Market Integration and Industrial Structure: Home Market Effects Revisited

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Abstract

Does market size matter for industrial structure? This paper generalises the theory on home market effects to reconcile the recent debate. It is shown that, in general, market size matters for industrial structure. Even when both sectors face identical transport costs, a "home market effect" can arise, disappear, or reverse in sign, depending on whether the elasticity of substitution between the homogenous good and the composite of differentiated goods is greater than, equal to, or less than one. It is also shown that a commonly used benchmark - the relative market size in a one-factor economy - for discussing trade and industrial structure is, in general, not correct. The results should change common perceptions about how market integration affects a country's industrial structure.

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1. Introduction

Theory on “home market effects” suggests that differentiated industries tend to concentrate in large markets.[1] Since transport costs give an advantage to firms located in larger markets, the larger country will end up with a more-than-proportionate share of production of differentiated goods with increasing returns. However, Davis (1998) argues that what was previously an assumption of convenience – no transport costs on the competitively produced good – is in fact critical to the results. When the homogenous good and differentiated goods face identical transport costs, Davis shows that market size may not matter at all for industrial structure – the home market effects vanishes. The purpose of this paper is to generalize the theory on home market effects to reconcile this debate and then show that the commonly used benchmark - the relative market size in a one-factor economy - for discussing trade and industrial structure is, in general, not correct. The results should change common perceptions about how market integration affects a country’s industrial structure.

A crucial element of the model developed in this paper is to allow the expenditure share of total income spent on differentiated goods to be endogenous. To do this, I replace the commonly used Cobb-Douglas (C-D) function with a constant-elasticity-of-substitution (CES) specification for the upper tier utility function. The key difference between the CES and the C-D functions is that, with the CES function, the expenditure share on differentiated goods depends on both the prices of all goods and the number of differentiated products. With the C-D function, this expenditure share becomes exogenous.[2] It turns out that the endogeneity of the expenditure share is crucial for our analysis.

Three main results are obtained. First, even when both sectors face identical transport costs, in general, market size matters for industrial structure. It is only when the elasticity of substitution (EOS) between the homogenous good and the composite of

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[1] The term denotes the phenomenon described in Helpman and Krugman (1985) and Krugman (1995), which could also be found in Krugman and Venables (1990) (i.e. the effects due to absolute difference in demand). It is different from that used in Krugman (1980) regarding the relative difference in demand. These two, however, are difficult to differentiate in empirical studies.

[2] Helpman and Krugman (1985) realise that the expenditure share will change under a more general homothetic function but it was not used because it could make any general propositions about trade pattern difficult.

differentiated goods is equal to one that we have the "proportionate equilibrium" - each country produces differentiated goods in exact proportion to its size. When the EOS is greater than one, the larger country ends up with a more-than-proportionate share of production of differentiated goods. The intuition is that the price index of differentiated goods relative to the price of the homogenous good is relatively low for the larger country, this will increase the demand for differentiated goods in the larger country. Thus, its expenditure share on differentiated goods goes up relative to the smaller country when the EOS is greater than one. If the EOS is less than one, however, the expenditure share on differentiated goods would decrease even though a lower price index of differentiated goods increases the demand for them. In this case we obtain a "reverse home market effect" - the larger country ends up with a less-than-proportionate share of production of differentiated goods.

Second, with an endogenous expenditure share, it is no longer true that we can draw any conclusion on industrial structure based on the pattern of trade, or vise versa. That is, the effects of market size on the pattern of trade and industrial structure are no longer equivalent, in contrast to what was found with the C-D utility function. Under the C-D utility function, a country that has a more-than-proportionate (less-than-proportionate) share of production of differentiated goods is also a net exporter (importer) of differentiated goods. It is shown in this paper that, in general market size matters for industrial structure but trade in the homogenous sector does not have to occur.

While it may seem intuitively obvious that trade in the homogenous good would not occur if transport costs for this sector were sufficiently high, Davis (1998) makes a very important contribution by showing that trade in differentiated products will be balanced when both sectors face identical transport costs. This result, which is also found under the CES utility function, becomes more significant in this paper because the effects of market size on the pattern of trade and industrial structure are no longer equivalent. Davis also recognizes that it is an over-sufficient condition that two sectors face identical transport costs. In this paper we are able to move one step further by deriving a sufficient condition for the level of transport costs for the homogeneous good for no trade to occur in this sector. This sufficient condition is found to depend on the level of transport costs for differentiated goods and the substitutability among differentiated goods. It is shown that, for trade in differentiated goods to be balanced, the level of transport costs in the homogenous sector need not be high if the substitutability among differentiated goods is low.[3]

Third, in general, market size also matters for industrial structure in autarky. This result is intuitively obvious but it has an important implication for discussing trade and industrial structure. All studies in the literature, including both theoretic and empirical work, use the relative market size in a one-factor economy as a benchmark for discussing how market integration affects a country's industrial structure. As a result, for example, a country, that ends up with a less-than-proportionate share of production of differentiated goods after markets are integrated, is often considered being "de-industrialised" (though not totally) (e.g., Helpman and Krugman, 1985; Davis, 1998).[4] This is correct in these studies because there the expenditure share on differentiated goods is exogenous and trade in the homogenous good does not require any transport cost. With an exogenous expenditure share, in autarky each country produces differentiated goods in exact proportion to its size. With no transport cost for trade in the homogenous good, a country, that has a less-than-proportionate share of differentiated goods, has to be a net importer of differentiated goods and an exporter of the homogenous good.

However, when the expenditure share becomes endogenous and both sectors face transport costs, trade in the homogenous sector does not have to occur. As a result, it is not always correct to make the conclusion that a country is being "de-industrialised", if it ends up with a less-than-proportionate share of production of differentiated goods. The reason for this is simply that we do not know about this country's share of production of differentiated goods prior to market integration. A less-than-proportionate (or more-than-proportionate) share of production of differentiated goods only describes the relative distribution of differentiated industry in an integrated

3 In a different framework, Feenstra, Markusen and Rose (1998) shows that the home market effect vanishes when transport costs are introduced into the numeraire sector, even though they may be only half as large as those in the other sector.

4 Note that here "de-industrialization" is due to goods market integration, which is different from that Krugman, 1991) where labor market integration is the key issue.

market; it does not tell us how a country's industrial structure is affected *by market integration*. It could be the case that its share of production of differentiated goods prior to market integration is even smaller. It is possible to have, as is shown in this paper, that a country's share of production of differentiated goods in market integration is smaller than its relative market size but larger than its share of production of differentiated goods before markets are integrated. Furthermore, unless complete specialization occurs, we cannot either say that the smaller country in this case is de-industrialized *in market integration* – we do not have a benchmark for such discussion.

Another implication of the above result is that, transport cost is no longer the sole element for understanding how trade affects a country's industrial structure. Traditionally, home market effects rely entirely on transport costs (in differentiated goods) for discussing trade and industrial structure. We show that when the expenditure share on differentiated products is endogenous, the magnitude of the EOS between the homogenous good and differentiated goods becomes very important. In particular, even in the absence of transport costs, trade will change a country's industrial structure. The reason for this is as follows. When trade in differentiated goods does not require any transport cost, market integration ensures that each country produces differentiated goods in exact proportion to its size. But since in closed economies, the relative share of production of differentiated goods is not proportionate, trade affects industrial structure even when there is no transport cost for trade.

Recent work by Trionfetti (1998) and Brulhart and Trionfetti (1999) on home-based demand and international specialisation also does not rely on the presence of transport costs. The Amington-type home-biased demand for differentiated products, rather than transport costs, is the essential element in their analysis on home market effects.

Empirical evidence on home market effects is mixed. Weder (1997) finds that relative demand is positively related to net exports, which supports a home market effect. Davis and Weistein (1998,1999) also find that the difference in relative demand has a positive effect on production. Work along this line is further developed in Trionfetti (1998) and Brulhart and Trionfetti (1999), which do not rely on transport costs.

Another recent paper by Head and Ries (1999) attempts to test the Krugman (1980) and Armington (1969) models, since these two models have opposite predictions about whether an increase in a country's share of demand translates into more-than- or less-than-proportionate increase in its share of output. They also find mixed evidence. In a reciprocal-dumping model of Brander (1981) when the number of firms is fixed, Feenstra, Markusen and Rose (1998) have found a "reverse home market effect" [as also suggested in Markusen (1981)].

The paper is organised as follows. Section 2 revisits the debate of Davis vs. Krugman on home market effects, first by providing a direct proof of Davis's proportionate equilibrium, and then by deriving a sufficient condition for the level of transport costs for the homogenous good for no trade to occur in this sector. Section 3 provides a general analysis of home market effects with a CES utility function. Section 4 discusses how market integration affects a country's industrial structure. Section 5 concludes the paper.

2. Revisiting Davis vs. Krugman on home market effects

The model has two countries, Home and Foreign (*), and labour is the only factor of production, such that L > L*. There are two industries, X and Y. Industry X produces a large variety of differentiated goods and industry Y produces a homogenous good. Sector X faces transport cost t , such that if t > 1 units are shipped abroad only 1 unit arrives. Similarly, sector Y faces transport cost γ, such that when transport costs are assumed to be present the shipment of γ > 1 units of good Y leads to only 1 unit arriving abroad. Technologies are identical in both countries. The production function for Y exhibits constant returns to scale: Y= L_y . The production technology for X has a constant marginal cost and a fixed set up cost. The labor requirement for producing x units of any differentiated good is $l = a + bx$.

Preferences are also identical across countries such that the utility of a representative consumer is

$$u = C_x^a C_y^{1-a} \text{ where } a \in (0,1)$$

where C_y is consumption of Y good and C_x is the composite of differentiated goods. The latter is given by

$$C_x = (\sum_{i=1}^{n} x_i^q + \sum_{i=1}^{n*} x_i^{*q})^{1/q}, \; q \in (0,1),$$

where n is the number of differentiated goods in the home country and n* is that in the foreign country. The elasticity of substitution between any two differentiated goods is $e = 1/(1-q)$. Note that this sub-utility function, the same as in Davis (1998), is just a monotonic transformation of that in Krugman (1980).

Assuming $t > 1$ but $g = 1$, Krugman (1995) and Helpman and Krugman (1985) show that n/n^* is greater than L/L* and the home country imports the homogeneous good. That is, whichever country is larger will end up with a more-than-proportionate share of production of differentiated products and thus run a trade surplus in this sector. However, Davis (1998) finds that when $g = t > 1$, the "proportionate equilibrium" (i.e., n/n^* = L/L*) is obtained again and trade in differentiated products is balanced.

2.1 Deriving the "proportionate equilibrium"

Davis proves the "proportionate equilibrium" by a set of contradictions. In what follows we provide a constructive proof that is more illuminating and derive a sufficient condition for no trade to occur in the homogeneous sector.

Assume that there are transport costs for the homogeneous good (i.e., $\gamma > 1$). Let w and w* denote the costs of labor at home and abroad. We first derive the gap in wages that are possible if no trade in Y is to occur. Since the cost of the Y good produced at home is w and that produced abroad and imported is w*γ, Y will be cheaper if produced at home whenever

$$w < gw^* \text{ or } w/w^* < g \; . \tag{2.1}$$

Similarly, the cost of the Y good produced in the foreign country is w* and that produced abroad and imported is wγ, Y consumption will be cheaper if produced in the foreign coutry whenever

$$w^* < gw \text{ or } 1/g < w/w^* . \tag{2.2}$$

Therefore, if no trade in Y is to occur we must have both (2.1) and (2.2) holding, and this means

$$1/g < w/w^* < g \ . \tag{2.3}$$

So, for example, suppose you lose approximately ten percent of your product in shipping, such that γ is 1.10 and 1/γ is .90. If relative wages do not differ by more than 10 percent in either direction, then it is not profitable to ship the Y good across borders and there will be no trade in Y.

Note that, if Y is not shipped across borders (i.e., demand equals supply in the Y sector in each country), then we can immediately calculate the amount of labor allocated to it in both countries. From the utility function, there is a constant fraction of 1-α of income spent on the Y good. From constant returns production $(Y = L_y)$ we know the price of the Y good at home is $P_y = w$ and the price of the Y good in the foreign country is $P_y^* = w^*$. Since there are no profits, incomes are wL and w*L* for the two countries respectively. These are summarized in the following set of relationships

$$\begin{aligned}
&(1-a)wL = P_y C_y \\
&P_y C_y = P_y Y = P_y L_y \\
&P_y = w \\
&\text{and this implies} \\
&\mathrm{L}_y = (1-a)L \text{ and } L_x = aL
\end{aligned} \tag{2.4}$$

for the home country. Similarly, for the foreign country we have

$$\begin{aligned}
&(1-a)w^* L^* = P_y^* C_y^* \\
&P_y^* C_y^* = P_y^* Y^* = P_y^* L_y^* \\
&P_y^* = w^* \\
&\text{and this implies} \\
&\mathrm{L}_y^* = (1-a)L^* \text{ and } \mathrm{L}_x^* = aL^*
\end{aligned} \tag{2.5}$$

There are two things to note about (2.4) and (2.5). First, the allocation of labor to the Y industry is a fixed number - at least as long as relative wages satisfy (2.3). Second, since the fraction 1-α of the labor force is dedicated to producing Y goods for domestic consumption (in either country), the fraction α is left for producing differentiated products. This implies that the ratio of "effective endowments" L_x / L_x^* remaining for X is equal to the ratio of total endowments L/L*. That is,

$$L_z / L_x^* = L / L^* \qquad (2.6)$$

To summarize: if relative wages differ by less than the amount allowed by (2.3), then both countries produce Y for their own use and both countries allocate the same fraction of their labor force to do so. As a result, the ratio of their total endowments equals the ratio of endowments left over for producing differentiated products.

Since no trade in good Y takes place, trade in differentiated goods is overall balanced. Also notice that incomes spent on differentiated goods in the two countries are

$$awL = wL_x$$

and ,

$$aw^* L^* = w^* L_x^*$$

respectively. Therefore, trade in differentiated good in this model is actually identical to a one-sector, pure intra-industry model of Krugman (1980) except that the labour endowments are L_x and L_x^*.

Now from the optimal consumption decision of the representative consumer in both countries, we can find that the imports of the home country is

$$\frac{n^* t\,(tp^*)^{q/(q-1)}\, wL_x}{np^{q/(q-1)} + n^*(tp^*)^{q/(q-1)}}$$

and the exports (or the imports of the foreign country) is

$$\frac{n\ t\,(tp\ \ )^{q/(q-1)}\, w^* L_x^*}{n^* p^{*q/(q-1)} + n\ \ (tp\ \ )^{q/(q-1)}}\,.$$

Notice that in such a pure intra-industry model, it is easy to show that $n / n^* = L_x / L_x^*$. Then applying the balance-of-trade condition, we obtain

$$\frac{(tp^*)^{q/(q-1)}}{np^{q/(q-1)} + n^*(tp^*)^{q/(q-1)}}\, w = \frac{(tp)^{q/(q-1)}}{n^* p^{*q/(q-1)} + n(tp)^{q/(q-1)}}\, w^*\,. \qquad (2.7)$$

Since $p / p^* = w / w^*$, we can re-write (2.7) as follows:

$$(\frac{n}{n^*})(\frac{w}{w^*}) = \frac{1-[t^q(\frac{w}{w^*})]^{1/(1-q)}}{1-[t^q(\frac{w^*}{w})]^{1/(1-q)}}. \qquad (2.8)$$

But notice that the left-hand side of (2.8) is always positive and therefore both the numerator and the denominator should be either positive or negative. It is straightforward to show that the latter is true and we have the following result.

Proposition 1 *When intra-industrial trade is balanced, the relative wage is bounded,*

$$1/t^q < w/w^* < t^q .$$

It is not surprising that the two bounds depend on t but do not depend on country size. As was also found in Krugman (1980), the larger country will have a higher wage when t >1 and the two countries will have the same wage when t =1. However, it is interesting that the bounds of the relative wage depend on q. Since a small value of q means low substitutability, Proposition 1 says that the divergence of the relative wage becomes smaller when the substitutability of differentiated goods is lower. The intuition for this result could be better understood if we explain the above results in Krugman (1980) from the demand side.[5] When it is costly to ship goods abroad, the price of import variety goes up. As a result, the substitution effect shifts demand away from imported to domestic varieties. This adverse effect of transport cost is stronger for the varieties produced in the smaller country. Therefore, the number of varieties in the larger country increases relative to the smaller country. This will increases pressure on trade balance for the smaller country because of the love-of-variety preference. To keep trade balancing, the relative price (and hence the relative wage) must go up. Notice that the smaller the value of q, the less the substitution effect between domestic and imported varieties. Hence, the divergence of the relative wage becomes smaller.

From Proposition 1 we can still move a step further. Since $0<q<1$ and $t>1$, this implies that $t^q < t$ and $1/t < 1/t^q$. When g and t are the same we can rewrite the above more completely as:

$$1/g < 1/g^{q} < w/w^{*} < g^{q} < g \ . \qquad (2.9)$$

This is an interesting result. Recall that we started this exercise by making a conditional statement concerning relative wages. We said that if relative wages were bound by (2.3), then no trade in Y would occur. If no trade in Y occurs, then it is as if a fraction of each country's labor force is stripped away and we are left with a pure intra-industry trade model with some fraction of the original endowment. We have just shown that in this intra-industry trade model, relative wages are always bound by (2.9) when both the Y and the X sectors face the identical transport costs. Moreover, we have shown that in every equilibrium of the intra-industry trade model, wages will be bound within a set smaller than what was needed for this exercise to make sense.

Now Davis' result becomes very clear. That is, the increase in the relative wage will adjust to ensure trade balance in differentiated goods without inducing trade in the homogenous good. Moreover, since n/n^{*} = L_x / L_x^{*}, together with (2.6) this also means that n/n^{*} = L/L*. Therefore, we have obtained the proprotionate equilibrium – each country produces differentiated goods in exact proportion to its size.

2.2 Discussion

One of the objectives of providing the above proof is to draw the following observations. First, the pressure on the trade balance in differentiated products can be resolved in two ways. If there are no transport costs for the homogeneous good, trade in the homogenous sector will arise to release the pressure on trade balance. Otherwise, the adjustment in the relative wage will restore trade balance in differentiated products through changes in the relative price of differentiated goods, without inducing trade in the homogenous good. The latter means that trade in differentiated goods can always be balanced as long as transport costs for the homogeneous good is sufficiently enough. From Proposition 1, we have derived a sufficient condition: $g = t^{q}$.

Davis (1998) is correct in noticing that the assumption $g = t$ is an over-sufficient condition and he provides some empirical evidence that trade costs (including

[5] A traditional explanation is based on supply side (see Krugman, 1980, p955).

conventional and non-conventional) for homogeneous goods could be higher (or at least not lower) than for differentiated products. We have shown that g can certainly be lower than t and that g ***need not be high if*** q ***is small.***

Second, when intra-industry trade is balanced, with the C-D utility function this also means that each country produces differentiated goods in exact proportion to its size. Therefore, market size does not matter for industrial structure in this case. In the next section we will show that Proposition 1 is still valid with the CES utility function and therefore trade in the homogenous good would not occur as long as transport cost for the homogenous good is larger than t^q . However, it turns out that in general market size matters for industrial structure even when trade in differentiated goods is balanced.

3. A Generalisation of Home Market Effects

Since this section will show that in general market size matters for industrial structure even when trade in differentiated goods is balanced, we assume that $1/g < w/w^* < g$ initially. But we will show that Proposition 1 is still valid under the CES utility function and therefore any level of g that is greater than t^q will ensure that no trade in Y is to occur. Note that, except for the CES utility function, the environment we have now is the same as in Davis (1998) and trade in differentiated products is effectively the one-sector model in Krugman (1980).

Retaining all the other assumptions in Section 2, we only replace the C-D utility function with the following CES function:

$$u = (C_x^r + C_y^r)^{1/r},\ r \in (-\infty, 1),$$

The elasticity of substitution (EOS) between C_x and C_y is $h = 1/(1-r)$. We assume $e > h$. That is, the elasticity between differentiated goods is greater than that between the homogeneous good and the composite of differentiated good. The price indices for differentiated products are

$$q = \left(\sum_{i=1}^{n} p_i^{q/(q-1)} + \sum_{i=1}^{n^*} (tp_i^*)^{q/(q-1)}\right)^{(q-1)/q} \qquad (3.1)$$

in the home country and

$$q^* = \left(\sum_{i=1}^{n} (tp)_i^{q/(q-1)} + \sum_{i=1}^{n^*} p_i^{*\,q/(q-1)}\right)^{(q-1)/q} \qquad (3.2)$$

in the foreign country.

Since $P_y = w$; $P_y^* = w^*$, the share of total incomes spent on differentiated products can be obtained as follows [see Varian (1992, p112)]:

$$S = S(q/w) = \frac{(q/w)^{1-h}}{1+(q/w)^{1-h}}\,; \quad S^* = S(q^*/w^*) = \frac{(q^*/w^*)^{1-h}}{1+(q^*/w^*)^{1-h}} \qquad (3.3)$$

It is straightforward to show that [see also Dixit and Stiglitz (1977, p298)]

$$\frac{(q/w)}{S}\frac{dS}{d(q/w)} = (1-h)(1-S)\,.$$

Therefore, we have the following result.

Lemma 1 $S'(.) < 0$ if $h > 1$; $S'(.) = 0$ if $h = 1$; and $S'(.) > 0$ if $h < 1$.

The intuition is straightforward. For example, a decrease in the relative price, q/w (or q/P_y), would increase the demand for differentiated goods but the share of total expenditure on differentiated goods could either increase or decrease. When the EOS is greater (smaller) than unity, the expenditure share increases (decreases). Using the C-D utility function forces the expenditure share on differentiated goods to be exogenous. In fact the endogeneity of this expenditure share turns out to be very important for the effects of market size on industrial structure.

Since trade in the homogenous good does not occur, following (2.4) and (2.5) we can obtain $L_x = SL$ and $L_x^* = S^* L^*$. Also, since intra-industry trade is balanced, we have $n/n^* = L_x / L_x^*$. Therefore, we obtain the following result.

Lemma 2 $n/n^* = (SL)/(S^* L^*)$.

It is not surprising that n/n* depends on not only L and L* but also S and S*. The difference in the expenditure share on the differentiated products will certainly affect the relative number of varieties produced in the two countries. In empirical work, many studies focus on the relative share of expenditures to explain the relative share of production of differentiated products.

Now it is straightforward to show that, by following the proof of Proposition 1, we can obtain the same equation as (2.7). Therefore, <u>*Proposition 1 is also valid under the CES utility function*</u>. The reason for this is that when intra-industry trade is balanced, in each country the income spent on differentiated goods is equal to the income received by the labor allocated to this industry.

Since under the CES utility function in general $S \neq S^*$, from Lemma 2 it is no longer expected that we will have the proportionate equilibrium. Furthermore, we can make some more specific comments on S/S*. From (2.7) we can obtain that $q/q^* = (w^*/w)^{1/q}$ or

$$\frac{(q/w)}{(q^*/w^*)} = (\frac{w^*}{w})^{(1+q)/q}.$$

It is not difficult to show that w>w* when $t > 1$ and this means that $(q/w) < (q^*/w^*)$. Using Lemma 1, we obtain that S/S* >1 if h > 1; S/S* = 1 if h = 1; and S/S*<1 if h <1. Therefore, together with Lemma 2 we have the following result.

Proposition 2 *When $t > 1$ and $g > t^q$, trade in the homogeneous sector would not occur but in general market size matters for industrial structure. In particular, when L>L**

i) $n/n^* > L/L^*$ if $h > 1$;

ii) $n/n^* = L/L^*$ if $h = 1$;

iii) $n/n^* < L/L^*$ if $h < 1$.

That is, when h = 1, we find Davis's result of the proportionate equilibrium. When h > 1, it re-emerges that the larger country has a more-than-proportionate share of production of differentiated goods. The reason for this is that the price index of differentiated goods relative to the price of the homogenous good is lower for the larger country. This will increase the relative expenditure share on differentiated goods in the larger country when h >1. However, when h <1, we obtain a "reverse home market effect" - the larger country ends up with a less-than-proportionate share of production of differentiated goods.

4. Market Integration and Industrial Structure

4.1 Market Size and Industrial Structure in Autarky

Since consumption is equal to output in both sectors in each country in a closed economy, similar to Lemma 2 we can obtain

$$\frac{n_a}{n_a^*} = \frac{S(q_a / w)L}{S(q_a^* / w^*)L^*},$$

where n_a and n_a^* are the numbers of differentiated goods in the home and foreign countries respectively. The price index of differentiated goods is $q_a = (\sum_{i=1}^{n_a} p_i^{q/(q-1)})^{(q-1)/q}$ for the home country and $q_a^* = (\sum_{i=1}^{n_a^*} p_i^{*q/(q-1)})^{(q-1)/q}$ for the foreign country. With the CES utility function, in general, $S(q_a / w)$ is not equal to $S(q_a^* / w)$. Therefore, we have $n_a / n_a^* \neq L / L^*$. Together with Lemma 1 we obtain the following result.

Proposition 3 *Market size also matters for industrial structure in autarky. In particular, when L>L**

i) $n_a / n_a^* > L / L^*$ if h > 1;

ii) $n_a / n_a^* = L / L^*$ if h = 1;

iii) $n_a / n_a^* < L / L^*$ if h < 1.

Proof: See Appendix.

Therefore, in autarky the larger country, for example, could already have a more-than-proportionate share of production of differentiated goods if h > 1. The intuition is as follows. A large market tends to have a large differentiated industry. The larger the number of differentiated goods, the lower the price index of differentiated goods relative to that of the homogenous good. This will increase the total expenditure on differentiated goods if the EOS between the homogenous good and the composite of differentiated goods is greater than one. An increase in the expenditure share on differentiated goods will increase the number of differentiated goods. Similarly, the smaller country could already have a less-than-proportionate share of production of differentiated goods in autarky. When the EOS between the homogenous good and differentiated goods is less than unity, however, we obtain the converse.

4.2 Market Integration and Industrial Structure

The result that market size also matters for industrial structure in autarky is important for understanding how trade affects industrial structure. Almost all studies in the literature rely on transport costs to discuss trade and industrial structure. In this section we will show that when the expenditure share on differentiated goods becomes endogenous, transport costs are no longer essential for discussing trade and industrial structure.

In Section 3 we found that $1/t^q < w/w^* < t^q$. Actually, it is not difficult to show that when t = 1, we will have w=w*. Thus, from (3.1) - (3.3), we obtain q = q* and $S(q/w) = S(q^*/w^*)$. Therefore, we have $n/n^* = L/L^*$. This result, however, has a very different meaning now. When trade in differentiated goods does not require any transport cost, market integration ensures that each country produces differentiated goods in exact proportion to its size. But since in closed economies, the relative share of production of differentiated goods is not proportionate, trade affects industrial structure even when there is no transport cost for trade. Compared with Proposition 3, we obtain the following results.

Proposition 4 *Market integration will affect industrial structure even if trade does not require any transport cost. In particular, when* t *= 1 and L>L*, we have*

a) $n/n^* < n_a/n_a^*$ if $h > 1$;

b) $n/n^* = n_a/n_a^*$ if $h = 1$;

c) $n/n^* > n_a/n_a^*$ if $h < 1$.

That is, if the EOS between the homogenous good and the composite of differentiated goods is greater (smaller) than one, the number of differentiated goods in the larger country relative to that in the smaller country will decrease (increase) after markets are integrated.

The result in Proposition 3 is also important for understanding how a country's industrial structure is affected by market integration, and one of the purposes of deriving Proposition 4 is to show that, it is possible to have $n/n^* > L/L^*$ but n/n* < n_a/n_a^*. Notice that the ratio of n/n* depends on the level of t. When t is close to 1, n/n* will approach L/L* regardless of the value of h. However, n_a/n_a^* does not depend on t. Therefore, together with Proposition 3 we can obtain the following results.

Proposition 5 *In general* n/n^* *is not equal to* n_a/n_a^*. *Moreover, when* t >1 and L>L*, *it is possible to have*

a) $n_a/n_a^* > n/n^* > L/L^*$ (or $n_a^*/n_a < n^*/n < L^*/L$) when $h > 1$;

b) $n_a/n_a^* < n/n^* < L/L^*$ (or $n_a^*/n_a > n^*/n > L^*/L$) when $h < 1$.

Proof: See Appendix.

An immediate implication of Proposition 5 is that some common perceptions about how market integration affects a country's industrial structure should change. For example, it is no longer appropriate to consider the smaller country (i.e. the foreign) being "de-industrialized" if n*/n is smaller than L*/L in market integration. Since from Part (a), we can show that

$$\frac{n_a^*}{n_a^* + n_a} < \frac{n^*}{n^* + n} < \frac{L^*}{L^* + L}.$$

That is, the share of differentiated industry for the smaller country prior to market integration could be lower than that after market integration. This could happen when the EOS between the homogenous good and the composite of differentiated goods is greater than unity and transport costs are small. The intuition is as follows. When the EOS is greater than one, in closed economies the smaller country has a less-than-proportionate production of differentiated goods. When transport costs are small, market integration tends to ensure that each country produces differentiated goods in exact proportion to its size. Therefore, the smaller country in this case is certainly not de-industrialized *by market integration*.

Also notice that unless complete specialization occurs (which will never happen in this model), we cannot either say that the smaller county is de-industrialized *in market integration* – we do not have a benchmark for such discussion. The relative market size (L/L*) is not a good benchmark for discussing de-industrialization either by market integration or in market integration. That is, the relative market size is, in general, not a correct benchmark for discussing trade and industrial structure. It is a benchmark just for discussing whether market size matters for industrial structure *per se*.

5. Concluding Remarks

This paper has provided a general analysis of home market effects using a CES specification for the upper tier utility function. We have found that effects of market size on the pattern of trade and industrial structure are not equivalent when the expenditure share on differentiated goods becomes endogenous. Trade in the homogeneous sector would not occur and trade in differentiated goods will be balanced as long as transport costs for the homogeneous sector are sufficiently large - a sufficient condition for this was derived. However, in general market size matters for industrial structure but a home market effect could disappears, re-emerges or even reverse in sign depending on the magnitude of the elasticity of substitution between the homogenous good and the composite of differentiated goods.

Also, since market size also matters for industrial structure in closed economies, the relative market size is not an appropriate benchmark for discussing trade and industry structure. The results should change previous perceptions about how a country's industrial structure will be affected by market integration. Our results also suggest that either in closed economies or in market integration, large countries and small countries could have either advantages or disadvantages in terms of their share of production of differentiated goods. The elasticity of substitution between the homogeneous good and the composite of differentiated goods is very important in determining industrial structure.

The key issue in this paper is not just the CES versus the C-D utility functions. Rather, it is whether or not we force the expenditure share on differentiated goods, which is intrinsically endogenous when differentiated goods are involved, to be exogenous. Of course, this paper is not the first to recognize this important issue (e.g., Helpman and Krugman, 1985). The contribution of this paper is to show that with an endogenous expenditure share on differentiated goods, it is still possible to derive meaningful results that can provide some new insights into the issue of home market effects. For completeness of our discussion, note that some of the results could also be obtained with exogenous expenditure shares but then we have to assume that preferences are different across countries.

Appendix

<u>Proof of Proposition 3:</u> Note that we only need to show that S is increasing in L when $h > 1$ and S is decreasing in L when $h < 1$. Since in autarky output equal to consumption, for differentiated goods we have $n_a px = SwL$ or

$$n_a \frac{bw}{q} \frac{aq}{b(1-q)} = \frac{(q_a / w)^{1-h}}{1 + (q_a / w)^{1-h}} wL \,,$$

since $p = (b / q)w$.

It is also straightforward to show that in autarky

$$\frac{q_a}{w} = \frac{b}{q} n_a^{(q-1)/q} \,.$$

After substitute this into the above equation, we can find the following derivative,

$$\frac{dn_a}{dL} = \frac{(1-q)}{a} [1 + \frac{(q / b)^{(1-h)}}{n_a^{(1-h)/(1-e)}} (\frac{e-h}{e-1})]^{-1} \,.$$

Notice that since < 1 and $e > 1$, we find that n_a $q_a / w)$ is decreasing in L when $e > h$. Together with Lemma 1, we have proved the result.

<u>Proof of Proposition 5:</u> Since $S / S^* = S_a / S_a^* = 1$ and $n / n^* = n_a / n_a^*$ when $h = 1$, to prove that in general $n / n^* \neq n_a / n_a^*$ it is sufficient if we can show that

$$\left.\frac{d(S / S^*)}{dh}\right|_{h=1} \neq \left.\frac{d(S_a / S_a^*)}{dh}\right|_{h=1} \,.$$

Let $z = (w / q_a)^{1-h}$. After taking logs on both sides we obtain the following derivative,

$$\frac{1}{z}\frac{dz}{dh} = -\ln(w / q_a) + (1-h)(q_a / w)\frac{d(w / q_a)}{dh} \,.$$

Therefore, we find that $\left.\frac{d(w / q_a)^{1-h}}{dh}\right|_{h=1} = \ln(\frac{q_a}{w})$ and similarly,

$$\left.\frac{d(w^* / q_a^*)^{1-h}}{dh}\right|_{h=1} = \ln(\frac{q_a^*}{w^*}).$$

We can write $\frac{S_a}{S_a^*} = \frac{1 + (w^* / q_a^*)^{1-h}}{1 + (w / q_a)^{1-h}}$. After taking logs and derivative we obtain that

$$\frac{S_a^*}{S_a}\frac{d(S_a/S_a^*)}{dh}=\frac{1}{1+(w^*/q_a^*)^{1-h}}\frac{d(w^*/q_a^*)^{1-h}}{dh}-\frac{1}{1+(w/q_a)^{1-h}}\frac{d(w\ /q_a)^{1-h}}{dh}\ .$$

Therefore, using what we have obtained above, at $h=1$ we have

$$\left.\frac{d(S_a/S_a^*)}{dh}\right|_{h=1}=\frac{1}{2}\ln(\frac{q_a^*}{w^*}\frac{w}{q_a})$$

$$=\frac{1}{2}\ln[(\frac{b}{q}n_a^{*(q-1)/q})(\frac{q}{b}n_a^{(1-q)/q})] \qquad \text{(Eq. A1)}$$

$$=\frac{(1-q)}{2q}\ln(L/L^*)>0$$

Similarly, we have that

$$\left.\frac{d(S/S^*)}{dh}\right|_{h=1}=\frac{1}{2}\ln(\frac{q^*}{w^*}\frac{w}{q})$$

$$=\frac{1}{2}\ln[(\frac{w}{w^*})^{(1+q)/q}] \qquad \text{(Eq. A2)}$$

$$=\frac{(1+q)}{2q}\ln(w/w^*)\geq 0$$

Since L/L* is a constant but w/w* depends on t , in general Eq. A2 will not equal to Eq. A1. Finally, notice that when t is close to 1, ln(w/w*) is close to zero and hence at h=1 we have $d(S_a/S_a^*)/dh>d(S/S^*)/dh$. Since $n_a/n_a^*=(S_aL)/(S_a^*L^*)$ and n/n*=(SL)/(S*L*), we have proved the results.

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