The role of intra-firm trade

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Multinational Enterprises And Trade Structure:
The Role of Intra-Firm Trade

MULTINATIONAL ENTERPRISE AND TRADE

STRUCTURE:

THE ROLE OF INTRA-FIRM TRADE

VON

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Abstract: The paper analyses "intra-firm" trade in manufacturing, that is, the estimated one-third of world trade in manufactures which is transacted between affiliated parties. As firms realize the increasing potential for integrating their operations throughout the world, they are contributing to significant shifts in the patterns of international trade and industrial development. As can be seen from the material presented here, a substantial and growing part of international trade is internalized through the MNEs.

1. Introduction

1.1 The Importance of Intra-Firm Trade

Intra-firm trade is so understudied and not incorporated in most conventional discussions of international trade that there seems to be a special need to attempt to gather together what information exists and place it in one place.

The evolution of post-Second World War international trade has been characterized by a phenomenal real rate of growth in developing as well as industrialized economies. Primary products accounted largely for the expansion of the volume of world trade till the end of the 1930s. After World War II, however, the share of primary goods in total exports has steadily declined to a low point of 30 per cent in 1972, recovering somewhat after the oil crisis.[1] Many hypotheses have been formulated in attempting to explain this turnaround in the positions of primary and manufactured commodities in the trade statistics.

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[1] See Hood/Young (1979), p. 132.

Table 1 below reveals the striking characteristic that trade in manufactures accounts for a rising share of total world trade.

Table 1 - Trade in Manufactures Relative to Total Trade

Year	Value ($ billion)	As % of Total Trade
1928	12	39
1953	32	45
1973	350	67
1979	943	58

Source: Ethier (1982), p. 38

The main share of world trade occurs as trade in similar products between developed countries, rather than between these countries and the less developed.[2] This tendency has been accompanied by an essential qualitative change in the international economic relationships between national economies. Much of this rapid growth of international trade has been accomplished under the auspices and control of multinational corporations.[3]

A large degree of international transactions have been internalized by multinational corporations in a combination of foreign direct investment, technology transfer, finance and trade flows. Nearly one-third of world trade in manufactures is "intra-firm" trade transacted between affiliated parties [compare e.g. Hesse et al. (1985), p. 43]. As such, many technology transfers occur simply between parent

[2] Compare e.g. Broll and Gilroy (1987).

[3] MNE's have been defined in many ways. For our purposes, a MNE is any enterprise, whether privately or publicly owned, which following Dunning (1974, p. 13) owns and controls income-generating assets in more than one country. For a discussion as to the definition of what a MNE is see e.g. Aharoni (1971), Lenel (1976), Macharzina (1981).

corporations and their foreign affiliates. Thus the appropriability of the inherent information contained in the technology remains within the corporation.[4] Illustrative of this is the case of the United States for which on average, 78 per cent of the fees and royalties received annually by U.S. parent corporations came from foreign affiliated companies during 1970 - 1972, increasing to 81 per cent for the period 1979 - 1981.[5] Similarly, to some extent intra-firm capital transfers are generated internally by the earnings of multinational enterprises, or provided by in-house finance corporations made available by banks closely tied with industrial enterprise [compare e.g. Ebenroth (1979)].

Finally, a large proportion of commodity trade is generated by multinational enterprises. The United Nations Center on Transnational Corporations registers for the U.S. that this share was over 90 per cent in 1977, and in the case of 1977 exports of the United Kingdom it was 80 per cent.[6] In addition, the intra-firm trade of U.S. majority-owned foreign affiliates increased from 19 per cent of total trade in 1966 to 22 per cent in 1977, if minority-owned affiliates and non-United States multinational enterprises are added (that is, total intra-firm trade transactions), 39 per cent of imports and 36 per cent of exports of the United States were intra-firm transactions in 1977. For the United Kingdom, 29 per cent of the exports have been accounted for as intra-firm trade in 1976, and the share increased to 31 per cent in 1980.[7] Buckley and Pearce (1979) have estimated intra-firm trade for the Federal Republic of Germany to lie within the magnitude of 20 per cent.[8]

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[4]   See e.g. Magee, S.P. (1977).

[5]   See Transnational Corporations in World Development: Third Survey, United Nations Center on Transnational Corporations, New York, 1983, p.6. The payment of fees and royalties received by German MNE's from their foreign subsidiaries March 1985 for example, was of the magnitude of 1.5 Mrd DM (compare p. 30 Monatsberichte der Bundesbank, März, 1985).

[6]   IBID.

[7]   IBID.

[8]   For further empirical evidence compare additionally Helleimer (1981), UNIDO (1981), Jarrett (1979).

1.2 Towards a Theory of International Production

The economics literature on the subject MNE's has been quite vast.[9] Originally, analysis was carried on in terms of a theory of the impact of international capital flows. The relative rates of return on investments in various countries were examined in order to assess the impact of foreign direct investment upon a host country in terms of the <u>marginal productivity of capital</u> as formulated by MacDougall's classic paper (1960).[10]

Then a quite different approach emerged focusing on matters of <u>market structure and industrial organisation.</u> Hymer (1960/1976) (reprint) was the first to articulate the correlation between the degree of concentration and the degree of involvement in foreign direct investment. His work was continued by Charles Kindleberger (1969) and became the foundation for other theories based on product and factor market imperfections. The market imperfections paradigm has been further extended by the economists at the University of Reading in the United Kingdom (see e.g. Buckley and Casson (1976), Dunning (1977), Casson (1987). Geroski and Jacquemin (1985) have documented the market structure aspects of the multinationality, growth and extent of industrial concentration in Europe.[11]

Although concentration measures, whether or not adjusted for international trade, are an inadequate measure of monopolistic behaviour in markets, they provide <u>prima facie</u> evidence that the traditional trade model of perfect competition is an inaccurate description of the real world. The extensive literature on the product cycle [Vernon (1966)], the business and economics literature on plant location [e.g. Hirsch (1976), Dunning (1977), (1981), Casson (1979), Buckley and Casson (1985)], or the papers of the industrial organization literature [see especially Caves (1971), (1974), (1982)] all fit into this explanatory category. An important element in this literature is

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9)   This section is based largely upon Helleiner (1981). For more detailed surveys see e.g. Kay (1983), Calvet (1981).

10)   Empirically, however, it has been difficult to find any correlation of interest rate differentials with foreign direct investment in time-series analysis (see e.g. Ruffin and Rassekh (1986, p. 1126).

11)   See further Fishwick (1982), especially pages 49-51 for the German Case, and for a theoretical discussion, Kierzkowski (1984) and Neuman/Böbel/Haid (1985).

the attempt to explain why "arm's length" market transactions are replaced through non-market devices (planning systems, internal hierarchies) [see e.g. Williamson (1975), (1981), (1985), Masten (1984), (1986), Klein, Crawford, Alchian (1978), Rugman (1980)]. In this context, transaction cost economics has pointed out the serious neglection of neoclassical theory with regard to its absence of transaction costs, market failure problems such as monopoly, externality and public goods [see Williamson (1980)]. Loasby (1976) has demonstrated that even given zero transaction costs economies of scale may be exploited in fully competitive markets if property rights to usage of indivisibilities are unambiguously defined [see further Kay (1983, p. 304)]. Rugman (1982) has argued that internalisation is a general theory of foreign direct investment; due to the idiosyncratic nature of long term relationships market exchange involves transaction cost inefficiencies which provide a strong incentive for the creation of multinational enterprises.

A third related, but separate, approach in explaining foreign direct investment found its roots in Latin America. The multinational enterprise was analysed at a dis-aggregate level (or unpackaged), both conceptually and in practice, into its constituent components - capital, technology, management etc. Each of these corresponding markets was then analysed separately [compare e.g. Vaitsos (1974), UNCTAD (1972)].

Fiscal economists then began to examine the important element in a firm's decision-making process, namely their tax obligations to the governments of different international locations [UN Department of Economic and Social Affairs (1974), Horst (1971), Kratz (1986)]. In the discussion of tax minimization, the issue of transfer prices also was given extensive analysis [e.g. Ebenroth (1979), Lall (1973), Copithorne (1971)].

Up to this point in time, those economists who actively dealt with issues of multinational enterprise were specialists in industrial organisation, location theory, international finance, and fiscal policy. Only trade theorists failed to give due atten-tion to the institution multinational enterprise. Although Ohlin (1933), pp. 50-58 and 106-11, has remarked himself

> "Instead of asking why certain countries exchange goods with another, one can ask why production is divided in a certain way. On the whole, the exchange of goods is determined once the location of production has been fixed."

The multinational corporation and the intra-firm trade which it conducts put in question two of the most basic premises of traditional trade theory:

1) that is the nation state which is the appropriate basic unit of analysis, within which factors of production are assumed to be mobile and between which they are not,

2) that internationally traded commodities are exchanged on markets by transactions occurring at arm's length at prices and volumes established by international demand and supply considerations.

Recent trade theorists [compare Helpman/Krugman (1985)] have, however, begun to eliminate this deficiency. In examining trade patterns three main themes have emerged thus far:

1) Under a large variety of industrial structures the predictive power of the HOS-Model or Factor-Proportions Theory remains valid for the intersectoral pattern of trade, and the factor content of trade flows [see e.g. Hamilton and Svensson (1984), Leamer (1984), Broll and Gilroy (1986a)]. Recent analysis [see e.g. Eaton and Panagariya (1979), Panagariya (1980, 1981), Markusen and Melvin (1981), Herberg et al. (1982), Ethier (1982) and Mendez (1985) have examined among other aspects the sensitivity of the properties of the Heckscher-Ohlin and Ricardo trade models as well as the specific factor production model.

2) Given economies of scale large volumes of trade are consistent with small factor endowment dispersions across countries [compare e.g. Markusen (1984)].

3) The decomposition of trade volumes into an intra-industry and an intersectoral component can be related to fundamental characteristics of the exchanging nations [compare Helpman and Krugman (1985), Broll and Gilroy (1985, 1987)].

The following presentation based upon Helpman/Krugman (1985) supplements traditional trade theory by including explicitly the additional component of inter-

national trade "intra-firm trade", that is, trade among affiliates of the same multi-national enterprise.[12] Inclusion of multinational enterprises into trade theory is founded upon <u>two main premises</u>:

1) product differentiation and economies of scale exist in some industries,

2) there are inputs - such as management, marketing, and product specific R. & D. - that are highly specialized and that can be located in one country and serve product lines in another country.[13]

In a domestic setting, the economic theory of the firm has attempted to answer questions such as "what is the nature of the firm?", "why do firms exist?", and "why are centralized organizations, such as firms, chosen in preference to a price system to allocate resources?".[14]

In an international setting, the multinational firm may naturally also be interpreted as an alternative economic organizational institution in which transaction costs, information costs, and bargaining costs are all reduced relative to exchange transactions on international markets [see e.g. Hennart (1982)].

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[12] Including multinational enterprises into any study of trade flows is desirable even if one does not focus the analysis upon intra-firm trade per se, since the behaviour of other significant trade variables such as the volume of trade or share of intra-industry trade are increasingly influenced by the existence of multinational enterprises. Any full explanation of world trade structures thus requires taking account of the functioning of multinational enterprises [see Helpman and Krugman (1985), Chap.12/13)].

[13] This idea originates in Williamson's (1981, p. 1548) <u>Asset Specificity Principle</u>:

"The first principle of efficient organizational design is this: the normal presumption that recurring transactions for technologically separable goods and services will be efficiently mediated by autonomous market contracting is progressively weakened as asset specificity increases."

See further the discussion throughout Caves (1982), and the highly informative discussion in Hauschka and Harm (1987).

[14] See e.g. Behrens (1985).

The question remains thus "what difference does multinationality make?". An analytical framework is needed which is capable of explaining why in certain situations economic agents choose firms, rather than a price system, to co-ordinate their international activities. In all of the attempts made thus far in offering an explanation of the existence of multinational firms a common theme arises: there are strong economic and business rationale for their existence. The decision to invest in production facilities abroad evolves out of a complex process motivated by strategic, behavioral, and economic considerations.

Factor and product market imperfections are sufficient and necessary conditions for the evolvement of multinational enterprises. Market imperfections may come about naturally, but as Caves (1971) and others have stressed, they commonly result due to policies adhered to by firms and governments. Firms seek specifically to establish unique competitive advantages through their product differentiation strategies [compare e.g. Gilroy and Broll (1987)]. They create their own firm-specific advantages by producing and marketing differentiated products, which arise from research- and development and marketing expenditures on brand identification. Furthermore, the research and marketing process continues to produce a steady stream of new differentiated products, since the productive experience as expressed in cumulative output leads to a better available technology. As Furubotn (1987) has adeptly pointed out, the institutionalization of the technical learning process (e.g. value engineering) within multinational enterprises has resulted in high levels of technological improvement. *Informational economies of consolidation* arise within the institution multinational enterprise, which must be balanced with the costs of consolidating such information internationally.

Placing the various theoretical strands in perspective, they all attempt to explain why firms transact through foreign direct investments rather than resorting to exporting, licensing, or management contracts. In other words, the "black box" character of the internalization hypothesis may be lifted.

Such a framework will be presented in the following Section in which those firms possessing the capability of employing a general purpose input in such a manner as to adapt it to some specific usage will develop a firm-specific asset, for example *"headquarter services"*. Such an asset is highly specialized and decreasingly transferable to other applications. The degree of specificity will eventually result in economies of

scale, given the firm employs the asset under its own internal administration. Multinational enterprises maximize profits and therefore make cost-minimizing location choices of product lines. The emergence of multinational corporations arises thus as a response to tendencies of factor rewards to differ across countries, as well as being induced by the technology available to them.

The explanatory emphasis is therefore on one source of pressure or incentive causing multinational firms to arise due to relative factor reward differences in relative factor endowments. Various other reasons for multinationality, which may also be significantly important, e.g. transport costs, tariffs, tax advantage, risk diversification [see e.g. Broll and Gilroy (1986d)], are not considered here.

Traditional international trade theorists consider dissimilarity of preferences, endowments, and technologies as the major reasons for international trade. However, within an international product differentiation framework not all varieties of products will be produced in a single country [see Broll and Gilroy (1986c)]. The availability of product variants worldwide will be insured through intra-trade, whereas intra-firm trade within MNE's secures an efficient factor allocation that strengthens the tendency towards factor price equalization.

The model presented below is embedded in a general equilibrium system in which product differentiation strategies of firms along with internal economies of scale illustrate the conditions that cause firms to choose multinationality given differences in factor rewards across countries. Trade patterns are thereby obtained in which multinational enterprises play a major role illustrative of empirically observed world trade structures exhibiting intersectoral, intra-industry, and intra-firm trade.

2.   The Basic Model Or "Why Foreign Direct Investment?"

> "In South Korea, Taiwan and Indonesia we see promising markets
> and we see an attractive supply of cheap labour."
>
> *(Henry Ford II, 1972)*[15]

The above citation illustrates the first issue concerning multinational enterprises that has attracted the attention of trade theorists. Essentially, of course, firms invest abroad for inherently the same reasons that they invest at home, namely to make profits and to grow.[16]

For the sake of simplicity, the model presented below deals only with single-product firms. As such the intra-firm trade component consists only of trade in invisibles, that is, in "headquarter services". The model may however be extended to cover multi-product firms [see Helpman (1985)].

Two original factors of production exist, labour (L) and capital (K). The economy consists of two sectors. The sector Y produces a homogeneous good, say food, and is characterized by perfect competition. Food is produced by means of labour and capital with a standard increasing, twice differentiable linear homogeneous and strictly quasi-concave production function with the associated cost function $c_y(w_L, w_K)$, whereby w_L and w_K designate the respective factor payments. Assuming that a producer of food must employ all factor inputs in the same geographical location and setting food as the numéraire good one obtains,

$$1 = c_y(w_L, w_K) \qquad \ldots (1)$$

Equation one simply states that in an equilibrium with food production the price of food is equal to the unit cost of food.

The structure of the second sector of the economy x which produces manu-factured (differentiated) goods is somewhat complexer.

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[15]   cited according to Richard J. Arnet and Ronald E. Miller (1974), page 307.

[16]   See the classical work of Penrose (1956).

Finished manufactured (differentiated) products are produced by means of labour, capital, and an intermediate manufactured input (we restrict our interpretation here to "headquarter services", in the form of management, marketing, or product-specific R. & D). Headquarter services (H) themselves are a differentiated product, which may be produced in a continuum of varieties, just as can the finished manufactured product.[17] A firm has to adapt it at a cost in order to make it suitable for the production of its variety of the finished good. Once adapted, the H factor becomes a firm specific asset h tied to the entrepreneurial unit. The main characteristic of this factor is its ability to be employed in several plants simultaneously. It need not be located within a plant in order to serve its product line [see Hirsch (1976), Helpman (1984), Markusen (1984)]. This important characteristic allows multinational firms to employ the adapted input internationally. Representative of such firm specific assets are inputs such as product-specific research and development, management, marketing skills, etc. Although in reality generally many such inputs are necessary for an efficient organization of the multinational enterprise [see Caves (1982), Chap. 1], it is assumed here simply that they may be aggregated after being adopted as "headquarter services". If knowledge is entirely firm-specific, labour becomes a quasi-fixed factor of production in the sense of Oi (1962). See further Steigum (1984). The firm will train new workers internationally without charge and pay them a subsequent wage that is lower than the value of the worker's marginal profit. It is this difference between revenue and labour costs of subsidiaries that may be interpreted as profits repatriated by the parent firms or payments by the subsidiaries for services rendered by the parent firms [see Helpman (1984, p. 462)].

Costs required to produce x units of a variety in a single plant when h units of H have been adapted for its particular use are:

$$C^p(w_L, w_K, h, x) = f(w_L, w_K) + g(w_L, w_K, h, x)$$

with $f(\cdot) > 0$ and $g(\cdot)$ being positively linear homogeneous in (h, x). The term $f(\cdot)$ on the right hand side of the above equation generates the plant-specific fixed cost element, whereas $g(\cdot)$ represents the variable cost component exhibiting constant

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[17] One may argue in fact that each variety of the finished good has a corresponding best variety of the intermediate input "headquarter services", in the sense that if the corresponding intermediate input is used in its production the required quantities of labour and capital are lowest [compare e.g. Helpman, (1985, p.7)]. See further the model of Jones and Kierzkowski (1986).

returns to scale. It is assumed that $C^P(\cdot)$ is associated with an increasing returns to scale production function in which h is essential for production.

Furthermore, the minimum costs required in order to produce h in the desired variety must be considered:

$$C^H(w_L, w_K, h) .$$

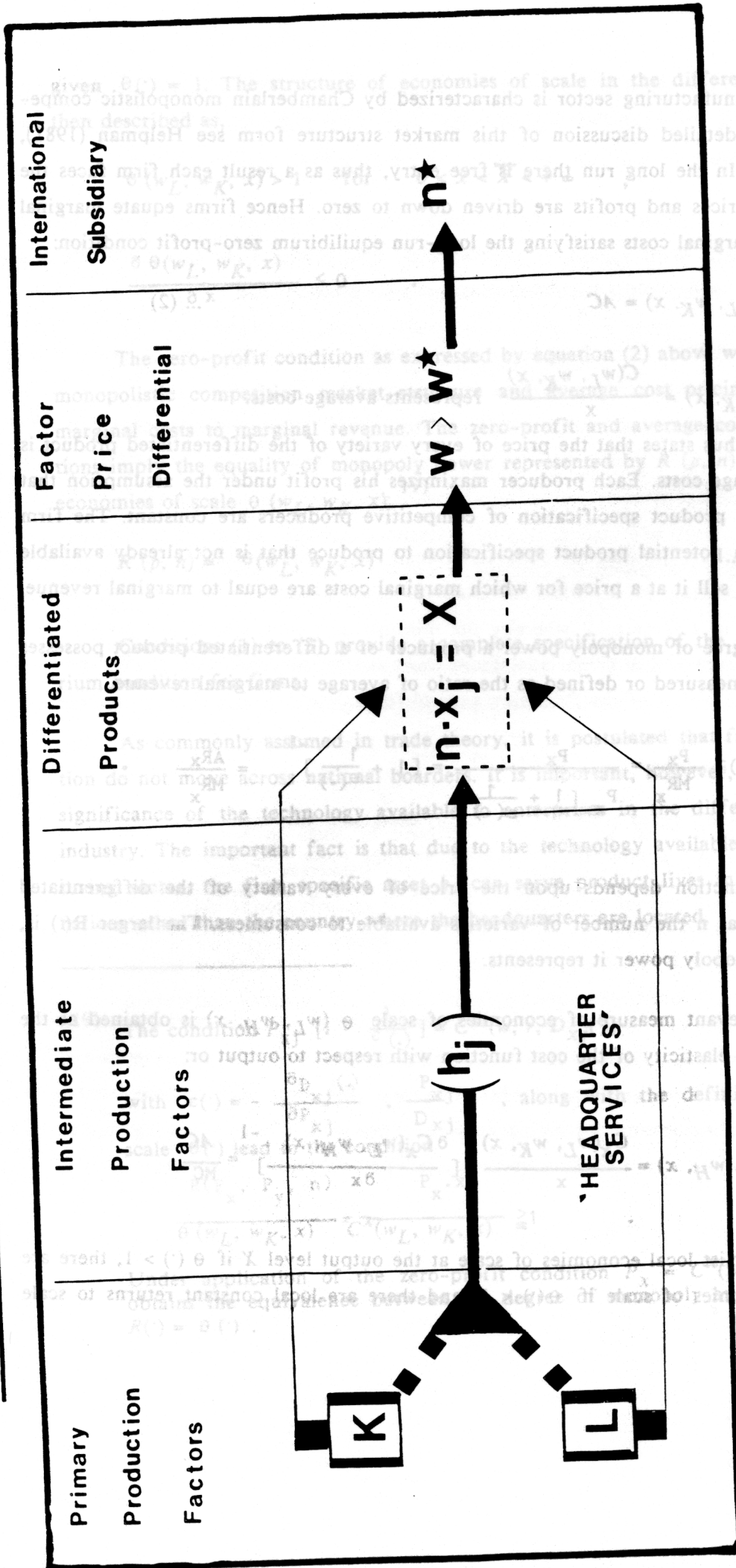$C^H(\cdot)$ is associated with a nondecreasing returns to scale production function.

The Total Cost Function for a firm's single-plant is then obtained as:

$$C(w_L, w_K, x) = \min_{h} [C^P(w_L, w_K, h) + C^H(w_L, w_K, h)].$$

The firm wishes to minimize its labour and capital costs along with its adaptation costs of the H factor [Compare Figure 1 below]. A multinational enterprise thus exhibits fixed costs which are corporation specific but not plant specific as a result of employing h and adapting it, it furthermore has plant-specific fixed costs, and plant-specific variable costs. The assumption that $C^P(\cdot)$ is associated with an increasing returns to scale production function implies that it pays to concentrate production in a single plant, unless there are transportation costs or differences across locations in product prices.[18] Finally, all firms possess the same cost structure and each firm produces only one variety.

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[18] Another important aspect although not dealt with here has been pointed out by Marschak (1986), p.1391. One may formulate schemes ("planning" mechanisms of various sorts), in which there is still a "center", which falls short of the unthinkable total centralization, but in which the center may yet receive more information about members' technologies and tastes than would be given by a classic sequence of utility- und profit-maximizing excess demands. The messages sent by the center, moreover, constrain members' actions more than prices alone constrain them in the classic scheme. The multinational enterprise may be interpreted as an institution capable of minimizing opportunistic behaviour of agents, as well as offering informational economies. As Furubotn (1987) has proposed, the advantages of pooling information in a collective group may make special sharing rules unnecessary.

FIGURE 1: The Structure Of Multinational Production

Primary Production Factors

Intermediate Production Factors

Differentiated Products

Factor Price Differential

International Subsidiary

$n \cdot x_j = X$

$n^\star$

$w > w^\star$

w, $w^\star$

h_j

'HEADQUARTER SERVICES'

K

L

SYMBOLS:

K = capital

L = labor

h_j = «headquarter services»

n, $n^\star$ = domestic/foreign subsidiary

x_j = output of product variant 'j'

X = total output

w, $w^\star$ = domestic/foreign wage rate

The manufacturing sector is characterized by Chamberlain monopolistic competition [for a detailed discussion of this market structure form see Helpman (1981), Hart (1985)]. In the long run there is free entry, thus as a result each firm faces the same factor prices and profits are driven down to zero. Hence firms equate marginal revenue to marginal costs satisfying the long-run equilibirum zero-profit condition:

$$p = c(w_L, w_K, x) = AC \qquad \qquad \dots (2)$$

$$c(w_L, w_K, x) = \frac{C(w_L, w_K, x)}{x} \qquad \text{represents average costs.}$$

Equation (2) thus states that the price of every variety of the differentiated product is equal to average costs. Each producer maximizes his profit under the assumption that the price and product specification of competitive producers are constant. The firm chooses which potential product specification to produce that is not already available and offers to sell it at a price for which marginal costs are equal to marginal revenue.

The degree of monopoly power a producer of a differentiated product possesses may now be measured or defined as the ratio of average to marginal revenue,

$$R(p, \bar{n}) \equiv \frac{P_x}{MR_x} = \frac{P_x}{P_x \left[1 + \frac{1}{\varepsilon(\cdot)}\right]} = \left[1 + \frac{1}{\varepsilon(\cdot)}\right]^{-1} = \frac{AR_x}{MR_x} \ .$$

This function depends upon the price of every variety of the differentiated good as well as n the number of varieties available to consumers. The larger R(·) is, the more monopoly power it represents.

The relevant measure of economies of scale $\theta(w_L, w_H, x)$ is obtained as the inverse of the elasticity of the cost function with respect to output or:

$$\theta(w_L, w_H, x) = \frac{C_x(w_L, w_K, x)}{x} \left[\frac{\partial C_x(w_L, w_H, x)}{\partial x}\right]^{-1} = \frac{AC}{MC}$$

There exist local economies of scale at the output level X if $\theta(\cdot) > 1$, there are local diseconomies of scale if $\theta(\cdot) < 1$, and there are local constant returns to scale

given $\theta(\cdot) = 1$. The structure of economies of scale in the differentiated sector is then described as,

$$\theta(w_L, w_K, x) > 1 \quad \text{for} \quad 0 < x < \overline{X} < +\infty \quad ,$$

$$\frac{\partial\,\theta(w_L, w_K, x)}{\partial x} < 0 \quad .$$

The zero-profit condition as expressed by equation (2) above was a result of the monopolistic competition market structure and average cost pricing. Firms equate marginal costs to marginal revenue. The zero-profit and average-cost pricing conditions imply the equality of monopoly power represented by $R(p, n)$ to the degree of economies of scale $\theta(w_L, w_K, x)$:[19]

$$R(p, \bar{n}) = \theta(w_L, w_K, x) \qquad \dots (3)$$

Conditions (1) to (3) provide a complete specification of the long-run equilibrium condition for firms.

As commonly assumed in trade theory, it is postulated that factors of production do not move across national boarders. It is important, however, here to grasp the significance of the technology available to enterprises in the differentiated product industry. The important fact is that due to the technology available in the manufacturing sector, the firm specific asset h can serve product lives in plants located in nations other than the country where the headquarters are located.

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19) The condition $P_{xj}\left[1 - \dfrac{1}{\varepsilon(\cdot)}\right] = C^{xi}(w, r, D_{xj}(\cdot))$

with $\varepsilon(\cdot) = -\dfrac{\partial D_{xj}(\cdot)}{\partial P_{xj}} \cdot \dfrac{P_{xj}}{D_{xj}}$, along with the definition of return to scale $\theta(\cdot)$ lead to the condition

$$\frac{R(P_x, P_y, n)}{\theta(w_L, w_K, x)} = \frac{P_x \cdot x}{C^x(w_L, w_K, x)} \gtreqless 1$$

Under application of the zero-profit condition $P_x = C^x(w_L, w_K, x)/x$ one obtains the equivalence between the degree of monopoly and returns to scale: $R(\cdot) = \theta(\cdot)$.

Furthermore, the specificity of h also implies that arm's length trade in head-quarter services is an inferior organizational form to a multinationally integrated firm [see Klein, Crawford, and Alchian (1978), Helpman (1984), Masten (1986)].

Due to the importance of the statements thus far made let us summarize briefly the main points. With regard to multinational enterprises, firm specific assets and product differentiation the following facts have been established:

(A)   In a first step firms generate and accumulate some firm specific asset which permits product differentiation (e.g. investment in product specific R & D expenditures). The production of the firm specific asset implies costs $C^H(w,r,h)$; whereby a firm wishes to find the minimal cost combination (w, r) for a given level of adapted h.

(B)   Furthermore, product specific costs exist. The cost function for the physical manufacturing of x_j units of some product variant j causes a cost in the amount of $C^p(w,r,x,h)$; whereby the minimal cost combination for given factor prices (w,r) and a given level from (x,h) is desired. The total production cost function is thus of the following general form:

$$C^p(w,r,x,h) = F + g(w,r,x,h) \quad .$$

F represents fixed costs and $g(w,r,x,h)$ designates the variable cost element. The cost function exemplifies decreasing average costs with respect to x (Average Costs $AC(\cdot)$ for C^p are decreasing in x; this is an indicator for increasing returns to scale since we know that $\theta(\cdot) \equiv \dfrac{AC(\cdot)}{MC(\cdot)} > 1$ implies increasing returns to scale).

The important characteristic of the model is that the production function $F(\cdot)$, which possesses a dual relationship to the respective cost function $C^p(\cdot)$, has the following properties: $F(L,K,h_j) = x_j \, \mathbb{\Psi}_j$ is a homogeneous production function exhibiting increasing returns to scale in (L_j, K_j). Furthermore, the input factor h_j is necessary and essential for production such that

$$F(L_j, K_j, 0) \equiv 0 \quad .$$

C)   Finally, in a last step the firm minimizes the total costs $C^H(\cdot)$ plus $C^p(\cdot)$ over h. The optimization problem of the firm is to minimize h "over all costs":

$$C(w,r,x) \equiv \min_{h}[C^p(\cdot) + C^H(\cdot)]$$

whereby $h > 0$.

The first-order condition for a cost minimum is obtained as $-C_h(\cdot) = C_h(\cdot) > 0$. The cost reduction given a marginal increase in h must be equal to the marginal costs of producing/adapting additional h.

Recapitulating, the starting point is some firm-specific asset h which is the basis of some degree of monopoly power. The asset h then permits the production of differentiated commodities and given factor price differences across international boarders induces the multinationalization of enterprises. The factor h is essential and necessary for product differentiation and product differentiation induces multinationalization.

Product differentiation does not necessarily imply that worldwide markets must always be serviced by foreign direct investment. Classifying differentiated products into three categories according to Caves (1971) the following conclusions may be reached:

1)   If economies of scale in production reduce the costs of a product and the product can be marketed without much adaptation to local market condition, a traditional export strategy will be implemented to service international markets.

2)   If the product does not enjoy economies of scale, or if the product involves a proprietary process, licensing of foreign firms may occur.

3)   However, if the firm's main competitive advantage is embodied in some firm specific asset (research, marketing, managerial expertise), rather than in any specific existing differentiated products, then international markets will be serviced by foreign direct investment.

2.1 Equilibrium In An Integrated World Economy

In order to examine the nature of trade under given factor endowments, especially e.g. in situations characterized by factor price equalization or non-equalization, it is helpful to study the case of a fully integrated world economy, i.e. one in which factors as well as goods are mobile [compare Dixit and Norman (1980), Chap. 4]. In an integrated world economy, factor prices are the same everywhere, and all the firms operating in the sector producing differentiated products have the same structure. Each firm produces one variety, employing the same quantity of capital and labour. They charge the same price for every variety and produce the same final output and the same quantity of appropriate headquarter services. Free entry into the industry brings profits down to zero.

In the previous Section the conditions of an industry equilibrium were derived. It remains to derive the equilibrium conditions in the markets for goods and production factors. It is then possible to identify patterns of cross-country distributions for the world's allocation of labour and capital, as well as the intermediate H factor, which allow one to predict trade patterns for a fixed-size world economy.

The equilibrium conditions for the factor markets are obtained as:

$$a_{LY}(w_L, w_K)\, \overline{Y} + a_{Lx}(w_L, w_K, x)\, \overline{X} = \overline{L} \qquad \text{...(4)}$$

$$a_{KY}(w_L, w_K)\, \overline{Y} + a_{Kx}(w_L, w_K, x)\, \overline{X} = \overline{K} \qquad \text{...(5)}$$

Equations (4) and (5) express simply the clearing conditions in labour and capital markets, respectively. The coefficients $a_{JY}(\cdot)$, $J = L, K$, are the cost minimizing input-output ratios in the food industry and they are derived from its cost function as follows:

$$a_{LY}(w_L, w_K) = \frac{\partial c_y(w_L, w_K)}{\partial w_L}\ ,$$

$$a_{KY}(w_L, w_K) = \frac{\partial c_y(w_L, w_K)}{\partial w_K}\ .$$

Accordingly, the conditional factor demand of a firm in Sector x is obtained as the first derivative of the cost function with regard to the respective factor price:

$$a_{lx}(w_L, w_K, x) = \quad a_{lx}(w_L, w_K, x) = \frac{\partial c(w_L, w_K, x)}{\partial w_1} \quad , \quad 1 = L, K \quad .$$

$\bar{L}$ and $\bar{K}$ are the quantities of labour and capital available in the world economy. $\bar{Y}$ is the output of food and $\bar{X}$ is the output of manufactures defined as:

$$\bar{X} = \bar{n} \, x \qquad \qquad \dots (6)$$

The left-hand side of equation (4) presents the aggregate demand for labour, consisting of labour demanded by the homogeneous good sector and of labour demanded by the $\bar{n}$ firms in the differentiated goods sector. In equilibrium, this is equal to the given supply of labour. Equation (5) may be interpreted similarly as the equilibrium condition of the capital market. Equation (6) is simply a definition.

The equilibrium condition for the commodity markets depends upon the specification of consumer preferences. However, it may be implied that the equilibrium condition in the commodity markets is fulfilled, since no use of consumer preferences is made explicitly in what follows. Due to the Walras Law it suffices to state the market clearing condition of the homogeneous sector

$$\alpha_Y(p, \bar{n}) \cdot (\bar{Y} + p\bar{X}) = \bar{Y} \quad , \qquad \text{or rearranging terms:}$$

$$\alpha_Y(p, \bar{n}) = \frac{\bar{Y}}{(\bar{Y} + p\bar{X})} \qquad \qquad \dots (7)$$

where $\alpha_Y(\cdot)$ is the share of spending allocated to food, $(\bar{Y} + p\bar{X})$ is the world's gross domestic product (both together thus represent total demand), and $\bar{Y}$ is the world supply of Y.

Conditions (1) to (7) represent the equilibrium conditions of the integrated economy.

For the following analysis the assumption is made that the food sector is relatively labour intensive,

$$\frac{a_{Kx}}{a_{Lx}} > \frac{a_{KY}}{a_{LY}}$$

3. Multinational Enterprises And Trade Patterns

Examining an integrated two country world economy with its fixed amount of resource endowment $(\overline{L}, \overline{K})$, trade patterns may be related to differences in factor endowments. Two major features are important for the derived trade patterns: relative country size and differences in relative factor endowments. This section examines and identifies the relationships between these features and the economic rationale for the emergence of multinational enterprises, the intersectoral pattern of trade, the intra-industry pattern of trade, and the intra-firm pattern of trade.

The Heckscher-Ohlin theorem asserts that with factor intensity regularity and incomplete specialization it is efficient for countries to export those commodities in which its most abundant factor is used relatively intensively and to import those commodities which require for production those factors with which it is least endowed. A corollary to the Heckscher-Ohlin theorem is the factor-price equalization theorem which asserts that free international trade will equalize relative commodity prices which in turn will equalize relative factor prices in both countries. Trade in commodities is a perfect substitute for factor movements: given that trade equalizes factor prices, there exist at first glance no further welfare gains available from factors being mobile.

Multinational enterprises represent an internal market in which the economic rationale for this organizational form is to be seen in the private gain from internalization stemming largely from the appropriation of an increase in social welfare due to the avoidance of external market imperfections.

Assuming that the production of the homogeneous product, food, is relatively labour intensive, the equilibrium distribution of factor employment across sectors may be demonstrated by introducing a factor allocation box [see Dixit/Norman, (Chap.4), Helpman (1984)]. As mentioned, the world economy possesses two basic factors of

production, *L* and *K*. These endowments are fixed through the analysis and may be represented by the sides of a box as illustrated in Figure 2 below.

Figure 2:
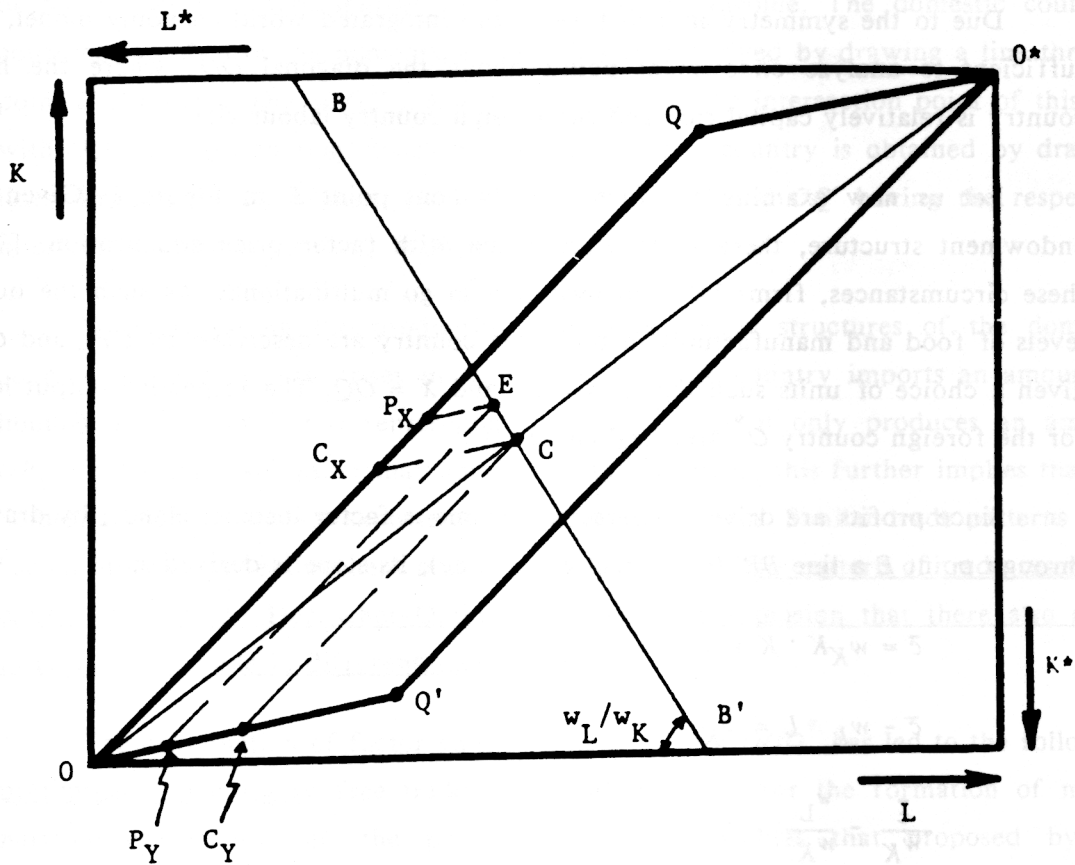
The vector OO^* denotes the world's total endowment of factors of production. The vector OQ describes factor employment in the manufacturing sector for country O and OQ' describes employment in the production of food. The factor price equalization set is obtained as OQO^*O' (see Dixit and Norman, Chap. 4). Any subset in the box outside of this set is characterized by the fact that each country offers a

lower reward to that factor of production it possesses in abundance and a higher reward to the scarce factor of production.

Without explicit examination of the effects of multinational enterprises, the pattern of trade that emerges in both sets will be that as predicted by the Heckscher-Ohlin theorem.

Due to the symmetry in structure of the integrated world economy model, it is sufficient to analyze endowment points above the diagonal OO^* where the home country is relatively capital rich and the foreign country labour rich.

Let us now examine the factor endowment point E in Figure 1. Given this endowment structure, there is an equilibrium with factor price equalization. Under these circumstances, firms have no incentive to go multinational. As such the output levels of food and manufactures in the home country are described by OP_y and OP_x, given a choice of units such that $Y = OQ'$ and $X = OQ$. The respective output levels for the foreign country O^* are P_yQ' and P_xQ.

Since profits are driven to zero, all income is factor income. Hence, by drawing through point E a line BB' (equal factor cost line), its slope is derived as

$$\bar{c} = w_K K \cdot K + w_L \cdot L$$

$$\bar{c} - w_L \cdot L = w_K \cdot K \quad,$$

$$\frac{\bar{c}}{w_K} - \frac{w_L}{w_K} \cdot L = K \quad,$$

$$\frac{dK}{dL}\bigg|_{\bar{c}} = -\frac{w_L}{w_K}$$

The distribution of factor endowment between the domestic and foreign country are fixed in point E. Relative factor prices are determined by the slope of BB'. Defining a country's command over a factor as the quantity of the factor used indirectly to satisfy consumer wants in that country, the locus BB' represents a specific allocation of factors for satisfying consumer wants in each country in accord with each country's income from factor ownership. However, only one point on the

locus BB' is consistent with the world's joint consumption restriction, whereby the same proportion of both factors must be allocated to servicing consumption in each country. Potential consumption strategies are thus restricted to the diagonal OO^* at point C. The relative income of the domestic country is derived as OC/CO^*, or by a proper choice of units simply OC and respectively CO^*. Both countries exhibit similar spending patterns, i.e. the domestic country purchases a proportion s^1 of the world's output Y, with s^1 representing its share in world income. The domestic countries consumption level of the homogeneous good is thus derived by drawing a line through point C parallel to OQ as OC_y, where C_y designates the intersection point of this line with OQ'. The production structure for the domestic country is obtained by drawing lines through the endowment point E parallel to OQ and OQ' having the respective intersection points p_x and p_y in Figure 1.

Now composing the production and consumption structures of the domestic country, a trade pattern arises in which the domestic country imports an amount of homogeneous good (food) represented by P_yC_y, since it only produces an amount OP_y. Under the assumption that trade is always balanced, this further implies that the domestic country is a net exporter of differentiated goods. Similar trade patterns arise for all other factor endowment points in the set OQO^*. The pattern of trade resembles closely that of the Heckscher-Ohlin model with the extension that there also exists intra-industry trade in differentiated goods.

The examination of factor endowments in the set OQO^* has led to the following preliminary conclusions: free trade causes no incentive for the formation of multi-national enterprises and the pattern of trade resembles that proposed by the Heckscher-Ohlin theorem in which intersectoral patterns of trade are due to differences in relative factor endowments with the extension that intra-industry trade is caused by monopolistic competition in differentiated products.

Now let us consider a factor endowment point above the interior of the set OQO^*.

Such endowment points are characterized by unequal factor prices given that firms are restricted to domestic production. Assuming that capital is cheaper domestically and labour is cheaper abroad, what effects will these circumstances have upon the decision making process of a firm given the restriction that all inputs must be inputed domestically is no longer valid?
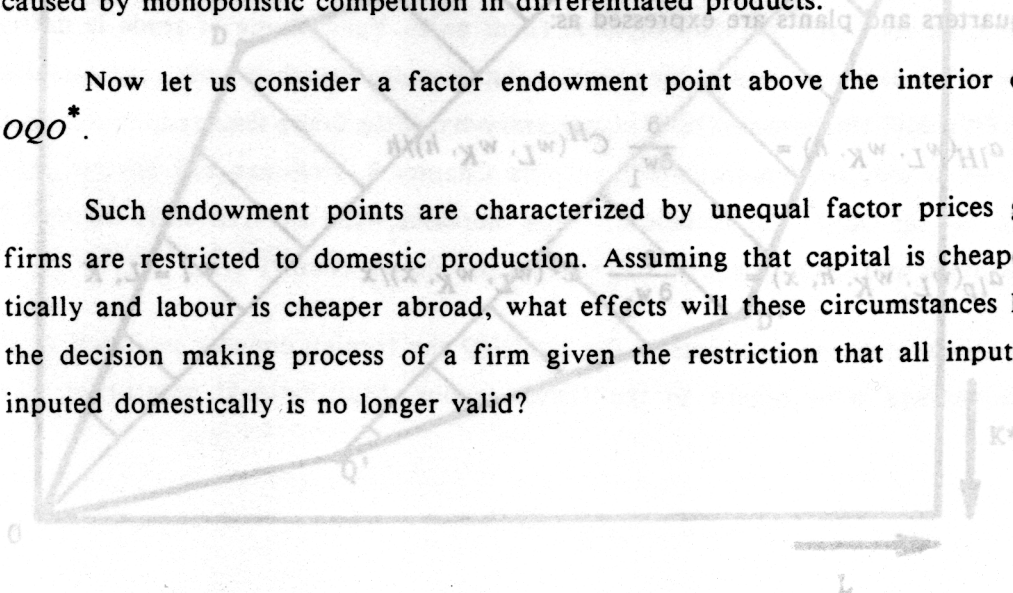
Under this scenario, there exists an incentive for firms to go international. In particular, headquarter services will be located in the domestic (parent) country and production subsidiaries opened in the foreign country. These moves would reduce the demand for labour in the home country and increase it in the foreign country, while increasing the demand for capital in the home country and decreasing it in the foreign country. An equilibrium would be attained either when factor prices are equalized or the home country became the parent of all enterprises (with unequal factor prices all headquarters will be located in the capital cheap country).

Recall that h was chosen so as to minimize overall costs. The first-order condition of this cost minimization problem is derived as:

$$c(w_L, w_K, x) = \min_h [C^P(w_L, w_K, h, x) + C^H(w_L, w_K, h)]$$

$$\frac{\partial c(w_L, w_K, x)}{\partial h} = C^P_h(w_L, w_K, h, x) + C^H_h(w_L, w_K, h) = 0$$

or rearranging,

$$-C^P_h(w_L, w_K, h, x) = C^H_h(w_L, w_K, h)$$

Given the values of factor rewards and output per firm in the integrated equilibrium, this condition which states that the cost savings from such an expansion must be equal to the cost of marginal expansion of headquarter activities, determines the equilibrium level of headquarter activity h.

Applying the equilibrium value of h, employment levels per unit output at headquarters and plants are expressed as:

$$a_{lH}(w_L, w_K, h) = \frac{\partial}{\partial w_1} C^H(w_L, w_K, h)/h$$

$$a_{lP}(w_L, w_K, h, x) = \frac{\partial}{\partial w_1} C^P(w_L, w_K, x)/x \qquad \forall \; l = L, K$$

The relationship between these input-output ratios and the a_{li}'s used in Equation (4) and (5) above is:

$$a_{lx}(w_L, w_K, x) = a_{lp}(w_L, w_K, h, x) + a_{lH}(w_L, w_K, h)\frac{h}{x} \quad \text{for all } l = L, K.$$

The headquarter and plant input-output ratios can be used to reformulate the factor market-clearing conditions illustrative of the underlying different nature of an enterprise's activity, with $H = \bar{n}h$.

$$a_{LY}(w_L, w_K)\bar{Y} + a_{Lp}(w_L, w_K, h, x)\bar{X} + a_{LH}(w_L, w_K, h)\bar{H} = \bar{L} \qquad ...(4')$$

$$a_{KY}(w_L, w_K)\bar{Y} + a_{Kp}(w_L, w_K, h, x)\bar{X} + a_{KH}(w_L, w_K, h)\bar{H} = \bar{K} \qquad ...(5')$$

Thus, there are three outputs basically food Y, differentiated products X, and headquarter services H. This may be graphically illustrated in the factor box presented below in Figure 3.

Figure 3: The Existence of Multinational Enterprises
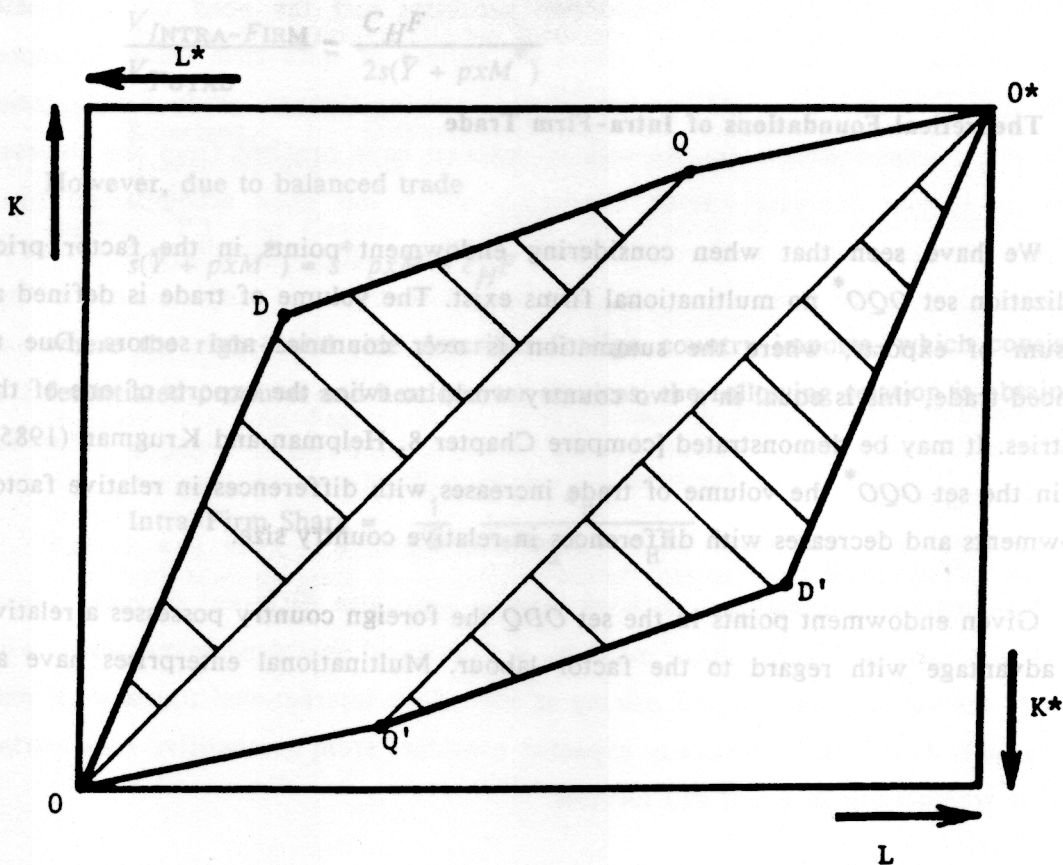
The respective domestic employment vector in the differentiated products sector OQ is now decomposed into headquarter employment OD and plant employment DQ.

It is now postulated that headquarter activities are the most capital intensive, that plant activities in the manufacturing sector are of intermediate capital intensity, and that food production is the least capital intensive.

If international transactions in markets were possible in Y, X and H then $ODQO^*D'Q'$ would represent the factor price equalization set. However, since H services are specialized (firm specific assets) and each firm supplies its own requirements, they are not traded at arm's length. Thus, factor endowment points within the shaded areas of Figure 3 are consistent with factor price equalization only when firms go multinational. In the set OQO^*Q' there exists factor price equalization with national firms.

Multinational enterprises develop therefore whenever the endowment allocation lies outside the parallelogram OQO^*Q', and they enforce factor price equalization tendencies in the shaded areas of Figure 3. It should perhaps be explicitly stated hare that the international mobility of capital and technology creates only a *tendency* toward factor price equalization. As Dollar (1986, p. 188) has pointed out, if innovation arises in the industrial countries strict equalization of factor prices will never occur.

4. Theoretical Foundations of Intra-Firm Trade

We have seen that when considering endowment points in the factor price equalization set OQO^* no multinational firms exist. The volume of trade is defined as the sum of exports, where the summation is over countries and sectors. Due to balanced trade, this is equal in a two country world to twice the exports of one of the countries. It may be demonstrated [compare Chapter 8, Helpman and Krugman (1985)] that in the set OQO^* the volume of trade increases with differences in relative factor endowments and decreases with differences in relative country size.

Given endowment points in the set ODQ the foreign country possesses a relative cost advantage with regard to the factor labour. Multinational enterprises have an
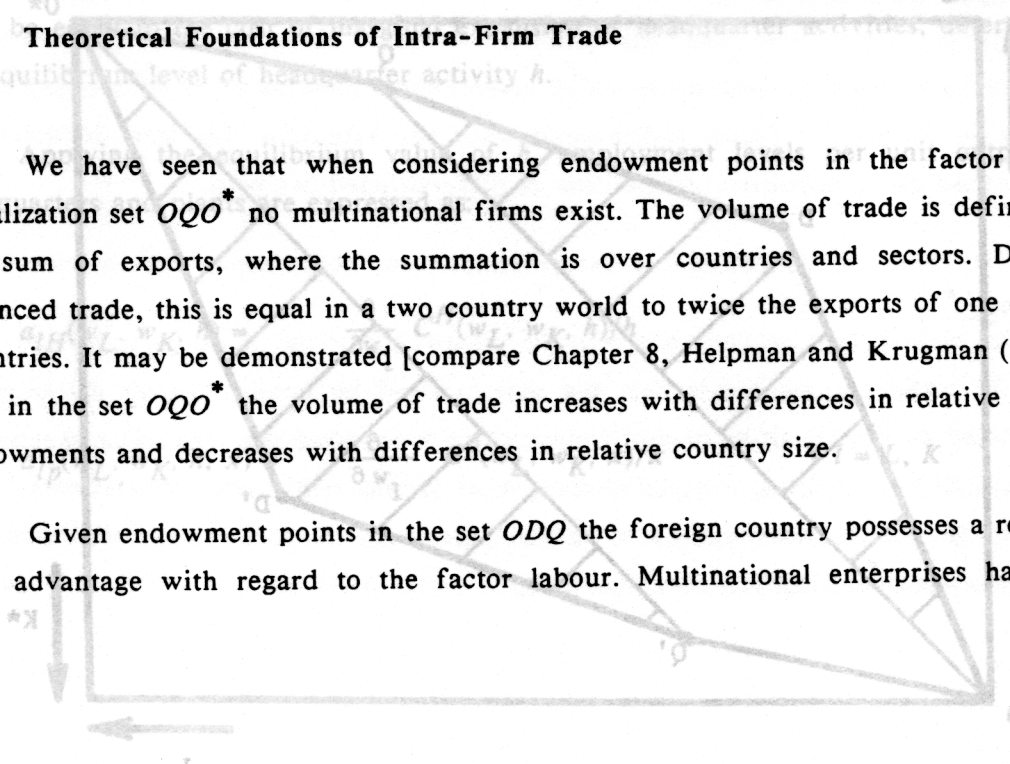
incentive to employ in their foreign production subsidiaries foreign labour (L^f) and foreign capital (K^f). The products manufactured in the foreign location are then sold, and the difference between the sales profits and the resulting foreign costs are commonly transferred back to the parent [see Broll and Gilroy (1986b)]. The profits arising from this type of transaction may be interpreted as the 'appropriated rent' for usage of the firm-specific asset (technical knowledge, management and marketing skills, product design, etc.).

The effect of such transactions upon trade flows may be illustrated as follows. Intra-firm trade is defined as trade in headquarter services (or as the difference between revenue and the resulting costs of a foreign subsidiary):

$$V_{INTRA-FIRM} = pxF - w_L L^f - w_K K^f = C_H F$$

C_H represents the necessary inputs of resources to accumulate the specific asset $C_H = (w_L \, a_{LH} + w_K \, a_{KH})h$; M is the number of domestic multinational enterprises. The positive difference between the revenue and costs of foreign subsidiary production may be interpreted as an 'appropability rent'.

The volume of trade is defined as the sum of exports, e.g. $V = 2s(Y^* + pxM^*)$, so that the share of intra-firm trade is derived as

$$\frac{V_{INTRA-FIRM}}{V_{TOTAL}} = \frac{C_H F}{2s(\bar{Y} + pxM^*)}$$

However, due to balanced trade

$$s(\bar{Y} + pxM^*) = s^* pxM + c_H F$$

where the right-hand side describes foreign country imports, which consist of differentiated products and headquarter services, the following relation is obtained:

$$\text{Intra-Firm Share} = \frac{1}{2} \frac{c_H F}{s^* p_x M + c_H F}$$

Thus, for constant international income distributions (s^*), an increase in the relative factor endowments will increase the number of multinational enterprises. The domestically manufactured product variants in the x sector, however, decline. Intra-firm trade is positively correlated with differences in factor endowments, hence larger differences in factor composition are associated with larger shares of intra-firm trade.

5. Conclusions

During the post-war period, the volume of total world trade has been rising rapidly. A pattern of world trade dominated by flows of manufactured goods between developed countries has arisen. Furthermore, the exchange of imports and exports among the developed countries has been through intra-industry trade in differentiated products. The rapid increase in the volume of trade has been affected by various factors. Firstly, the sustained growth of output and incomes of the developed countries has also promoted differentiated preferences on the demand side internationally. Secondly, multilateral tariff reductions achieved through GATT had a large liberalising effect [Knies and Gilroy (1987)]. Thirdly, and most importantly, the rising share of manufacturing in total world trade coincides with the rapid growth of multinational enterprises and the intra-firm trade they conduct. Very few studies have analyzed explicitly the determinants of intra-firm trade. Lall (1978) was however able to establish empirically such factors as technological intensity, the extent of foreign investment, the 'divisibility' of production processes and the need for after-sales services as significant factors which affect the pattern of intra-firm trade. Entrepreneurial strategies which focus on obtaining and securing through product differentiation strong market segments in international markets have profited from the observed per-capita income increase among consumers which has been accompanied by a stronger diversification of preferences. Firms which are internationally active have an additional chance of reacting (with relatively low costs of adjustment) to this diversification of preferences, since embodied factors, so-called *firm specific assets* such as management, marketing skills and technological know-how may be used to service production plants in countries other than the country in which these inputs are employed originally.

Non-market international decision-making generates different outcomes from those of the market. The decisions made by multinational enterprise management with regard to the volume, pattern and pricing of intra-firm international transactions may differ greatly from the theoretically expected outcomes from competitive spot market exchange transactions in goods and services.

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