $\tilde{l}$ is labour used in the production of a variant, and $\tilde{x}_H$ and $\tilde{x}_Z$ is output of that variant for the home and export market respectively under the presence of a real trade cost.

The profit of a home firm, producing a variant, is given by $\tilde{\pi} = \tilde{p}_H \tilde{x}_H + \tilde{p}^*_M \tilde{x}_Z - \tilde{l} w$, where $\tilde{p}^*_M = \tilde{p}_M = \tilde{p}_Z$, i.e. consumer import prices (identical to the export prices, though not necessarily firm gate prices) are identical in both countries. Given that market access costs are specific to each market and identical, and given constant marginal cost we can separate the problem into two independent maximisations (one on the home market and one on the foreign market), where firms place half the fixed costs α on each market. We arrive at the following profit functions for the home and foreign market respectively:

$$\begin{aligned} \tilde{\pi}_H &= \tilde{p}_H \tilde{x}_H - (\tfrac{\alpha}{2} + \beta \tilde{x}_H)w \\ \tilde{\pi}_Z &= \tilde{p}_Z \tilde{x}_Z - (\tfrac{\alpha}{2} + (\beta + \tilde{t})\tilde{x}_Z)w \end{aligned} \tag{6}$$

Following the same procedures as above it is now possible to derive the prices and quantities in each market and the resulting number of firms. The important characteristic of the real trade costs specification is that labour is actually used in the process (transporting, border formalities, safety regulations). Firms employ workers to carry out these tasks when exporting, hence they will supply less output at a higher price to the foreign market. The workers engaged in the frictional trade barrier activity still get the wage w, and will demand both home and imported products - so total spending power is unchanged. However, some labour input is missing for the actual production of goods. Solving the model we arrive at the following equilibrium:

$$\tilde{p}_H = \frac{\beta w}{\theta} \quad , \quad \tilde{p}_Z = \frac{(\beta + \tilde{t})w}{\theta}$$

$$\tilde{x}_H = \frac{\alpha\theta}{2(1-\theta)\beta} \quad , \quad \tilde{x}_Z = \frac{\alpha\theta}{2(1-\theta)(\beta + \tilde{t})} \tag{7}$$

$$\tilde{n} = \tilde{n}_H = \tilde{n}_Z = \frac{(1-\theta)L}{\alpha}$$

The number of firms can either be derived via the labour market clearing condition using (5) or by utilising the fact (stemming from the maximisation of utility function (1)) that consumers will use equal shares of their income on imported goods and on home goods, i.e. $\tilde{p}_j \tilde{n}_j \tilde{x}_j = \frac{wL}{2}, \ j = H, Z$. The latter requirement demonstrates that each firm in fact will choose to supply both markets. Comparing the resulting equilibrium (7) with the free trade case (4), we notice that supply of home goods to the home market is unchanged. Yet, for the exports we have that prices have risen and quantities have fallen. However, the number of firms (variants) remained unchanged.

Market equilibrium - tariff trade costs

We can now calculate the effects of a tariff trade barrier as opposed to a frictional trade barrier. The tariff is different from a real costs, because - even though it enters the producers problem as before - the tariff revenue remains in the system. Also, no real resources (labour) are used up when paying the tariff. In particular we assume that all tariff receipts are redistributed to consumers. In order to generate a tariff set-up resembling the previous problem, consider a specific tariff $\hat{T}$. Then the profit function of a firm becomes $\hat{\pi} = \hat{p}_H \hat{x}_H + \hat{p}_M^* \hat{x}_Z - \hat{T}\hat{x}_Z - \hat{l}w$, where the cost function is identical to the initial version from (2), namely $\hat{l} = \alpha + \beta\hat{x}_H + \beta\hat{x}_Z$. Defining the specific tariff in real terms by $\hat{t} = \frac{\hat{T}}{w}$ and separating the maximisation for the two markets, the firms profit function can be restated as:

$$\begin{aligned} \hat{\pi}_H &= \hat{p}_H \hat{x}_H - \left(\tfrac{\alpha}{2} + \beta\hat{x}_H\right)w \\ \hat{\pi}_Z &= \hat{p}_Z \hat{x}_Z - \left(\tfrac{\alpha}{2} + (\beta + \hat{t})\hat{x}_Z\right)w \end{aligned} \tag{8}$$

Thus from the firms perspective the situation under a tariff trade barrier (8) is identical to the situation under a real costs trade barrier (6). Namely, a specific tariff enters the exporting firms profit function like an increase in marginal cost. Again free entry and exit ensure that firms compete industry profits down to zero and by using the altered profit function we can calculate the resulting output and quantities per firm and the number of firms. The equilibrium is depicted by:

$$\hat{p}_H = \frac{\beta w}{\theta} \quad , \quad \hat{p}_Z = \frac{(\beta + \hat{t})w}{\theta}$$

$$\hat{x}_H = \frac{\alpha\theta}{2(1-\theta)\beta} \quad , \quad \hat{x}_Z = \frac{\alpha\theta}{2(1-\theta)(\beta+\hat{t})} \tag{9}$$

$$\hat{n} = \hat{n}_H = \hat{n}_Z = \frac{(1-\theta)L}{\alpha}\frac{2(\beta+\hat{t})}{2(\beta+\hat{t})-\theta\hat{t}}$$

The number of firms can again be calculated via the labour market clearing condition using (2) or by utilising the fact that half the income is spend on home goods and imports respectively. However, this time one has to take account of the fact that the redistributed tariff revenue enters household income, i.e. $\hat{p}_Z \hat{n}_Z \hat{x}_Z = \frac{wL + \hat{T}\hat{n}_M \hat{x}_Z^*}{2}$. Using the fact that $\hat{x}_Z = \hat{x}_Z^*$ and $\hat{n}_Z = \hat{n}_M$ one can calculate the number of firms that want to supply the foreign market and subsequently the number of firms that also want to supply the home market. As before it turns out that $\hat{n}_Z = \hat{n}_H = \hat{n}$. Thus, even though prices and quantities for each firm are unchanged compared to the case of a real trade barrier, the number of firms has increased. What causes this increase? Since all tariff revenues are redistributed to the consumers the economy experiences an increase in spending power (compared to the pure waste of a real trade barrier), and more firms can enter the market before profits turn to zero. In fact, under the specific tariff, industry profitability is stabilised, while each individual firm experiences a reduction in profitability. Consumers will spend part of the redistributed tariff revenue on home goods and part on imported goods (thus the tariff does actually reduce total imports). The extra spending power (total tariff revenue) is given by:

$$R^{\hat{t}} = \frac{\hat{t}Lw\theta}{2(\beta + \hat{t}) - \theta\hat{t}}$$

However, this increase in the number of firms in the tariff barrier case (increasing the number of firms beyond the number of firms under free trade) is not a free lunch! The increased expenditures on fixed costs α (due to more variants) is sub-optimal, i.e. there are too many firms. Using (1) to calculate the representative consumers utility and taking the free trade utility U as our benchmark we get the following ranking for a given trade barrier $\tilde{t} = \hat{t}$.

$$U > \hat{U} > \tilde{U} \tag{10}$$

The utility under the tariff trade barrier ($\hat{U}$) is larger than the utility under a frictional barrier of equal magnitude ($\tilde{U}$), though less than free trade utility (see appendix 1). The intuition for this ranking is clear cut. The frictional barrier burns up resources (resources used on transport, administration, etc. which give no utility) such that the total consumption volume is reduced, though the number of firms remains unchanged. A tariff barrier on the other hand, does not use resources on transport etc, but on creating more variants (firms) than is optimal. That is, a pure waste ($\tilde{t}$) is converted into too much fixed cost (α) expenditure. The extra firms create some utility (via the love of variants), yet consumers would be better of with slightly fewer firms producing a larger volume each (the free trade benchmark).

4. Industry concentration and the effects from reducing trade barriers

In this section we analyse the impact of bilateral reductions in trade barriers (real and tariff) on some standard measures of industry concentration. There are various measures of concentration that can be calculated, based on both the variable observed (output, employment, capital employed, etc) and the means of calculation. Here we will focus on output and three frequently used methods of calculation. It is shown that the concentration indices react very differently to a reduction in trade barriers, and more importantly that the Herfindahl index (one of the most comprehensive measure of industry concentration) reacts differently depending on wether the reduction occurs in real trade barriers or in tariff trade barriers.

A simple measure of concentration

A typical first cut measure of industry concentration is the inverse of the number of firms servicing a given market. If we take the home country as the relevant market[3] and using the values from (7) above, then this measure for the case of real (frictional) cost becomes:

$$c\tilde{o}n = \frac{1}{\tilde{n}_H + \tilde{n}_Z^*} = \frac{\alpha}{2(1-\theta)L}$$

which is independent of the size of the trade barrier $\tilde{t}$. On the other hand for a tariff barrier (using (9)) the measure becomes:

$$c\hat{o}n = \frac{1}{\hat{n}_H + \hat{n}_Z^*} = \frac{\alpha}{2(1-\theta)L}\frac{2(\beta+\hat{t})-\theta\hat{t}}{2(\beta+\hat{t})}$$

where this measure is rising for a reduction in $\hat{t}$. Thus, for this simple measure of industry concentration we find that a reduction in frictional (real) costs is neutral on concentration, while a reduction in tariff barriers will result in an increase in concentration, i.e. reducing the tariff results in fewer firms servicing the market.

The concentration ratio

A second - and frequently used (see e.g. EU-Commission (1996), Pryor (2001)) - measure of concentration is the combined market share of the *k* biggest producers, called the concentration ratio. A typical specification is the cr4 measure, where the joint market share of the four biggest firms is taken as an indicator of concentration. To construct such

3. Due to symmetry, the measures for the two countries are of course identical.

measure for our cases we have to calculate total output, i.e. the market volume.[4] For the case of a real cost we have $\tilde{X} = \tilde{n}(\tilde{x}_H + \tilde{x}_M)$. Plugging in the values from (7) gives:

$$\tilde{X} = L\theta \frac{2\beta + \tilde{t}}{2\beta(\beta + \tilde{t})} \tag{11}$$

The market share of the *k* ($k < \tilde{n}$) largest firms (in fact these are home firms) becomes:

$$c\tilde{r}k = \frac{k\,\tilde{x}_H}{\tilde{X}} = \frac{k\alpha(\beta + \tilde{t})}{(1-\theta)L(2\beta + \tilde{t})}$$

It is easy to show that this measure of concentration will fall for a decrease in real cost $\tilde{t}$, i.e. industry concentration falls for a fall in the real trade barrier. Turning to tariff trade barriers we have from (9) the total market volume $\hat{X} = \hat{n}(\hat{x}_H + \hat{x}_M)$ given by:

$$\hat{X} = L\theta \frac{2\beta + \hat{t}}{2\beta(\beta + \hat{t})} \frac{2(\beta + \hat{t})}{2(\beta + \hat{t}) - \theta\hat{t}} \tag{12}$$

Now the market share of the *k* largest firms becomes:

4. When looking at the home market, the domestic producers have a larger market share than foreign producers, thus the concentration ratio can actually be calculated, even though we have a model, where all firms are of equal size.

$$c\hat{r}k = \frac{k\,\hat{x}_H}{\hat{X}} = \frac{k\alpha(2\beta + (2-\theta)\hat{t})}{(1-\theta)2L(2\beta + \hat{t})}$$

Again, it can be shown that $\frac{\partial c\hat{r}k}{\partial \hat{t}} > 0$, i.e. the concentration ratio measure will fall for a decrease in tariff cost $\hat{t}$. This analogy between the impact of real verus tariff costs stems from the fact that the market volumes (11) and (12) increase for reductions in both types of trade barriers. Or to put it differently, the total output of *k* home firms is unaffected by real or tariff costs, but the total market volume increases due to a reduction in any of the two trade barriers, and hence the concentration ration falls.

The Herfindahl index

The Herfindahl index of concentration is one of the most far-reaching measures, taking into account both the number of firms and their respective market share. The index is defined as $\sum_{j=1}^{n} s_j^{\,2}$ where s_j is the market share of the *j*'s firm. Thus for the present model the index becomes $h = n\left(\left(\frac{x_H}{X}\right)^2 + \left(\frac{x_M}{X}\right)^2\right)$. Plugging in the relevant values from (7) and using (11) we get the following expression for the case of a real cost trade barrier:

$$\tilde{h} = \frac{\alpha(\beta + \tilde{t})^2 + \alpha\beta^2}{(1-\theta)L(2\beta + \tilde{t})^2} \tag{13}$$

Differentiating (13) with respect to $\tilde{t}$ one can show that $\frac{\partial \tilde{h}}{\partial \tilde{t}} > 0$, i.e. industry concentration decreases as real (frictional) trade costs are reduced. This result is in line with the common pre-perception, that increased economic integration should result in a preferable market structure, i.e. reduced concentration.

Turning to the case of a tariff trade barrier, the picture changes. Using (9) and (12) we can calculate the Herfindahl index $\hat{h}$ for the case of tariff costs $\hat{t}$:

$$\hat{h} = \frac{\alpha((\beta + \hat{t})^2 + \beta^2)}{(1-\theta)L(2\beta + \hat{t})^2} \frac{(2\beta + (2-\theta)\hat{t})}{2(\beta + \hat{t})} \tag{14}$$

Differentiating (14) with respect to $\hat{t}$ one finds, that the sign depends on $\hat{t}, \beta$ and θ . In particular, it can be shown that $\frac{\partial \hat{h}}{\partial \hat{t}} < 0$, for $\hat{t} < \bar{t}$, where $\bar{t} = \frac{3}{4}\theta\beta$ (see appendix 2).[5]

Thus, for small tariff levels (small relative to marginal costs) the Herfindahl measure of concentration will actually rise for a reduction in the trade barrier. That tariff costs are a fraction of marginal costs, i.e. relatively small, appears to be a realistic assumption. Also, as we are interested in reactions to reductions in trade barriers, the process will eventually reach such low values.

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5. The value $\bar{t}$ is not the accurate threshold value but merely a sufficient condition. The precises switching point for $\frac{\partial \hat{h}}{\partial \hat{t}} = 0$ is calculated in a separate appendix, available from the authors upon request.

Why does the Herfindahl measure react differently to reductions in real versus tariff trade barriers? Under the real (frictional) trade cost, the number of firms remained constant throughout, but a cut in the trade costs increases the export volume of foreign firms, thus increasing total output and resulting in a more balanced market structure. On the other hand with tariff trade costs we have two forces at work, (a) an increase in the total import volume from foreign producers (this is exactly what causes the fall in concentration under the real costs) and (b) a reduction in the number of firms, increasing concentration. In particular, the later effect stems from the fact that a reduction in tariff rates means that we remove part of the tax on foreign producers, hence their optimal production volume increases. But if each firm maximises profits with a higher export volume, the market becomes more crowded and there is only space for fewer firms. Intuitively, the later effect dominates for low levels of the tariff. Namely, the total volume effect (making for a more balanced - equal shares - market structure) does not matter that much if we are close to the free trade benchmark. However, the reaction in the number of firms is most significant for smaller $\hat{t}$.[6] Hence, we get that the Herfindahl index of concentration increases for a reduction in tariff barriers, while it falls for a reduction in a real trade barriers.

The findings of the various concentration measures are summarised in table 1, each time illustrating the reaction of the measure to a reduction in the trade barrier. It becomes clear that there is both variation across the methods of measurement and across the form of the

6.To see this, notice that the number of firms $\hat{n}$ is a concave function approaching $\frac{(1-\theta)L}{\alpha}\frac{2}{2-\theta}$ asymptotically for $\hat{t} \to \infty$.

barrier (real versus tariff). It is the latter variation - stemming from a fairly general model of intra-industry trade - that reconciles the observed ambiguity in the empirics of industry concentration with theory. Namely, economic integration in it self produces opposing forces on industry concentration. In particular, if one accepts that European economic integration started out by removing tariff barriers and subsequently (say the Single Market Program of the late 1980's) moved on towards the removal of real trade barriers, then the mixed evidence on developments in industry concentration for the EU, member states of the EU and different sectors makes sense. Finally, notice that even though we find cases, where a reduction in trade barriers increases some measures of industry concentration, social welfare is - within the model - not reduced. Recall from section 3 that total consumer utility is always increasing for a reduction in trade barriers, no matter if the barrier is of the real or of the tariff type.

Table 1. Effects on industry concentration from a reduction in trade barriers

	Simple Measure: $\frac{1}{n}$	Herfindahl index	Concentration Ratio: *crk*
Reduction in real costs $\tilde{t}$	–	↓	↓
Reduction in tariff costs $\hat{t}$	↑	↑ *	↓

Notes: *. The effect on the Herfindahl index of industry concentration applies only for small tariff levels in the sense that $\hat{t} < \frac{3}{4}\theta\beta$.

5. Conclusion

Contrary to intend and prior expectation, economic integration in Europe has not resulted in a clear cut reduction in industry concentration. Hence, some of the supposed benefits from integration - in terms of improved market structure - have not been realised. In the literature there are various explanations of this empirical finding, including for example the increase in mergers and acquisitions or the role of endogenous fixed costs. The present paper provided a novel theoretical point, illustrating that economic integration in it self may generate opposing forces on industry concentration.

The paper developed a simple two country imperfect competition model that features intra-industry trade. As a new feature we distinguish - and model explicitly - between reductions in real (frictional) trade costs and reductions in tariff trade costs. Economic integration is characterised by reductions in both these types of costs. Real trade costs burn up resources, e.g. firms have to employ staff to deal with border formalities, transport is made costly by a deficient infrastructure, etc. On the other hand, tariff costs are like a tax on foreign producers, yet tariff revenues are eventually redistributed to consumers. Both these types of costs are trade costs that reduce import volumes and rise prices.

In the general equilibrium set-up of the present paper, we show that if integration occurs both as a reduction in tariff costs and a reduction in real costs, the impact on industry concentration will be ambiguous. In particular, industry concentration measured by the Herfindahl index, falls for a reduction in real trade costs, but rises for a reduction in tariff costs. Yet, welfare - measured by consumer utility - will unambiguously increase for a reduction in the trade barriers. The reason for the divergent impact on industry concentration is the following. Real (frictional) barriers burn up resources, they do not just induce each firm to produce less, but they also reduce overall industry profitability, reducing entry, and resulting in fewer firms and higher concentration. On the other hand, under a tariff barrier, the tariff revenue is redistributed which prompts some demand. The tariff still induces each foreign firm to export less, but industry profitability remains stable, attracting entry and resulting in lower concentration. Nevertheless, from a welfare point of view, the number of firms under a tariff trade barrier is too high, and thus welfare is - though higher than under an equivalent real cost trade barrier- below the free trade benchmark.

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Appendix 1

Proof that $U > \hat{U} > \tilde{U}$. Inequality (10) of the main text.

From (1) and (4), utility under free trade is:

$$U = \ln\left(n x_H{}^{\theta}\right) + \ln\left(n x_M{}^{\theta}\right)$$
$$= 2\ln\left(L(1-\theta)^{1-\theta}\alpha^{\theta-1}\theta^{\theta}\beta^{-\theta}2^{-\theta}\right) \qquad \text{(A1.1)}$$

From (1) and (7), utility under a real trade barrier is:

$$\tilde{U} = \ln\left(\tilde{n}\tilde{x}_H{}^{\theta}\right) + \ln\left(\tilde{n}\tilde{x}_M{}^{\theta}\right)$$

Since $n = \tilde{n}$, $x_H = \tilde{x}_H$ and $x_M > \tilde{x}_M$ we have $\tilde{U} < U$.

From (1) and (9), using (A1.1), utility under a tariff trade barrier is:

$$\hat{U} = \ln\left(\hat{n}\hat{x}_H{}^{\theta}\right) + \ln\left(\hat{n}\hat{x}_M{}^{\theta}\right)$$
$$= U + \ln\left(\left(\frac{2(\beta+\hat{t})}{2(\beta+\hat{t})-\theta\hat{t}}\right)^{2}\left(\frac{\beta}{\beta+\hat{t}}\right)^{\theta}\right) \qquad \text{(A1.2)}$$

Since $\hat{n} > \tilde{n}$, $\hat{x}_H = \tilde{x}_H$ and $\hat{x}_M = \tilde{x}_M$ we have $\tilde{U} < \hat{U}$.

Finally, define:

$$g = \left(\frac{2(\beta + \hat{t})}{2(\beta + \hat{t}) - \theta\hat{t}} \right)^2 \left(\frac{\beta}{\beta + \hat{t}} \right)^\theta$$

Since $\lim_{\hat{t} \to 0} g = 1$ and $\lim_{\hat{t} \to \infty} g = 0$, and since g is a monotone function in $\hat{t}$ we have that

$\ln(g) < 0 \ \forall \ \hat{t} > 0$. Hence, using (A1.2) we have $U > \hat{U}$. ■

Appendix 2

Proof that $\partial\hat{h}/\partial\hat{t} < 0$, *for* $\hat{t} < \bar{t}$, *where* $\bar{t} = \frac{3}{4}\theta\beta$. Here we derive a simple sufficient condition, the precises $\bar{t}$ derived from $\frac{\partial\hat{h}}{\partial\hat{t}} = 0$, is calculated in a separate appendix, available from the authors upon request.

Differentiating (14) with respect to $\hat{t}$ we get:

$$\frac{\partial\hat{h}}{\partial\hat{t}} = \frac{-\alpha}{(1-\theta)2L}\frac{\beta(2\beta+\hat{t})\left(4\beta^3\theta + 2\beta^2(3\theta-2)\hat{t} + 2\beta(3\theta-4)\hat{t}^2 + (3\theta-4)\hat{t}^3\right)}{\left((2\beta+\hat{t})^2(\beta+\hat{t})\right)^2}$$

Thus,

$$\frac{\partial\hat{h}}{\partial\hat{t}} < 0 \quad if \quad \left(4\beta^3\theta + 2\beta^2(3\theta-2)\hat{t} + 2\beta(3\theta-4)\hat{t}^2 + (3\theta-4)\hat{t}^3\right) > 0 \quad \cdot$$

Assume a rule $\hat{t} < \bar{t} = \gamma\theta\beta$. Setting $\hat{t} = \gamma\theta\beta$ in the above condition, the requirement collapses into $3-4\gamma > 0$. ■

References

Azzam A.M. (1997), Measuring Market Power and Cost-Efficiency Effects of Industrial Concentration, *Journal of Industrial Economics*, Vol.45 (4), pp.377-386.

Baier, S.L. and J.H. Bergstrand (2001), The Growth of World Trade: Tariffs, Transport Costs, and Income Similarity, *Journal of International Economics*, Vol. 53 (1), pp.1-27.

Davies, S. and B. Lyons et al. (1996), *Industrial organization in the European Union Structure, strategy and competitive mechanism*, Clarendon Press, Oxford.

Dixit, A.K. and J.E. Stiglitz (1977), Monopolistic Competition and Optimum Product Diversity, *American Economic Review*, Vol. 67, No.3, pp.297-308.

EU-Commission (1996), Economic Evaluation of the Internal Market, *European Economy Reports and Studies*, Vol. 4.

EU-Commission (1997), Impact on Competition and Scale Effects: Economies of Scale, *The Single Market Review*, Subseries 5, Vol.4, Office for Publications of the European Communities.

Hansen, J.D. and J.G. Jørgensen (2001), Market Integration and Industrial Specialization on a Monopolistic Competitive Market, *Journal of Economic Integration*, Forthcoming.

Krugman, P. (1980), Scale Economies, Product Differentiation, and the Pattern of Trade, *American Economic Review*, Vol. 70 (5), pp.950-959.

Krugman, P. (1981), Intraindustry Specialisation and the Gains from Trade, *Journal of Political Economy*, Vol.89 (5), pp.959-973.

Lyons, B; C. Matraves and P. Moffatt (2001), Industrial Concentration and Market Integration in the European Union, *Economica*, Vol.68, Iss. 269, pp.1-26.

Pryor, F.L. (2001), New Trends in U.S. Industrial Concentration, *Review of Industrial Organization*, Vol.18, pp.301-326.

Spence, M. (1976), Product Selection, Fixed Costs and Monopolistic Competition, *Review of Economic Studies*, pp.217-235.

Sutton, J. (1991), *Sunk costs and Market Structure: Price Competition, Advertising and the Evolution of Concentration*, MIT Press, Cambridge, Mass.