"THE DEGREE OF MONOPOLY, INTERNATIONAL TRADE, AND TRANSNATIONAL CORPORATIONS."*

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This paper explores the impact, on an average degree of monopoly used to analyse the functional distribution of income, of transnational corporations (TNC's) producing in and yet trading between several countries.

Cowling (1976), and Cowling and Waterson (1976) consider a closed economy and relate an industry's degree of monopoly (defined as the mark up of price over marginal cost) to its Herfindahl index of concentration, degree of collusion, and price elasticity of demand. Lyons (1979) introduces international trade into the model, allowing for imports from overseas corporations- i.e. firms which do not produce in the domestic market. This ignores the possibility of a transnational corporation, a firm which produces in more than one country, engaging in domestic production and importing from its overseas affiliates.

The importance of such trade is difficult to quantify, due to lack of data, but Panić and Joyce (1980) assert that the proportion of UK imports of manufactured goods coming from related enterprises may be similar to that estimated for the USA, namely 50%. Information is available for the car industry; Table 1 shows that domestically producing TNC's accounted for nearly 30% of imports in 1978, and this in spite of the excitement created by the activities of Japanese producers. Clearly, the phenomenon is a significant characteristic of international trade.

Consider first an industry comprising N profit maximising TNC's. Each produces a homogenous good by domestic and overseas production, and each imports into and exports from the domestic market.

TABLE 1: IMPORTS BY DOMESTICALLY PRODUCING TNC's AS A PERCENTAGE OF TOTAL IMPORTED NEW REGISTRATIONS OF NEW CARS IN THE UK, 1975-1978*

1975	1976	1977	1978
7.1%	20.0%	26.7%	29.2%

* The category denoted "others" in the data are assumed to be imports by overseas corporations. The percentages reported are thus lower bounds.

Source: compiled from tables 23 and 24 of SMMT (1979).

TABLE 2: IMPORTS AS A PERCENTAGE OF TOTAL NEW REGISTRATIONS OF NEW CARS IN THE UK, BY MODEL LINE, 1975-1978.

MODEL	1975	1976	1977	1978
MINI	0	0	0	7.4
ALLEGRO	0	0	4.6	16.7
HUNTER	0	0	50.0	98.0
ALPINE	100	81.0	9.1	0.3
FIESTA	---*	---*	0.3	31.2
ESCORT	0	7.3	9.0	13.8
CORTINA	0	0	1.6	22.4
CAPRI	0	20.9	100	100
GRANADA	0	40.1	100	100
CAVALIER	100	100	97.1	63.5

* Fiesta not produced at all in these years.

Source: compiled from tables 23 and 24 of SMMT (1979)

Product differentiation is often emphasised as an important characteristic in analysing TNC's - see, for example, Caves (1971). However, the homogeneity assumption is not altogether unrealistic, as illustrated in Table 2, which shows, for particular models, the percentage of new car registrations in the UK that are imported. For example, in 1978 Ford imported 31.2% of its Fiesta and 22.4% of its Cortina ranges, while Leyland imported 16.7% of its Allegro model. Moreover, the cross elasticities of demand over a producer's models are likely to be significantly positive.

Assuming one overseas market, the n^{th} firm's profit, Π_n, is given:

$$\begin{aligned} \Pi_n = {} & f(D + M).\ (D_n + M_n) + g(W + X).\ (W_n + X_n) \\ & - c_{(1)n}\ (D_n + X_n) \qquad - c_{(2)n}\ (W_n + M_n) \\ & - t_{(1)n}\ (X_n) \qquad\qquad - t_{(2)n}\ (M_n) - F \end{aligned} \tag{1}$$

For firm n,

D_n	$\equiv$	domestic production for domestic sale.
X_n	$\equiv$	domestic production for overseas sale.
W_n	$\equiv$	overseas production for overseas sale.
M_n	$\equiv$	overseas production for domestic sale.
$c_{(1)n}(\cdot)$	$\equiv$	variable costs of domestic production.
$c_{(2)n}(\cdot)$	$\equiv$	variable costs of overseas production.
$t_{(1)n}(\cdot)$	$\equiv$	non-production costs associated with exports, especially tariffs and transport costs.

$t_{(2)n}(\cdot)$ ≡ non-production costs associated with imports, especially tariffs and transport costs.

F ≡ fixed costs of domestic and overseas production.

In addition,

D ≡ total domestic sales from domestic production $= \Sigma_n D_n$

M ≡ total domestic sales from overseas production $= \Sigma_n M_n$

W ≡ total overseas sales from overseas production $= \Sigma_n W_n$

X ≡ total overseas sales from domestic production $= \Sigma_n X_n$

$f(D + M)$ ≡ the inverse demand function in the domestic market

$g(D + M)$ ≡ the inverse demand function in the overseas market

Profit maximisation FOC's with respect to D_n and M_n are:

$$\frac{\partial \Pi_n}{\partial D_n} = f(D + M) + (D_n + M_n) . \; f^1(D + M) . \; \frac{\partial (D + M)}{\partial D_n} - c^1_{(1)n}(D_n + X_n) = 0 \quad (2)$$

$$\frac{\partial \Pi_n}{\partial M_n} = f(D + M) + (D_n + M_n) . \; f^1(D + M) . \; \frac{\partial (D + M)}{\partial M_n} - c^1_{(2)n}(W_n + M_n) - t^1_{(2)n}(M_n) = 0 \quad (3)$$

However, product homogeneity implies that

$$\frac{\partial f(D + M)}{\partial D_n} = \frac{\partial f(D + M)}{\partial M_n} = \frac{\partial f(D + M)}{\partial (D_n + M_n)} \quad (4)$$

and thus that

$$\frac{\partial (D + M)}{\partial D_n} = \frac{\partial (D + M)}{\partial M_n} = \frac{\partial (D + M)}{\partial (D_n + M_n)}$$

Given (5), at the optimum (2) and (3) imply:

$$c^1_{(2)n}(W_n + M_n) + t^1_{(2)n}(M_n) = c^1_{(1)n}(D_n + X_n) \tag{6}$$

Defining this common value of marginal supply cost as c_n, the common value in (5) as λ_n, and the industry's equilibrium price as p, then, following the method of Cowling and Waterson (1976), (2) or (3) can be manipulated to yield a weighted average degree of monopoly,

$$\frac{p.(D + M) - \Sigma_n c_n.(D_n + M_n)}{p.(D + M)} = \frac{H_{DM}.(1 + \lambda)}{\eta} \tag{7}$$

where

H_{DM} $\equiv$ the Herfindahl index of concentration defined over total domestic sales.

$$\equiv \Sigma_n\left(\frac{D_n + M_n}{D + M}\right)^2$$

η $\equiv$ the absolute value of the domestic price elasticity of demand observed for the industry.

$$\equiv \frac{-1}{f^1(D + M)} \cdot \frac{p}{(D + M)}$$

λ $\equiv$ a measure of conjectural variation.

$$\equiv \frac{\Sigma_n (D_n + M_n)^2.\lambda_n}{\Sigma_n (D_n + M_n)^2}$$

A number of points arise from this analysis.

Equation (6) is merely an illustration of the familiar profit maximising condition for a multi-plant firm, namely: the firm will produce such that each plant has an identical marginal cost of supplying the market. Similar conditions will need to be met regarding overseas sales; the FOC's with respect to X_n and W_n imply that

$$c^1_{(1)n}(D_n + X_n) + t^1_{(1)n}(X_n) = c^1_{(2)n}(W_n + M_n) \tag{8}$$

(6) and (8) together require:

$$t^1_{(1)n}(X_n) + t^1_{(2)n}(M_n) = 0 \tag{9}$$

This is feasible. For example, tariffs could be used to discriminate against imports whilst exports are simultaneously encouraged by subsidies.

A second point to note is that the entire analysis implicitly assumes considerable centralisation of decision making in each TNC. The sources of supply do not compete with each other. This is at least reasonable because of the homogeneous good assumption, as, for instance, suggested in Wilson (1975).

More fundamental issues arise concerning the result given in equation (7). Assuming each firm faces a constant c_n, (7) can be rewritten:

$$\frac{\Pi_{DM} + F_{DM}}{p.(D + M)} = \frac{H_{DM}.(1 + \lambda)}{\eta} \tag{10}$$

where $\Pi_{DM} + F_{DM}$ is the profit from and fixed production costs of total domestic sales by the industry. This is the "non-competitive" imports result presented in Cowling (1982).

Assuming constant c_n assumes equality, at all levels of supply, in the marginal costs of supplying the domestic market from each source of production. In many realistic situations, this assumption will be inappropriate.

Even if this can be overcome, however, (10) has limited value. Following Cowling (1982), (10) can be used to analyse the functional distribution of income created by the worldwide production of goods for domestic sale. But the practical difficulties that face subordinate classes attempting to confront their dominant counterparts on a world scale are immense. Of necessity, the class struggle is fought at the level of a specific country.

This is not to say that the class struggle can be understood by ignoring occurences elsewhere in the world. On the contrary, the domination of transnational capital is, in its very nature, global, and can only be understood as such. Imperialist domination of "less-developed" countries, for example, can run hand in hand with the de-industrialisation of more "advanced" countries - see, for instance, Hymer (1975).

The implication is a need to define a relationship concerning the distribution of total domestic production, but with the relationship being understood and interpreted within a global framework.

Two further drawbacks with the analysis are its restriction to an industry comprising entirely TNC's involved in international trade, and its dependence upon a total conjectural variation parameter, λ. It would be preferable to encompass greater asymmetry in the type of corporation analysed, and to derive a relationship depending upon average conjectural variation, for example because λ is partly determined by the number of rivals -

see Cowling (1982).

Bearing these points in mind, consider now an industry producing a homogeneous good and in which there are three types of profit maximising firm: "importing" TNC's, "non-importing" TNC's, and domestic corporations, firms which only produce in the domestic market.

An importing TNC produces by domestic and overseas production, and imports into the domestic market. The i^{th} such firm has profit:

$$\Pi_i = f(D + M).\,(D_i + M_i) + g(W).W_i$$
$$- c_{(1)i}(D_i) - c_{(2)i}(W_i + M_i) - t_{(2)i}(M_i) - F_i \tag{11}$$

(Throughout this analysis, the terminology corresponds to that used earlier.)

Given product homogeneity (implying that (4) continues to hold), profit maximising FOC's require, when the industry is in equilibrium:

$$\frac{\partial \Pi i}{\partial D_i} = \frac{\partial \Pi i}{\partial M_i} = p + (D_i + M_i).\ f^1(D + M).\ \frac{\partial (D + M)}{\partial (D_i + M_i)} - c_i = 0 \tag{12}$$

where

$$c_i \equiv \{c^1_{(1)i}(D_i)\}^* = \{c^1_{(2)i}(W_i + M_i) + t^1_{(2)i}(M_i)\}^* \tag{13}$$

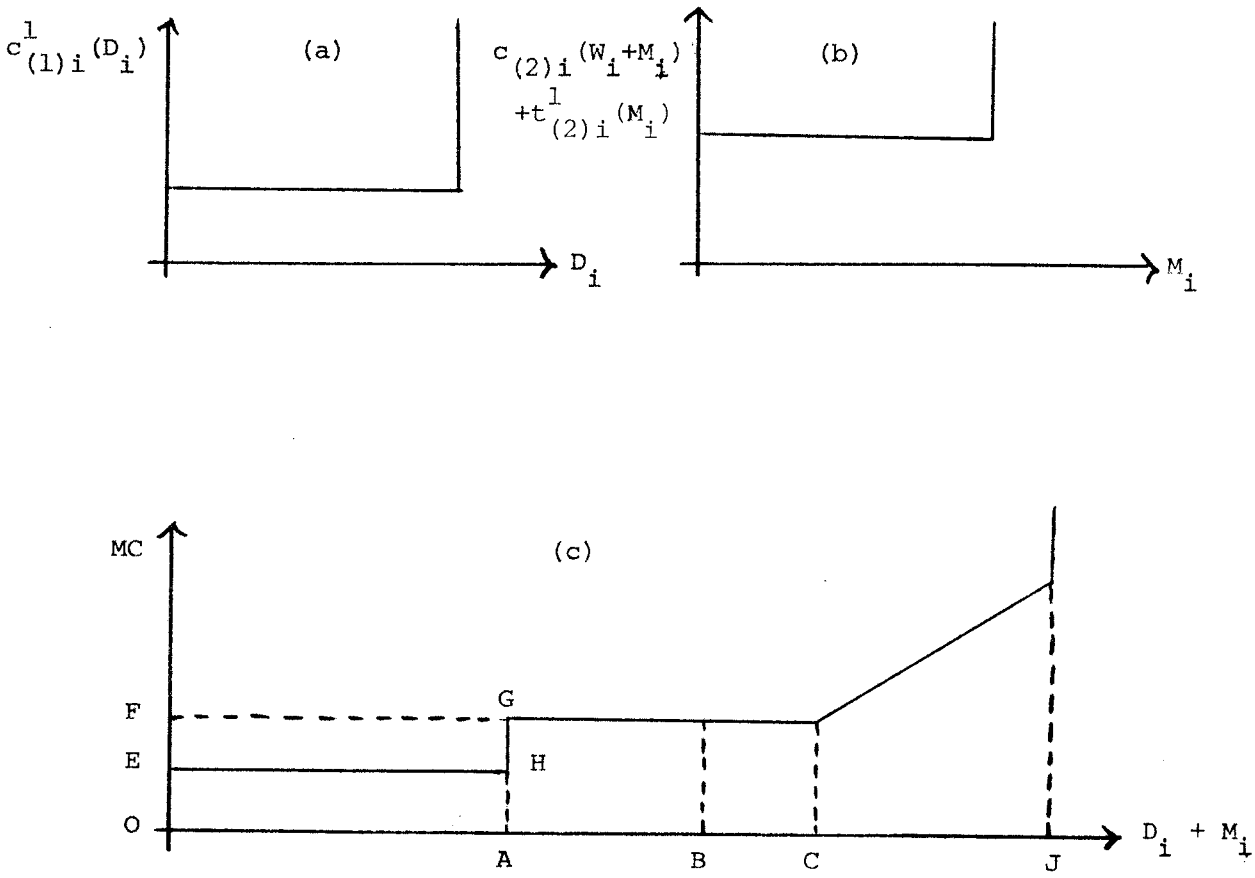
$\{c^1_{(1)i}(D_i)\}^* \equiv$ i's marginal cost of supplying the domestic market from domestic production when the industry is in equilibrium.

$\{c^1_{(2)i}(W_i + M_i) + t^1_{(2)i}(M_i)\}^* \equiv$ i's marginal cost of supplying the domestic market from overseas production when the industry is in equilibrium.

Assume marginal production costs are inverse L shaped, and that marginal non production costs associated with imports are constant. Two possibilities are of interest.

The first is depicted in Figure 1. It is assumed that the TNC satisfies its overseas demand with excess capacity remaining in its overseas production facilities - hence the horizontal segment in Figure 1(b). MC is i's marginal cost of supplying the domestic market.

FIGURE 1: THE COST CONDITIONS FACING AN IMPORTING TNC, CASE I.



If i's perceived marginal revenue is such that it sells OC in the domestic market, both domestic and overseas plants are operated at full capacity, producing OA and AC respectively for domestic sale. Sales exceeding OC are obtained at the expense of sales overseas. Beyond OC, the marginal cost of supplying the domestic market is upward sloping because it is assumed that i faces a negatively sloping marginal revenue curve in its overseas market, and thus that the marginal revenue foregone in not making a sale overseas (ie, the marginal cost of supplying the domestic market) is increasing. Total capacity of domestic and overseas plant is given by OJ.

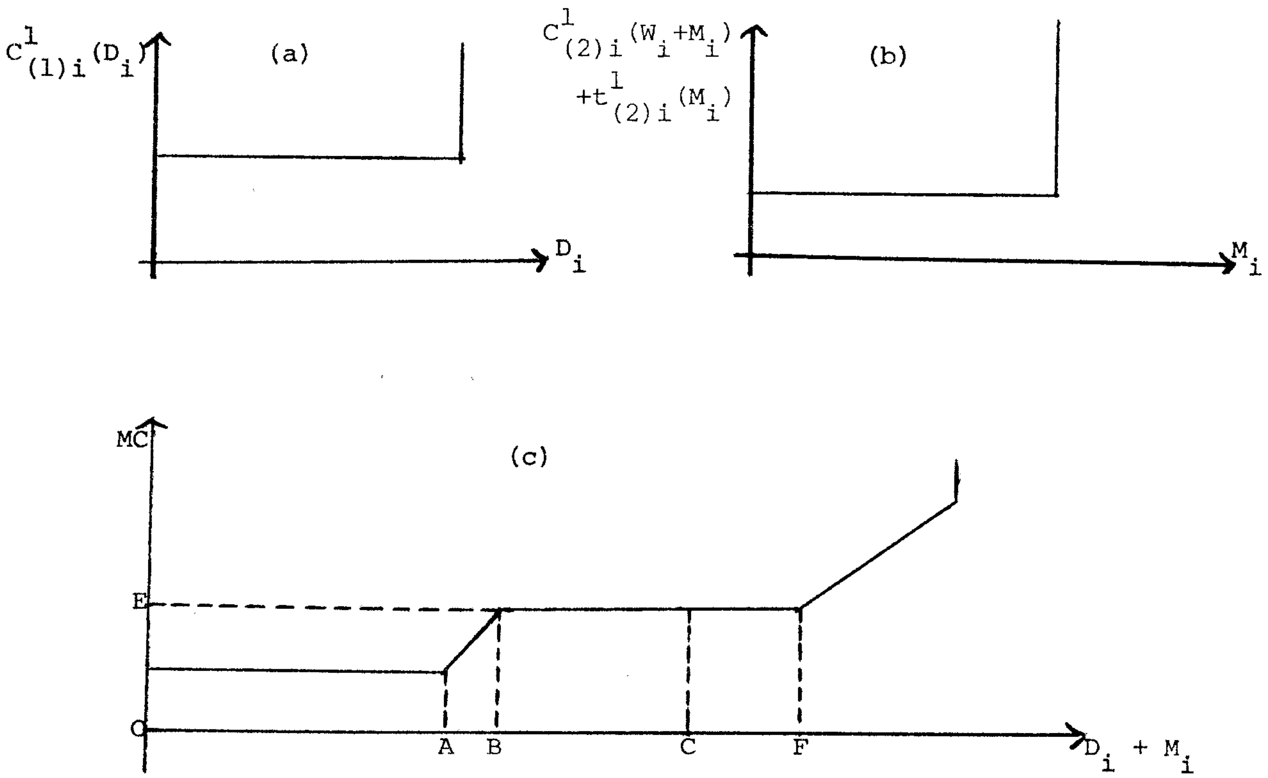
Long run considerations suggest domestic sales will be less than OC. Firm i will be uneasy diverting sales from its overseas to its domestic market because rivals may construe this as a willingness by i to reduce its overseas market share, which may be detrimental to long run profit maximisation if i's rivals consequently attempt to increase their overseas market share. In addition, arguments made in Cowling (1982) regarding entry deterrence and, following Chenery (1952), optimal investment strategy in a world of scale economies and growing demand, suggest that the TNC will at least desire excess capacity somewhere in its production empire.

Thus, it is reasonable to expect i's total domestic sales revenue to be such that, for example, total domestic sales are given by OB. Domestic plant will then operate at full capacity, supplying OA to the domestic market, whilst overseas plant will operate with excess capacity and supply AB.

Variable costs of total domestic production for such a TNC are given by area OEHA in Figure 1(c). The distance OF representc c_i, with area OFGA being the magnitude $c_i.D_i$. Thus, $c_i.D_i$ overestimates variable production costs, area OEHA being less than area OFGA, and $p.D_i - c_i.D_i$ is an underestimate of the profit from and fixed costs of total domestic production for such a firm.

The second possibility of interest is depicted in Figure 2, which should be interpreted similarly to Figure 1.

FIGURE 2: THE COSTS CONDITIONS FACING AN IMPORTING TNC, CASE II.



Suppose perceived marginal revenue is such that sales are given by OC. In this case, overseas plant operates at full capacity, supplying OB to the domestic market, whilst the excess capacity is in the domestic plant, used to supply BC. Of the quantity supplied from overseas, AB is diverted from overseas sales. If long run considerations mean the firm is reluctant to divert sales from overseas, AB will tend to zero - ie the long run marginal opportunity cost of supplying the domestic market from overseas production tends to infinity once overseas production reaches full capacity.

c_i is represented by OE in Figure 2 (c) and variable costs of total domestic production are accurately estimated by $c_i.D_i$. Thus, $p.D_i - c_i.D_i$ will not be a biased estimate of profit from and fixed costs of total domestic production by such a firm.

In reality, either of the cost situations depicted in these two cases might be observed. Scherer (1980) asserts that the inverse L shaped marginal production cost is realistic, Reserves of cheap labour in less developed countries suggests marginal production costs overseas will be less than in the UK, but once $t^1_{(2)i}(M_i)$ are taken into account, this need not be true of marginal supply costs to the UK market - Chandler (1980), for example, suggests that, historically, transportation costs have been an important factor. Moreover, marginal production costs are determined by productivity as well as wage rates. The nationality of a TNC is particularly important in this respect; a firm will face higher marginal costs in an unfamiliar environment because, for example, it has no experience of the best way to control, supervise, and therefore exploit local labour - see, for instance, Aharoni (1966) and Hymer (1976). In addition, "developed" as compared to less developed countries can offer firms positive externalities arising from their superior infrastructure - for example, a good health service should enable firms to extract more work from their employees.

It is similarly impossible to determine, ex ante, which cost situation is most likely when a TNC producing in two developed countries is being considered. Relative labour costs, familiarity with environment, and externalities must again be weighed against each other.

In the long run, it could be argued that TNC's will supply the domestic market entirely from the area with the lowest supply cost. But this ignores the global character of domination by TNC's; marginal supply costs, for instance, may be lower for overseas (domestic) production precisely because there is also domestic (overseas) production. This is clearly seen in the way Ford have threatened to switch production overseas unless domestic productivity improves - see CIS. There are also potentially grave risks in a TNC locating production entirely in one country - for instance, the imposition of import tariffs may leave it in a very vulnerable position compared to its rivals.

The second type of firm to consider is a non-importing TNC. The j^{th} firm's profit is given:

$$\Pi_j = f(D + M) . D_j + g(W) . W_j - c_{(1)j}(D_j) - c_{(2)j}(W_j) - F_j \qquad (14)$$

Assuming inverse L shaped marginal production costs, and less than full capacity working, the profit maximising FOC with respect to D_j requires that

$$\frac{\partial \Pi_j}{\partial D_j} = p + D_j . f^1(D + M) . \frac{\partial (D + M)}{\partial D_j} - c_j = 0 \qquad (15)$$

where c_j is the constant marginal cost of production.

The excess capacity assumption can be justified using the arguments put in Cowling (1982). It should be noted that reliance on the Chenery (1952) analysis implicitly assumes a growing domestic demand to be satisfied from domestic production, which excludes, for example, a growing domestic demand which the firm intends to satisfy by becoming an importing TNC.

As regards entry deterrence, all that is really necessary is that the TNC has spare capacity somewhere in its empire, and that its threat to use this to increase domestic market sales is credible. However, excess capacity in domestic production will, prima facie, be a more credible deterrent than spare capacity overseas for a firm serving the domestic market entirely from domestic production.

For this type of firm, $p.D_j - c_j.D_j$ is an accurate estimate of the sum of profit from and fixed costs of total domestic production.

Importing TNC's engage in international trade because domestic capacity is insufficient to satisfy domestic demand, or because marginal supply costs from overseas are less than from domestic production. It is feasible that some firmsbe involved in importing while others are not; for example, investment decisions may have differed across TNC's in the past, giving rise to different capacity constraints, or it could be that non-production import costs are much higher for some firms than for others, for instance because some have access to cheap shipping facilities.

Similarly, not all firms need be transnational. For example, it may not be worthwhile for a firm to produce overseas because it cannot get access to cheap labour used by others, perhaps because of government interference. Firm organisation and management capability are particularly important; heterogeneous management quality may make overseas operations by some firms especially costly, for instance - see Aharoni (1966) and Hymer (1975).

Profit for the k^{th} domestic corporation is given by

$$\Pi_k = f(D + M).D_k - c_{(1)k}(D_k) - F_k \tag{16}$$

Profit maximisation implies that

$$\frac{\partial \Pi_k}{\partial D_k} = p + D_k.f^1(D + M).\ \frac{\partial (D + M)}{\partial D_k} - c_k = 0 \tag{17}$$

where c_k denotes the constant marginal production cost for below capacity working. Entry deterrence and optimal investment strategy arguments provide clear justification for domestic corporations holding planned excess capacity. Again, $p.D_k - c_k.D_k$ is an accurate estimate of the profit from and fixed costs of total domestic production.

The FOC's for each type of firm considered above can be represented by a single equation,

$$p + (D_n + M_n).f^1(D + M).\ \frac{\partial (D + M)}{\partial (D_n + M_n)} - c_n = 0 \tag{18}$$

where $n = 1, 2, \ldots, N$ and the industry comprises N domestic producers. For all but importing TNC's, M_n will in fact be zero.

The model can be generalised by assuming that

$$M = \sum_i M_i + M_o \tag{19}$$

$$= M_{TNC} + M_o \tag{20}$$

where

$M_{TNC} \equiv$ total imports by importing TNC's

$M_o \equiv$ total imports from overseas corporations

Cowling (1982) points out that domestic producers can control imports either by producing the imports themselves, or by having agency agreements with overseas corporations. Because this paper focuses on the former, it is appropriate to assume that M_o are "competitive" in the sense that they are not controlled by domestic producers - ie there are assumed to be no agency agreements. This should not be taken to imply that such agreements are unimportant.

Suppose there are L overseas corporations. Then,

$$M_o = \sum_{\ell=1}^{L} M_\ell \tag{21}$$

Using (21), and following Cowling and Waterson (1976), (18) can be written:

$$p - c_n = -(D_n + M_n).f^1(D + M).\left[1 + \{\sum_{q \neq n} \frac{\partial(D_q + M_q)}{\partial(D_n + M_n)}\} + \{\sum_{\ell=1}^{L} \frac{\partial M_L}{\partial(D_n + M_n)}\}\right] \tag{22}$$

Define:

$$\beta_{nq} \equiv \frac{\partial(D_q + M_q)}{\partial(D_n + M_n)} \cdot \frac{(D_n + M_n)}{(D_q + M_q)} \tag{23}$$

$\equiv$ the elasticity of domestic producer q's total domestic sales with respect to a change in domestic producer n's total domestic sales, as perceived by n.

$$\gamma_{n\ell} \equiv \frac{\partial M_\ell}{\partial(D_n + M_n)} \cdot \frac{(D_n + M_n)}{M_\ell} \tag{24}$$

$\equiv$ the elasticity of overseas producer ℓ's total domestic sales with respect to a change in domestic producer n's total domestic sales, as perceived by n.

$$\alpha_n \equiv \frac{\sum\limits_{q \neq n} \beta_{nq} \cdot \frac{(D_q + M_q)}{(D_n + M_n)} + \sum\limits_{\ell=1}^{L} \gamma_{n\ell} \cdot \frac{M_\ell}{(D_n + M_n)}}{\sum\limits_{q \neq n} \frac{(D_q + M_q)}{(D_n + M_n)} + \sum\limits_{\ell=1}^{L} \frac{M_\ell}{(D_n + M_n)}} \tag{25}$$

$\equiv$ firm n's (weighted) average conjectural elasticity.

Substituting (25) into (22) and rearranging yields

$$p - c_n = - f^1(D + M) \cdot \left[(D_n + M_n) + \alpha_n \{ \sum_{q \neq n} (D_q + M_q) + \sum_{\ell=1}^{L} M_\ell \} \right] \tag{26}$$

and thus:

$$p - c_n = -(D + M) \cdot f^1(D + M) \cdot \left[\frac{D_n + M_n}{D + M} + \alpha_n \cdot \{ \sum_{q \neq n} \frac{(D_q + M_q)}{(D + M)} + \sum_{\ell=1}^{L} \frac{M_\ell}{(D + M)} \} \right] \tag{27}$$

Define, $\forall_n$,

$$S_n \equiv \frac{D_n + M_n}{D + M} \tag{28}$$

$\equiv$ firm n's share in total domestic sales.

Then,

$$\sum_{q \neq n} s_q + \sum_{\ell=1}^{L} \frac{M_\ell}{D + M} = 1 - S_n \tag{29}$$

Substituting (29) into (27),

$$p - c_n = -(D + M) \cdot f^1(D + M) \cdot \left[s_n + \alpha_n \cdot (1 - s_n) \right] \tag{30}$$

Multiplying throughout (30) by D_n , summing over all firmsand dividing by pD yields :

$$\mu \equiv \frac{p.D - \sum_n c_n . D_n}{p.D} = \frac{1}{\eta} \cdot \sum_n d_n \cdot \left[S_n + \alpha_n \cdot (1 - S_n) \right] \tag{31}$$

d_n is firm n's share in domestic sales from domestic production, i.e.

$$d_n \equiv \frac{D_n}{D} \tag{32}$$

From (31),

$$\mu = \frac{1}{\eta} \cdot \left[\sum_n d_n . S_n + \sum_n d_n . (1 - S_n) . \alpha_n . \left\{ \frac{\sum_n d_n . (1 - S_n)}{\sum_n d_n . (1 - S_n)} \right\} \right]$$

$$= \frac{1}{\eta} \cdot \left[\sum_n d_n . S_n + \alpha . \sum_n d_n . (1 - S_n) \right] \tag{33}$$

where

$$\alpha \equiv \frac{\sum_n d_n . (1 - S_n) . \alpha_n}{\sum_n d_n (1 - S_n)} \tag{34}$$

$\equiv$ the industry's (weighted) average conjectural elasticity.

(33) can be rearranged:

$$\mu = \frac{\alpha}{\eta} + \frac{(1 - \alpha)}{\eta} . \sum_n d_n . S_n \tag{35}$$

It is more convenient to express this result:

$$\mu = \frac{\alpha}{\eta} + \frac{(1 - \alpha)}{\eta} . T . \frac{(D + M_{TNC})}{(D + M)} \tag{36}$$

where

$$T \equiv \sum_n \frac{D_n}{D} . \frac{(D_n + M_n)}{(D + M_{TNC})} \tag{37}$$

The earlier discussion of costs shows that $p.D - \sum_n c_n.D_n$ is the lower bound on profits from and fixed costs of total domestic production by the industry. Thus, μ is the lower bound on the share of profits and fixed costs in the revenue created by total domestic production; i.e. μ is the lower bound on the (weighted) average degree of monopoly in domestic production.

Exports are ignored in the analysis, but this is because they add no theoretical difficulties. Similarly to the way in which μ is obtained from FOC's with respect to D_n and M_n, in a model containing exports the FOC's with respect to X_n and W_n can be used to find an expression, ρ, for the profit from and fixed costs of domestic production for overseas sale. Following Lyons (1979),

$$\frac{\Pi + F}{p.D + r.X} = \mu \cdot \frac{p.D}{p.D + r.X} + \rho \cdot \frac{r.X}{p.D + r.X} \tag{38}$$

where r is the equilibrium price in the overseas market, and $\Pi + F$ comprise profit from and fixed costs of total domestic production.

Consider again equation (36). As in the result presented in Cowling (1982) for a closed economy, μ is a function of the price elasticity of demand and the average conjectural elasticity. The crucial difference to the Cowling (1982) result is that (36) replaces the Herfindahl index of concentration defined over domestic production for domestic sale, namely

$$H \equiv \sum_n \left(\frac{D_n}{D}\right)^2 \tag{39}$$

with the expression:

$$T \cdot \frac{(D + M_{TNC})}{(D + M)} \tag{40}$$

The second part of (40) is simply the proportion of total domestic sales sold by domestic producers, taking account of all sales by the latter.

T is an index of sales concentration which is influenced by "non-competitive" imports. Given

$$O < \frac{D_n}{D} \leq 1 \quad , \quad O < \frac{D_n + M_n}{D + M_{TNC}} \leq 1$$

then

$$O < T \leq 1$$

If M_{TNC} is very small compared to D , $T \rightarrow H$. Indeed, (36) differs from the Lyons (1979) result precisely in that M_{TNC} very small compared to D implies that μ can be approximated by the equation:

$$\mu = \frac{\alpha}{\eta} + \frac{(1 - \alpha)}{\eta} \cdot H \cdot \frac{D}{(D + M)} \tag{41}$$

Had the Lyons (1979) analysis used average conjectural elasticities rather than total conjectural variation parameters, the result would have been equation (41).

Suppose, however, that M_{TNC} is not very small compared to D . Then, $T \rightarrow O$ if, $\forall n$,

$$\frac{D_n}{D} \cdot \frac{(D_n + M_n)}{(D + M_{TNC})} \to 0 \tag{42}$$

For domestic corporations and non-importing TNC's, for whom M_n is zero, this necessitates either

(i) all such firms have a very small share in domestic production for domestic sale, or

(ii) M_{TNC} is very large compared to D, and thus all such firms have a very small share in total domestic sales.

For importing TNC's, (42) requires either

(i) every such firm has a very small share in domestic production for domestic sale, or

(ii) M_{TNC} is very large compared to D, and those with a significant share in domestic production for domestic sale have a very small share of imports by importing TNC's.

In contrast, $T \to 1$ implies each of (at most) a few firms have very high shares in domestic production for domestic sale, and very high shares in total domestic sales by domestic producers.

Thus, considering all situations, very low values of T imply either

(a) every firm has a very small share in domestic production for domestic sale, or

(b) M_{TNC} is very large compared to D, and those firms with a very large share in domestic production for domestic sale have a very small share in the imports of domestic producers.

Very high values of T suggest either

(a) each of (at most) a few importing TNC's have a very large share in both domestic production for domestic sale and in imports by domestic producers, or

(b) M_{TNC} is very small compared to D, with (at most) a few corporations dominating domestic production for domestic sale.

The theoretical specification of the degree of monopoly presented above can be contrasted with Lyons (1979) in two further respects: in its implications for an increased import penetration, and for the estimated level of the degree of monopoly.

A conclusion drawn in Lyons (1979) is that "a *ceteris paribus* increase in import penetration leads to an unambiguous decrease in potential profitability". Lyons (1979) only considers imports from overseas corporations, and it does indeed follow from equation (36) that a *ceteris paribus* increase in such imports leads to an unambiguous fall in μ. (This conclusion requires $\alpha < 1$. Joint profit maximisation, which gives an upper bound to price cost margins, requires $\alpha_n = 1 \; \forall_n$, and thus $\alpha = 1$; see Cowling (1982). Thus, the conclusion is valid for all but the joint profit maximising solution, when changes in imports have no effect whatsoever, unless they cause a change in η.)

It must be emphasised, however, that this only refers to *ceteris paribus* changes, and does not account for every change in M_n. If each overseas corporation determines its import level by profit maximisation, it conforms to a FOC, given, for firm ℓ, by

$$\frac{\partial \Pi_\ell}{\partial M_\ell} = p + M_\ell \, . \, f'(D + M) \, . \, \frac{\partial (D + M)}{\partial M_\ell}$$

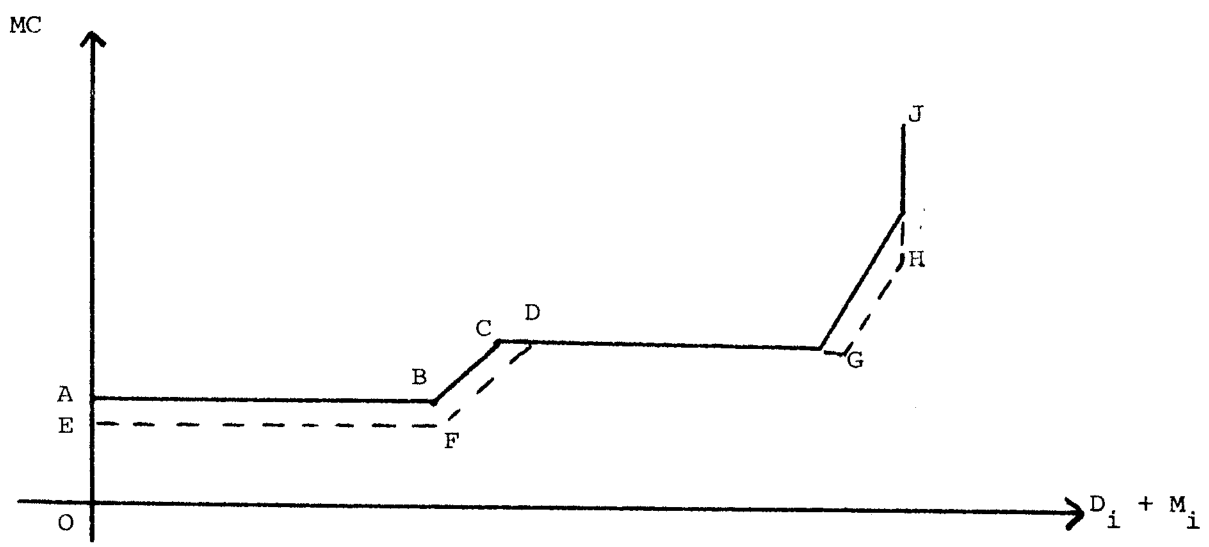
$$- c'_{(2)\ell}(W_\ell + M_\ell) - t'_{(2)\ell}(M_\ell) = 0 \qquad (43)$$

A change in M_ℓ implies an alteration in the parameters or exogenous variables underlying equation (43), for example a change in firm ℓ's marginal supply costs. But to the extent that conjectural elasticities depend upon a rival's costs, this implies a change in $\gamma_{n\ell}$, $\forall_n$, and hence in α, and a change in D_n or M_n. Acute difficulties can arise in determining the new equilibrium resulting from such changes, difficulties which will not be confronted here; suffice it to point out that the conclusion reached in Lyons (1979) does not claim that any increase in import penetration resulting from an increase in M will necessarily imply a fall in μ.

Similar difficulties can arise when considering changes in M_{TNC}. The relationship given by equation (36) is derived from profit maximising FOC's for domestically producing firms. These FOC's also determine D_n and M_n, meaning that neither D nor M_{TNC} are exogenous variables in the model. Nevertheless, it can still be shown that a rise in import penetration may cause a rise in μ.

Consider an importing TNC characterised by costs depicted as in case II, above. Suppose marginal supply costs to the domestic market are initially given by the unbroken line in Figure 3. If marginal supply costs from overseas production are now reduced, marginal supply costs to the domestic market are given by the curve EFDGHJ.

FIGURE 3 : INCREASED IMPORT PENETRATION IN A CASE II COST SITUATION



This cost change will not alter i's perceived marginal revenue. Crucial to this outcome is the fact that c_i is unchanged; to the extent that i's rivals hold conjectural elasticities determined by i's costs, c_i is the important parameter because, in equilibrium, this is i's marginal cost of supplying the market.

Although i's total sales to the domestic market remain unchanged, imports rise at the expense of domestic production for domestic sale by the amount CD . Import penetration has increased. (This implies a willingness by i to divert sales from its overseas market, otherwise BC would be vertical and CD zero. However, in the absence of such willingness marginal production costs which rise sharply but not vertically as overseas output reaches full capacity would still give rise to a non zero CD .)

The consequent change in μ is given:

$$d\mu\Big|_{\substack{p \\ c_n \,\forall\, n = 1, \ldots N \\ D_n \,\forall\, n \neq i}} = \frac{\partial\mu}{\partial D_i} \cdot dD_i \tag{44}$$

$$= -\left[\frac{p.D.c_i - p.\sum_n c_n.D_n}{p^2.D^2}\right] . \, dD_i$$

$$= \left[\frac{\sum_n c_n.D_n - c_i.D}{p.D^2}\right] . \, dD_i \tag{45}$$

Given $dD_i < 0$, the condition for μ to rise is :

$$\sum_n c_n.D_n - c_i.D < 0$$

i.e.:

$$c_i.D > \sum_n c_n.D_n \tag{46}$$

This requires that the i^{th} firm has high marginal supply costs relative to its rivals. If, for example, i is a TNC with overseas nationality, it could well have high marginal costs of production in the domestic market.

Thus, a rise in import penetration in an industry can be accompanied by a rise in the degree of monopoly. It can at least be concluded that the picture presented in Lyons (1979) is not complete.

A comparison of the two models in estimating the level of the degree of monopoly suggests that the Lyons (1979) analysis may lead to significant underestimates.

The typical firm in the Lyons (1979) analysis has a profit maximising FOC given by

$$p - c_n = - D_n \cdot f^1(D + M) . \frac{\partial (D + M)}{\partial D_n} \tag{47}$$

In contrast, the analysis leading to equation (36) as its result uses, under the homogeneous good assumption,

$$p - c_n = -(D_n + M_n) . f^1(D + M) . \frac{\partial (D + M)}{\partial D_n} \tag{48}$$

Consider $\mu_n \equiv \frac{(p - c_n) . D_n}{p.D}$ (49)

Estimating μ_n by (47) rather than (48) leads to an error:

$$\frac{-f^1(D + M) . \frac{\partial (D + M)}{\partial D_n} . \left[D_n + M_n - D_n \right]}{-f^1(D + M) . \frac{\partial (D + M)}{\partial D_n} . (D_n + M_n)} = \frac{M_n}{D_n + M_n} = \sigma_n \tag{50}$$

The Lyons (1979) analysis underestimates μ_n by σ_n.100%. For those domestic producers which are not importing TNC's, $M_n = \sigma_n = 0$, and there is no error, but for importing TNC's, $\sigma_n > 0$.

The error in estimating μ from (47) rather than (48) is:

$$\frac{\Sigma_n \not{W}_n - \Sigma_n (1 - \sigma_n).\not{W}_n}{\Sigma_n \not{W}_n} = \frac{\Sigma_n \sigma_n.\not{W}_n}{\Sigma_n \not{W}_n} \equiv \varepsilon \qquad (51)$$

The Lyons(1979) analysis underestimates μ by ε.100% If reliable estimates of $\not{W}_n$ are unavailable, a range of values can be placed on ε. Define:

$\sigma_{MIN} \equiv$ The minimum value of σ_n considered over all $n = 1,2,..,N$.

$\sigma_{MAX} \equiv$ The maximum value of σ_n considered over all $n = 1,2,..,N$.

Then,

$$\sigma_{MIN} \leq \varepsilon \leq \sigma_{MAX} \qquad (52)$$

Table 3 reports values of σ_n.100 for new registrationsof new cars produced by the four dominant domestic manufacturers in the UK car industry. The implication is that the Lyons (1979) analysis would lead to an underestimate of μ by 4-37% in 1978, 0-40% in 1977, 0-34% in 1976, and 0-17% in 1975. The lower bound in each year is due to the low level of Leyland cars that are imported; apart from Fords in 1975, the percentage of total domestic sales imported by the remaining producers is consistently very high.

Accurate calculation of $\not{W}_n$, and hence ε, is impossible. Cars are not the only goods produced by firms involved in the car industry - in particular, commercial vehicles are important - yet published profit and turnover data refers to all activities by a company. Moreover, fixed costs of domestic production for domestic sale cannot be measured because each firm also has substantial exports - domestic production for domestic sale - and indeed, company specific data on all fixed costs is unavailable.

TABLE 3 : σ_n.100 IN THE UK CAR INDUSTRY, 1975-1978.

YEAR	CHRYSLER	FORD	GENERAL MOTORS	LEYLAND
1975	17.8	0.2	10.8	0
1976	28.7	8.9	34.8	0
1977	18.8	25.4	40.9	0.8
1978	11.7*	35.2	37.2	4.2

* Where the production source is unspecified, it is assumed to be domestic. The only occasion on which this could be significant is for Chrysler in 1978. This figure is thus only a lower bound.

Source: compiled from tables 23 and 24 of SMMT (1979).

TABLE 4: APPROXIMATIONS TO ϕ_n , μ , AND ε.100 FOR THE UK CAR INDUSTRY, 1975-1978.

YEAR	ϕ_n				μ	ε.100
	CHRYSLER	FORD	GENERAL MOTORS	LEYLAND		
1975	0.005	0.044	0.014	0.072	0.135	1.84
1976	0.001	0.059	0.013	0.092	0.165	6.10
1977	0.006	0.073	0.011	0.077	0.167	14.84
1978	0.008	0.069	0.014	0.079	0.170	19.85

Source: compiled from EXTEL and Census of Production data.

Nevertheless, it is worth examining the crude approximations to $\not{W}_n$ - and hence μ and $\varepsilon.100$ - reported in Table 4. The estimates were obtained from data relating to all the activities of four companies:

(a) BL Ltd; the holding company ultimately responsible for the production and distribution of Leyland vehicles worldwide.

(b) Chrysler United Kingdom Ltd.; (during the period 1975-1978) a subsidiary of the US based Chrysler Corporation, but with its own subsidiaries outside the UK in Eire. Responsible for the production and distribution of Chrysler vehicles in the UK.

(c) Ford Motor Co. Ltd.; a subsidiary of the Ford Motor Co. of the USA, and also with its own subsidiaries in Eire. Responsible for the production and distribution of Ford vehicles in the UK.

(d) Vauxhall Motors Ltd; a subsidiary of the US based General Motors Corporation and responsible for the production and distribution of Vauxhall and Bedford vehicles in the UK.

For each company, data was obtained from EXTEL regarding gross pre tax profit, interest payments, turnover, and total employment. The latter statistic was used to approximate the fixed costs of each company not covered by gross pre tax profit and interest. These "other fixed costs" were estimated by the multiple of:

(i) the ratio of company employees to total employees in the UK motor vehicle manufacturing industry, and

(ii) total payments by the UK motor vehicle manufacturing industry for "non-industrial services" (including the rent on buildings,hire of plant, bank charges,and advertising costs), motor vehicle licensing, rates (but excluding water rates), and salaries (defined as the wages and salaries of administrative, clerical, and technical employees).

The reported approximations to $\not{\! W}_n$ are given by the ratio, for each company respectively, of gross pre tax profit, interest payments, and other fixed costs to the total turnover of all four companies. (This ignores the small domestic producers such as Reliant, but in 1978, for example, their combined share in domestic output for domestic sale was approximately 0.5%, and thus their omission will not cause a significant bias.)

Comparing the estimates of μ in Table 4 to those reported in Cowling (1982) for the motor vehicle industry, it seems that the figures in Table 4 are, if anything, underestimates. In Cowling (1982), μ ranges from 0.157 to 0.292, the value in 1975 being 0.181; in Table 4, μ varies from 0.135 to 0.170, the former being the value in 1975. Despite this discrepency, it is not so large as to cause too much concern.

The evidence in table 4 suggests that the errors in estimating $\not{\! W}_n$ for Leyland and Ford will be the most important determinant of errors in μ - for Chrysler and General Motors, the estimate of $\not{\! W}_n$ is small throughout the period considered. Together with the information in Table 3, this implies that the Lyons (1979) analysis would provide fairly accurate estimates of μ in 1975, when $\sigma_n.100$ is zero and 0.2 for Leyland and Ford respectively, but that the analysis would cause increasingly significant underestimation throughout the remaining years considered. Values of $\sigma_n.100$ of 4.2 and 35.2 for Leyland and Ford respectively in 1978 suggest that the underestimation in that year could be very large.

This is as firm a conclusion as can confidently be reached using the available data because exact estimates of any bias are themselves liable to significant error. Nevertheless, estimates of $\varepsilon.100$ calculated from the approximation to $\not{\! W}_n$ are also given in Table 4, and reflect the conclusions drawn in the previous paragraph.

It is clear that the phenomenon of TNC's producing in and yet trading between several countries is an important influence on the weighted average degree of monopoly in certain industries at certain times. A characteristic of the formulation for the degree of monopoly presented earlier and requiring emphasis is that when imports by importing TNC's are insignificant, (36) effectively reduces to the relationship presented in Lyons(1979). Given that the Lyons (1979) analysis leads to underestimates of μ when imports by importing TNC's are significant, there is nothing to lose and much to gain from using (36).

This is not to claim that the model presented above adequately explains the phenomenon in all cases. In particular, further work is needed to understand long run conditions more fully, and an analysis of differentiated products may, in some instances, yield more fruitful conclusions and greater understanding - for example, in an industry of differentiated products, the requirement that full capacity working be observed somewhere in the importing TNC's empire is unlikely to apply. Nevertheless,the model is a reasonable starting point.

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