Scale Economies And Export Advantage: A Theoretical Model

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CERTIFICATE

This is to certify that the dissertation entitled "SCALE ECONOMIES AND EXPORT ADVANTAGE : A THEORETICAL MODEL" submitted by Ms. W.V. Sita Ramani in fulfilment of six credits out of total requirement of 24 credits for the Degree of Master of Philosophy (M. Phil) of the Jawaharlal Nehru University, is her work according to the best of my knowledge and may be placed before the examiners for evaluation.

SUPERVISOR

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CHAPTER I

SCALE ECONOMIES, MARKET ACCESS AND PATTERNS OF TRADE

To explain the pattern of trade, the Heckshser - Ohlin theory proposes that a country (in a simple 2x2x2 case) will export the commodity which intensively uses its abundant factor. According to this theory, the trade pattern is dictated by relative factor endowments. The basic assumptions underlying this theory are: constant returns to scale, internationally identical production functions, perfect competition and zero transport costs.

Apart from the natural skepticism about the underlying assumptions, the blow to the theory came from Leontief's[1] emperical finding that U.S exports were more labour-intensive than its import substitutes, referred to in the literature as the "Leontief Paradox". Also more importantly, the inability of the theory to explain the actual pattern of International Trade led to a search for other explanations of the pattern of trade. Much of the World Trade happens to be in similar products and between similar countries. Among the alternative explanations are the Availability Hypothesis (Kravis, 1956); Preference Similarity Approach (Linder, 1961); Technology Gap Model (Posner, 1961); Product Cycle Approach (Vernon, 1966) etc. A brief look at these is indicative of the factors which were regarded as important in determining the pattern of trade.

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1. W.Leontief, "Domestic Production and Foreign Trade : The American Capital Position Re-examined", Proceedings of the American Philosophical Society, Vol.97, No.4, (Sept. 28, 1953), pp 332-349.

Availability Hypothesis

According to Kravis (1956), the commodity composition of trade is dictated primarily by 'availability': trade being confined to goods which are "not available at home". Nonavailability could be due to lack of natural resources or technical progress which confers a temporary monopoly advantage on the innovating country.

Linder's Hypothesis

Linder' (1961) rejects the factor proportions explanation for trade in manufactured products. According to Linder, each country has a range of potential exports which is determined by internal demand. He says "It is a necessary, but not a sufficient condition that a product be consumed (or invested) in the home country for this product to be a potential export product".[2] What is necessary for a good to be a potential export product is "representative demand". International trade is viewed as an extension of domestic economic activity. By producing goods demanded at home, the producers can attain relatively most advantageous production functions. Hence, a country will tend to produce and export those products for which it has a relatively large domestic market.

Linder proposes that, "The more similar the demand structures of two countries, the more intensive, potentially, is the trade between these two

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2. S.B. Linder, Essay on Trade and Transformation, Almqvist and Wicksell, Stockholm, 1961, pp 87.

countries".[3] If similarity of per capita income is used as an index of similarity of demand structures, the hypothesis suggests that trade will be most intensive, potentially between countries at similar levels of per capita income. Linder points out that tradeing braking factors like what he calls 'distance factor', transport cost and man-made trade obstacles may make actual trade smaller than potential trade. What is stressed is that demand structures are an important determinant of the pattern of actual trade in manufacturers.

Technology Gap Model

Posner (1961) suggests that trade may be caused by technical change. An innovation may take place in one country, 'comparative cost factors' may lead to exports of the concerned product's from the innovating country during the lapse of time taken by the Rest of the World to imitate the innovation. The "imitation lag" has three components: foreign reaction lag, domestic reaction lag and a learning period. The seperation of national markets gives rise to a demand lag: it is necessary that the new foreign goods be regarded as perfect substitutes for some home produced goods for trade to originate in these goods. Thus, the imitation lag and demand lag together determine whether or not and also the length of time for which trade will take place.

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3. Ibid. Linder.

Product Cycle Model

Vernon (1966) traces the product cycle or cylce in the life of a new product. He points out, although one may assume an equal access to scientific knowledge in all developed countries, the embodiment of this knowledge in new products is a function of geographical proximity to the market. In the early stages of a new product, input requirements and processing are quite unstandardized. Price elasticity of demand is low and focus is more on product characteristics rather than on cost conditions. In this stage, proximity to the market is a crucial factor becuse of the need to modify and adapt the product to user's requirements. With an expansion in the demand for the product, a certain degree of standardization takes place. Concern shifts to cost factors and there is likely to be a change in the location of production facilities. As demand for the product appears in other countries, this product may be exported to these countries. Beyond a point, it may be more advtangeous to set up production facilities abroad to service these markets. If it is assumed that scale economies are fully exploited, the labour cost advantage of new locations may lead to servicing of even third markets besides the local ones, from these locations. It is quite possible that labour cost advantage of the new location swamps transport cost and the product is actually imported into the country of origin. Once the product is 'standardised', the location of its production may shift to Less Developed Countries.

These explanations focus on factors like domestic market, technical progress etc. in trying to explain the pattern of trade. Linder's[4] seminal contribution brings out the importance of the domestic market. A large domestic market for a product is often regarded as an advantage for its export. Corden(1970) points out that in a simple static two product, two country model with economies of scale, differing demand patterns and zero transport cost, it does not follow that the country will export the product to which its demand pattern is biased. One has to bring in either learning effects or transport costs for the hypothesis to go through. The basic idea is that a large domestic market for a product enables the producer to reap economies of scale without incurring high distribution costs or exposing a large part of his output to risk and uncertainity about the trade policies of other countries. A producer in a small market, in order to reap economies of scale, has to depend in a large way on exports and incur distribution costs.

Dreze[5] advanced the hypothesis that small countries will have comparative advantage in internationally standardised products subject to economies of scale. He was examining the trade pattern of Belgium. Only large countries, if production is subject to economies of scale, can produce efficiently products having national characteristics that distinguish them from foreign products.

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4. Ibid, pp 82-109

5. J. Dreze, "Quelques reflexions sereines sur l'adaptation de l'industrie belge an March'e Commun", Complete rendus Travaux de la Societe Royale d' Economie Politique de Belgique, No.275, December 1960.

II

Guha (1981) examines the problems of industrialization in densely populated backward economies due to the weakness of the home market. He assumes the functioning of a free market, constrained only by the international immobility of labour.

Guha draws attention to the disparity between the predictions of the simple two-factor neoclassical model and the reality of factor prices in this class of capital poor economies. The simple 2x2 model[6] predicts that trade between a capital-abundant and a labour-abundant economy will equalize factor prices if their factor endowments happen to lie within the same 'equalization zone'. Otherwise, the model predicts, trade will leave the labour-abundant country with lower wages and a higher return on capital. While wages are lower in this group of economies, there is no evidence that return on capital is higher. The answer to this puzzle, according to Guha, lies in giving up the neoclassical assumptions of zero transport cost and constant returns to scale.

In this group of economies, industrial investment incentives are limited by the domestic market. In manufacturing, given the production function, there are two determinants of cost: factor prices and scale of production. While manufacturers in a densely populated poor economy have an advantage in the form of low wage costs, they are faced with the

6. 2x2 implying a 2 factor, 2 country model.

disadvantage of a small domestic market. They cannot enjoy economies of scale without incurring huge distribution costs. Guha points out that both volume and elasticity of domestic demand affect the rate of profit and hence investment incentives in manufacturing industry. Three classes of reasons may be adduced for the small size of the market for manufactured goods: a) the total income of a poor country is small, b) its per capita income is low implying that the proportion of total income spent on manufacturers is small, c) an unequal distribution of income. In such economies the poor can barely afford basic necessities, while the rich are numerically too few to constitute a significant market for any manufactured good. In the absence of a notable middle class, the market for each manufacture is not only narrow but also inelastic.

Guha notes that the above set of characterstics would have two implications. In the first place, in industries where economies of scale are substantial, local manufacturers are unable to compete with their rivals based on large markets of developed countries. Secondly, even if production were to begin under the umbrella of protection, the number of producers in each industry will be small.

All this adds up to a general picture of demand constraints on industrialization and of limited comparative advantage in manufacturing. However, there are exceptions to this general picture.

Poor counties with an easy access to the large markets of developed countries are in an advantageous position to overcome the constraints imposed by the smallness of the domestic market.

The object of this dessertation is to show how economies of scale and cost of market access interact to account for export success[7]. Market access cost includes not only transport cost but also tariffs and quotas, information costs etc. Economies of scale and differential cost of market access can together link up a lot of phenomena. As noted in the last paragraph, poor countries with easy access to developed markets can overcome the limitations imposed by the smallness of the domestic market. It may be possible to attribute, in part, the spectacular export performance of Asia's Super Exporters (Republic of Korea, Taiwan, Singapore, Hongkong), to the rapid expansion of markets in Japan and West Coast of USA in the sixties and seventies. Easy access to such rich markets, besides other factors, enabled these countries to initiate rapid economic development propelled by exports. Similarly, Turkey and West coast of India have benefitted from easy access to the Middle-East. This suggests a certain correlation between location and export success. What is being proposed is that easy access to developed market/s enables the country concerned to reap economies of scale and increase its penetration in all other markets too.

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7. Export success is interpreted as success in penetrating foreign markets.

One of the ways in which the various determinants of a country's export performance can be identified is by applying the Constant Market Share (CMS) analysis[8]. In this, a country's export growth is decomposed into a commodity composition effect, a market-distribution effect and a competitiveness effect. The CMS analysis starts with the assumption that a country's share in world markets should remain unchanged over time. The difference between the actual export growth and growth implied by the CMS norm is attributed to competitiveness. The CMS approach, for reasons to be outlined below, is not satisfactory for our purpose, i.e. in trying to capture the effect of easy market access. A brief look at the decomposition analysis and some empirical results based on this model throws further light on the issue. The symbols used in the decomposition are as follows[9]:

$V_{i.}$ = Value of A's exports of commodity i in Period 1.

$V'_{i.}$ = Value of A's exports of commodity i in Period 2.

$V_{.j}$ = Value of A's exports of country j in Period 1.

$V'_{.j}$ = Value of A's exports to country j in Period 2.

V_{ij} = Value of A's exports of commodity i to country j in Period 1.

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8. Approach was first applied to export growth by Tyszynski (1951).

9. E.E. Leamer and R.M. Stern, Quantitative International Economics; Ch.7, pp 172-175.

r = Percentage increase in total world exports from Period 1 to Period 2.

r_i = Percentage increase in total world exports of commodity i from Period 1 to Period 2.

r_{ij} = Percentage increase in world exports of commodity i to country j from Period 1 to Period 2.

The expression is

$$V'_{..} - V_{..} = \underset{(1)}{rV_{..}} + \underset{(2)}{\sum_i (r_i - r)V_{i.}} + \underset{(3)}{\sum_i \sum_j (r_{ij} - r_i)V_{ij}}$$

$$+ \underset{(4)}{\sum_i \sum_j (V'_{ij} - V_{ij} - r_{ij} V_{ij})} \qquad (1)$$

Where $V_{..} = \sum_i \sum_j V_{ij}$ = Value of Country A's exports in Period 1

$V'_{..} = \sum_i \sum_j V'_{ij}$ = Value of Country A's exports in Period 2

In Identity (1) the increase in A's exports is broken down into parts attributed to[10]:

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10. Ibid, pp 174.

1) the general rise in world exports;

2) the commodity composition of A's exports;

3) the market distribution of A's exports;

4) a residual reflecting the difference between the actual export growth and the growth that would have occured if A had maintained its share of the exports of each commodity to each country.

The commodity composition effect $\sum_i (r_i - r) V_{i.}$ would be positive if A had concentrated on the export of commodities whose markets were growing relatively fast. The market distribution is meant to capture the effect of having easy access to rapidly growing regions. Country A's concentration on relatively fast growing markets would be reflected in a positive market distribution term. The interpretation of the residual is not as straight forward as other terms. A negative residual reflects a failure to maintain market shares.

It is interesting to look at some empirical results. These are from a study by Parik[11]. The analysis is carried out for 13 ESCAP countries and areas. An approach based on CMS is used to identify and account for changes in the trade patterns during the period 1965-1980. The study uses an average of three years data for both base and terminal period. The three years 1965-67 have been used as the base period and 1978-1980 for the terminal period. For Pakistan, the base year figures refer to 1972, because the data for 1965-1967 includes Bangladesh, while for the terminal year

11. A. Parik, The Estimation and Forecasting of Trade Shares, ESCAP, Bangkok, 1986, Ch 2, Section 2.4

they exclude Bangladesh. The analysis is in constant prices. Table 1 gives the results of the decomposition analysis.

The results are briefly outlined as follows: For almost all the countries, except the Asian least developed countries, the contribution of market distribution was positive. For China, Hongkong, Indonesia, Malaysia, the Phillipines, the Republic of Korea, Singapore, Taiwan Province and Thailand, the contribution of market distribution to total change is less than 50%. The price competitivenss residual is very high in a positive sense for Indonesia, the Republic of Korea, Taiwan Province, Thailand and small Asian least developed countries. The contribution of various components can be ranked using ordinal analysis. For Indonesia, Republic of Korea and Taiwan price competitiveness can be given the highest rank. For Hongkong, the increase due to world trade gets the highest rank, market distribution next, commodity composition third and the residual last.

The market distribution term, however, may not fully capture the effect of easy access to rapidly growing markets. Only part of the effect is reflected in the market distribution term, remainder being captured by the residual competitivenss term. If we bring in economies of scale either in static or dynamic form, an easy access to a rapidly growing market would be translated into higher market shares or increased penetration in other markets. The latter being a departure from the CMS norm would be reflected

TABLE - I : CONSTANT MARKET SHARE ANALYSIS OF CHANGES IN EXPORTS BY COUNTRIES OVER THE PERIOD 1965 - 1980

(millions of U.S dollars at constant prices)

Changes in exports due to	Indonesia	Taiwan Province	Hong Kong	India	Republic of Korea	Malaysia	Pakistan*	Philippines	Singapore	Thailand	Asian least developed countries	Other Asia	China
Increase due to World trade	3096.1 (44.14) [2]	1867.9 (18.06) [2]	2900.3 (49.62) [1]	3590.6 (154.16) [1]	646.4 (7.1) [2]	2939.0 (73.06) [1]	1453.5 (394.54) [1]	2671.2 (203.15) [1]	3490.5 (150.83) [1]	1666.4 (58.81) [1]	279.4 (44.96) [2]	2136.7 (104.89) [1]	4051.0 (67.83) [1]
Market distribution	1068.9 (22.94) [3]	1150.6 (11.12) [3]	1466.6 (25.09) [2]	1508.2 (64.76) [2]	148.5 (1.63) [3]	1121.9 (27.89) [2]	1261.6 (342.45) [2]	617.2 (46.94) [2]	2693.7 (39.23) [2]	16.6 (0.59) [3]	-24.0 (-3.86) [3]	414.8 (20.36) [2]	1986.0 (33.25) [2]
Commodity composition	-1242.9 (-17.72) [4]	-150.9 (-1.46) [4]	1008.8 (17.26) [3]	86.6 (3.72) [3]	29.4 (0.32) [4]	-739.8 (-18.39) [4]	115.3 (31.29) [3]	-898.2 (-68.31) [3]	-718.8 (-10.47) [4]	-427.1 (-15.07) [4]	-70.9 (-11.4) [4]	-727.1 (-35.69) [4]	-299.8 (-5.02) [4]
Price competitiveness	3552.6 (50.65) [1]	7475.5 (72.28) [1]	469.8 (8.04) [4]	-2856.3 (-122.64) [4]	8276.8 (90.94) [1]	701.2 (17.43) [3]	-2462.0 (-668.29) [4]	-1075.3 (-81.78) [4]	1401.1 (20.41) [3]	1577.5 (55.68) [2]	436.9 (70.31) [1]	212.5 (10.43) [3]	235.2 (3.94) [3]
Changes in exports between 1965-67 to 1978-80.	7014.7	10343.1	5845.5	2329.1	9101.1	4022.3	368.4	1314.9	6866.5	2833.4	621.4	2036.9	5972.4

Note :
() contributions in percentages
[] Ordinal rankings
* for Pakistan, 1972 is used as a base year, but the growth rate in world trade between 1965-67 to 1978-80 has been used.

Changes in exports $= \sum_i \sum_j V'_{ij} - \sum_i \sum_j V_{ij}$

Increase in exports due to world trade $= r \sum_i V_{i\cdot} = r \sum_j V_{\cdot j}$

Increase in exports due to market distribution $= \sum_i \sum_j r_{ij} V_{ij} - \sum_i r_i V_{i\cdot}$

Increse in exports due to commodity composition $= \sum_i r_i V_i - \sum_i r V_{i\cdot}$

Increse in price competitiveness $= \sum_i \sum_j V'_{ij} - \sum_i \sum_j V_{ij} - \sum_i \sum_j r_{ij} V_{ij}$

in the residual or competitivenss term. Easy access to rapidly growing developed country markets when combined with scale economies, has both a direct market distribution effect on a country's export growth and also enhances its penetrative ability in other markets. The implication of this is that even if empirical analysis were to throw up a positive but relatively insignificant market distribution effect term and a positive and significant competitiveness term (e.g Republic of Korea), one cannot infer from this that foothold in rapidly growing markets is not very significant.

III

An issue of related interest is modelled in Krugman (1984)[12]. In this paper, Krugman tries to give substance to the popular view among businessmen that protection of home market leads to promotion of exports. Businessmen in trying to explain the success of Japanese firms in export markets often mention, the advantage of a protected home market. Firms with a secure home market are assured of economies of large-scale production, static and dynamic. Krugman in his paper, looks at three models. The essential ingredients of all three models are: 1) Olgopolistic and segmented markets 2) some form of economies of scale. Krugman notes that "In a world of perfect competition and constant returns to scale, protecting a product can never cause it to be exported"[13]. He takes the simple case of two firms a domestic firm and a foreign firm producing a

12. P.R. Krugman, "Import Protection as Export Promotion, International Competition in the Presence of Oligopoly and Economies of Scale" in Kierzkoioski, Hed, Monopolistic Competition and International Trade.

13. Ibid, pp 180.

single product and competing in several markets. His models are multi-market Cournot models. He shows that, "Protecting the domestic firm in one market increases domestic sales and lowers foreign sales in all markets[14].

The mechanics of the process in Krugman's words is as follows: "By giving a domestic firm a privileged position in some one market, a country gives it an advantage in scale over foreign rivals. This scale advantage translates into lower marginal costs and higher market share even in unprotected markets[15]".

The simplest case Krugman looks at is when marginal cost falls as total production by the firm rises. However, cases of declining marginal costs are probably rare. His models based on R & D investment and learning by doing are more relevant empirically.

An assessment of the export strategy of countries like South Korea, shows that they do not discriminate between export markets and domestic markets. They try to develop any industries with scale economy potential, whether it is for home market or for exports. These countries do protect their domestic market quite thoroughly.

Krugman's paper[16] represents, what he himself elsewhere has described as "New Thinking about Trade Policy"[17]. The basic theme is that the economic analysis on which the classicial case for free trade is based

14. Ibid, pp 187.

15. Ibid, pp 181.

16. Krugman (1984).

17. P.R. Krugman ed. Strategic Trade Policy and the New International Economics (The MIT Press, 1986).

requires modification in line with unfolding reality. Much of trade today requires an explanation in terms of economies of scale, learning curves, technical progress etc. These are incompatible with the kind of idealization under which free trade is always the best policy. Given imperfect competition, trade policy can be used to secure for the nation a larger share of the "rents". It can be used to alter the strategic game played by domestic and foreign firms[18].

An access advantage in one market also gives domestic firms a privileged position in that market. This can be translated into higher market shares in other markets.

IV

This section looks briefly at the various concepts of economies of scale and how they have been incorporated into trade theory.

Economies of scale may be external to the firm or internal to it. Until recently, external economies were the standard way in which increasing returns were introduced into trade theory. The concept of external economies was introduced into the literature by Marshall and refined by Edgeworth, Harberler, Knight, Viner, Kemp, Meade and others. The basic idea behind this concept is that cost curves of individual firms shift downward as the industry output expands.

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18. Ibid. J.A. Brander, "Rationale for Strategic Trade and Industrial Policy", pp 28.

External economies are consistent with perfect competition. Since marginal private cost exceeds marginal social cost, there may be certain analytical difficulties: 1) the economy may not produce on the production possibilities frontier (PPF); 2) even if it does, the slope of the production possibilities frontier will no longer give the ratio of commodity prices except under some specific assumptions. The slope of the PPF will give the commodity price ratio if it is assumed a La Meade that "there is a system of taxes and subsidies which equates price to marginal social cost in each competitive industry". Otherwise one may follow Kemp (1971) in assuming that external economies are of equal severity in both industries so that the ratio of marginal private cost to marginal social cost is the same in both industries[19].

The production function at the firm level is [20], $x = f(V, \eta)$. where x is the output of the firm, V is the vector of inputs and η is the vector of external influences. The focus has usually been on one element of η i.e. output of the industry to which the firm belongs. The standard way in which external economies have been modelled is as follow: each firm is assumed to believe that it is operating under constant returns to scale though there are increasing returns at the level of the industry. The firm's production function may be written as:

$x = g(x)\,\tilde{f}(V)$ where $g(x) > 0$ for $x>0$ and where $\tilde{f}$ is homogeneous of degree one in the vector of factor inputs. A proportionate increase in factor of inputs, industry output remaining the same, would lead to a

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19. M.C. Kemp, The Pure Theory of International Trade and Investment (Prentice-Hall 1971)

20. Helpman, E and Krugman, P.R., Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition and the International Economy (MIT Press, 1985).

proportionate increase in firm's output. For external economies $dg/dx>0$ and for external diseconomies $dg/dx<0$. One justification for the way industry output enters the firm's production function is that, a larger output enables the industry to support the production of a variety of intermediate inputs at lower costs.

Economies of scale internal to the firm are important enough to focus attention on their implications. Other things equal, a larger firm can better overcome indivisibilities, permitting either fuller-utilisation of capacity or use of more specialised and effecient machines. Other reason for economies of production at the firm level are: specialisation and division of labour in production, economies of manual resources, economies of increased physical dimensions of plant etc. Indivisibilities arise because at a given point of time, certain basic items of equipment are available in a limited number of sizes.

Economies of scale may be static or dynamic. Scale economies due to the length of production run may be regarded as static in the sense that they are independent of any argument about time. Dynamic economies of scale have been stressed in the work of Arrow and others. These may take the form of 'Learning by doing'. These economies accrue to the producers as a result of accumulated experience in producing a given product and are specific to them. The learning curve relates the unit cost of the individual firm to accumulated output. Unit costs decline with accumulated output. Therefore, short run output decision would affect accumulated output and hence future costs. If,

c = unit cost; x = numbers produced; t = time; T = the particular point of time under consideration;

$$c = f\left[\int_0^T x_t \, dt\right] \qquad \text{where } dc/dx < o$$

Another source of economies is investment in R & D. The firm can lower its unit cost of production through prior investment in R & D. We are basically concerned with process innovation through R & D designed to reduce cost of production. If R & D expenditure is denoted by N, then:

$$c = c(N);\ c'(N) < 0;\ c''(N) > 0.$$

Internal economies, if they persist, are inconsistent with perfect competition. Perfect competition would break down because eventually one firm would become large enough to supply the whole industry output. Thus, in modelling internal economies we have to use models of imperfect competition; i.e. monopolistic or oligopolistic competition or contestable markets.

This dessertation would mainly deal with two market structures namely oligopoly and contestable markets. An oligopoly is a market having few firms on the supply side and a very large number of buyers on the demand side, each of whom makes a negligible contribution to the market demand function. The key distinguishing feature that sets oligopoly apart from perfect competition and monopoly is that oligopolists are strategically linked to one another. The best policy for one firm depends on the policies being followed by each rival firm in the market. The Cournot model of oligopoly is dealt in chapter 3.

A contestable market is one into which entry is absolutely free and exit is costless. The entrant suffers no disadvantage in terms of production technique or product quality in relation to the incumbent. There are three welfare attributes of contestable markets. First, the contestable market never offers more than a normal rate of profit, Second, the attribute is the absence of any sort of ineffeciency in production in industry equilibrium. Third, where a product is sold by two or more firms, prices in equilibrium must equal marginal costs. This model is dealt in chapter 4.

The objective of this study is to examine the various implications of differential market access for market shares in varied market structures.

CHAPTER 2

COMPETITION IN A SINGLE MARKET

As a starting point, we look at competition in a single market and how differential access cost affects market shares. We have in our model two countries competing in a common market. Each country produces a nationally distinct product which, though different between the two countries, is homogenous between producers within the same country.

We assume that both goods are produced with the same unit production cost function;

$$c = c(S) \qquad c'(S) < 0 \ , \ c''(S) > 0$$

Where S denotes the sales volume. A specific example of this kind of assumption is the Spence - Dixit - Stiglitz kind of product differentiation where it is assumed that different varieties of a product, though distinguished by random distribution of consumer preferences between them, have well defined units such that if unit prices were equal they would command equal shares. It is assumed that the unit access cost to the common market differs for the two countries. Country 1 has a lower unit access cost than country 2 i.e. $t_1 < t_2$, where t_1 and t_2 are the unit access costs to the common market for countries 1 and 2 respectively.

The volume of sales of each country in the common market is going to depend on three things : (i) the income in the common market; (ii) the price of own product and (iii) the price of the other country's product. These relationships may be expressed as follows :

$$S_1 = f_1 [y, p_1, p_2] \quad 1$$

$$S_2 = f_2 [y, p_2, p_1] \quad 2$$

Where S_1 and S_2 denote the volume of sales of countries 1 and 2 respectively, while p_1 and p_2 are the prices of their products.

In this model economies of scale are external to the firm. In each country, the industry producing the product is perfectly competitive. Hence the price of each product equals its unit cost of production and distribution. This implies that,

$$p_1 = c(S_1) + t_1 \quad 3$$

and

$$p_2 = c(S_2 + t_2 \quad 4$$

Where t_1 and t_2 are the unit access costs to the market for countries 1 and 2 respectively.

We assume a specific functional form the unit production cost function:

$$c(S) = S^{-\eta} \quad \eta > 0 \;,\; c'(S) < 0 \;,\; c''(S) > 0 \qquad 5$$

Where S is the sales volume of the country. The unit cost of production declines with an increase in the output of the industry. [1] Thus, there are increasing returns at the level of the industy. In (5) η is the elasticity of cost with respect to output i.e.

$$\frac{\partial \ln c(S)}{\partial \ln S} = -\eta \qquad 6$$

The analysis may be simplified by assuming specific iso-elastic functional forms for (1) and (2). These relations may be written as :

$$S_1 = Y^{\epsilon y} [c(S_1) + t_1]^{-\epsilon_o} [c(S_2) + t_2]^{\epsilon_c} \qquad 7$$

$$S_2 = Y^{\epsilon y} [c(S_2) + t_2]^{-\epsilon_o} [c(S_1) + t_1]^{\epsilon_c} \qquad 8$$

Where ϵ_y is the income elasticity of demand; ϵ_o is the own price elasticity of demand while ϵ_c denotes cross price elasticity of demand. These are assumed to be constant.

From 7 and 8 on substituting for c(S) we get,

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1. Throughout the analysis we don't distinguish between sales volume and output and also between Country and industry. These terms are used interchangeably.

$$S_1 = Y^{\epsilon_y}[S^{-\eta}_1 + t_1]^{-\epsilon_o}[S^{-\eta}_2 + t_2]^{\epsilon_c} \qquad 9$$

$$S_2 = Y^{\epsilon_y}[S^{-\eta}_2 + t_2]^{-\epsilon_o}[S^{-\eta}_1 + t_1]^{\epsilon_c} \qquad 10$$

Equations 9 and 10 can also be expressed as

$$Y^{\epsilon_y} = S_1 [S^{-\eta}_1 + t_1]^{\epsilon_o}[S^{-\eta}_2 + t_2]^{-\epsilon_c} \qquad 11$$

$$Y^{\epsilon_y} = S_2 [S^{-\eta}_2 + t_2]^{\epsilon_o}[S^{-\eta}_1 + t_1]^{-\epsilon_c} \qquad 12$$

Equating 11 and 12 we get,

$$S_1 [S^{-\eta}_1 + t_1]^{\beta} = S_2 [S^{-\eta}_2 + t_2]^{\beta} \qquad 13$$

Where $\beta = \epsilon_o + \epsilon_c$

The above expression may be rewritten as

$$[S_1^{1/\beta - \eta} + t_1 S_1^{1/\beta}]^{\beta} = [S_2^{1/\beta - \eta} + t_2 S_2^{1/\beta}]^{\beta} \qquad 14$$

Let $\psi(S_1) = S_1^{1/\beta - \eta} + t_1 S_1^{1/\beta}$ 15

and $\psi(S_2) = S_2^{1/\beta - \eta} + t_2 S_2^{1/\beta}$ 16

From equation 14 we get

$$\psi(S_1) = \psi(S_2) \qquad 17$$

The above equation gives the equilibrium relationship between the volume of sales of the two countries. We have to look at the shapes of the curves $\psi(S_1)$ and $\psi(S_2)$. By differentiating equations (15) and (16) with respect to ψS_1 and ψS_2, we get

$$\psi'(S_1) = S_1^{1/\beta-1} [(\tfrac{1}{\beta}-\eta)S_1^{-\eta} + t_1/\beta] \qquad 18$$

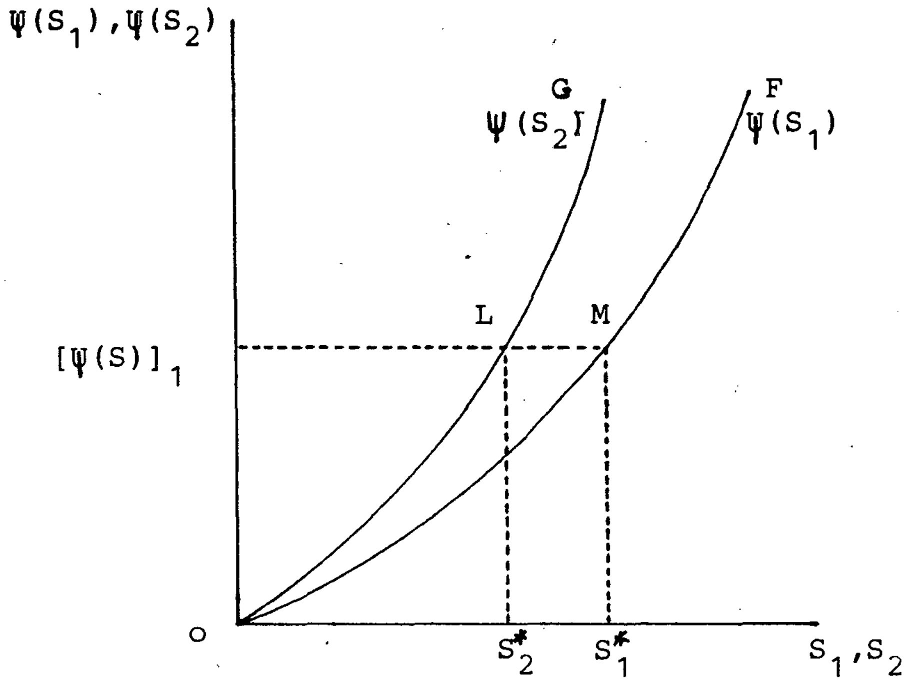
and $$\psi'(S_2) = S_2^{1/\beta-1} [(\tfrac{1}{\beta}-\eta)S_2^{-\eta} + t_2/\beta] \qquad 19$$

This would lead to the following cases :

1. If $1/\beta - \eta > 0$, $\psi'(S_1) > 0$ and $\psi'(S_2) > 0$

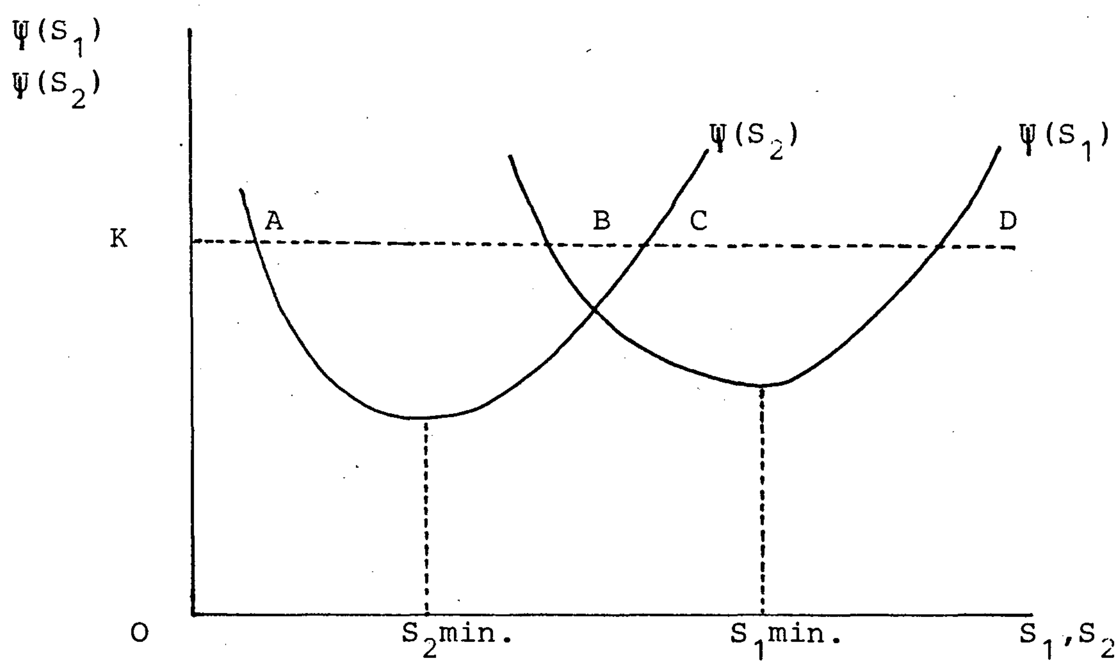
The relevant curves for $\psi(S_1)$ and $\psi(S_2)$ when $1/\beta-\eta > 0$ are indicated in Fig. 2.1. $\psi'(S_1) > 0$ implies that as S_1 increases, $\psi(S_1)$ increases. Similarly, $\psi'(S_2) > 0$ implies that as S_2 increases, $\psi(S_2)$ also increases. It is evident from equation (17) that $S_1 > S_2$ if $t_1 < t_2$ i.e. the country with access advantage sells more than the other country. In Fig. 2.1, curve OF indicates $\psi(S_1)$ while OG indicates $\psi(S_2)$. Given that $t_1 < t_2$, the curve OF lies to the right of curve OG indicating that in each position of equilibrium S_1 will be greater than S_2.

2. If $1/\beta - \eta < 0$, the curves $\psi(S_1)$ and $\psi(S_2)$ are U-shaped and have a minima. The curves are shown in Fig. 2.2. The respective points of minima are :



Case I : $(\frac{1}{\beta} - \eta) > 0$

FIGURE 2.1



Case II: $(\frac{1}{\beta} - \eta) < 0$

FIGURE 2.2

$$S_{1\,min} = \left[\frac{\eta\ \beta - 1}{t_1}\right]^{\frac{1}{\eta}} \qquad 20$$

and $$S_{2\,min} = \left[\frac{\eta\,\beta - 1}{t_2}\right]^{\frac{1}{\eta}} \qquad 21$$

From (20) and (21) we find that if $t_2 > t_1$

$$S_{2\,min} < S_{1\,min} \qquad 22$$

In this case, as is evident in Fig. 2.2, we will have a problem of multiple equilibria. Any equalised value of $\psi\ (S_1)$ and $\psi\ (S_2)$ say OK = $\psi\ (S_1) = \psi\ (S_2)$ corresponds to 4 different points on the relevant curves, A,B,C and D.

We are interested in exaining what happens to market shares as income in the common market grows. Growth in income is taken as analogous to growth in the market. The implications of income growth for the sales volumes of the two countries can be inferred from the following equation.[2]

$$\frac{dS_1\ /\ S_1}{dS_2\ /\ S_2} = \frac{S_2\ \psi'\ (S_2)}{S_1\ \psi'\ (S_1)} \qquad 23$$

on substituting for $\psi'\ (S_1)$ and $\psi'\ (S_2)$ in the above equation, we get[3] :

2. Proof of this is in Appendix-1.

3. Ibid. Appendix-1.

$$\frac{dS_1 / S_1}{dS_2 / S_2} = \frac{\hat{S}_1}{\hat{S}_2} = \frac{\frac{1}{\beta}\,\psi(S_2) - \eta\, S_2^{\,1/\beta - \eta}}{\frac{1}{\beta}\,\psi(S_1) - \eta\, S_1^{\,1/\beta - \eta}}$$

$$= \frac{\psi(S_2) - \eta\beta\, S_2^{\,1/\beta - \eta}}{\psi(S_1) - \eta\beta\, S_1^{\,1/\beta - \eta}} \qquad 24$$

where $\hat{S}_1 = d\,S_1 / S_1$ and $\hat{S}_2 = d\,S_2 / S_2$ denote the relative changes in the volume of sales of countries 1 and 2 respectively.

If, $S_1^{\,1/\beta - \eta}$ is taken common from both the numerator and the denominator, equation 24 becomes,

$$\frac{ds_1 / S_1}{dS_2 / S_2} = \frac{\hat{S}_1}{\hat{S}_2} = \frac{\delta(S_2) - \eta\beta\,(S_2/S_1)^{1/\beta - \eta}}{\delta(S_1) - \eta\beta} \qquad 25$$

Where $\delta(S_1) = \dfrac{\psi(S_1)}{S_1^{\,1/\beta - \eta}}$

$\delta(S_2) = \dfrac{\psi(S_2)}{S_1^{\,1/\beta - \eta}}$ and $\delta(S_1) = \delta(S_2)$

The following cases may be distinguished :

Case I

Where $\frac{1}{\beta} - \eta > 0$ or $1 - \eta\beta > 0$.

In this case, both the numerator and the denominator of equation (24) are postive. The numerator of equation (24) is :

$$\psi(S_2) - \eta\beta S_2^{1/\beta-\eta} = (1-\eta\beta) S_2^{1/\beta-\eta} + t_2 S_2^{1/\beta} > 0$$

$$\text{if } (1-\eta\beta) > 0$$

Similarly, we can show that the denominator of (24) is also positive. Hence,

$$\frac{dS_1/S_1}{dS_2/S_2} = \frac{\hat{S}_1}{\hat{S}_2} > 0 \qquad 26$$

From (25) we can infer that with an increase in income in the common market, the sales volumes of both countries will increase. Moreover $\frac{dS_1/S_1}{dS_2/S_2}$ will be larger, the larger is S_1/S_2

We shall examine Case I in more detail subsequently.

Case II

Where $^1/\beta - \eta = 0$ or $\eta\beta = 1$. In this case,

$$\frac{dS_1/S_1}{dS_2/S_2} = \frac{\hat{S}_1}{\hat{S}_2} = 1 \qquad 27$$

or $\hat{S}_1 = \hat{S}_2$

This implies that the relative increse in the sales volume is the same for both countries. Therefore, both countries maintain their market shares.

Case III

Where $^1/\beta - \eta < 0$ or $1-\eta\beta < 0$

In this case, as noted earlier $\psi(S_1)$ and $\psi(S_2)$ are U-shaped and have points of minima. This implies,

$$\psi'(S_1) \lesseqgtr 0 \text{ according as } S_1 \lesseqgtr S_{1\ min}$$

and

$$\psi'(S_2) \lesseqgtr 0 \text{ according as } S_2 \lesseqgtr S_{2\ min}$$

This suggests several posibilities :

1. If both S_1 and S_2 lie to the right of their respective points of minima i.e. $S_1 > S_{1\ min}$ and $S_2 > S_{2\ min}$, $\psi'(S_1)$ and $\psi'(S_2)$ will both the positive. This implies that

$$\frac{dS_1/S_1}{dS_2/S_2} = \frac{\hat{S}_1}{\hat{S}_2} = \frac{S_2\ \psi'(S_2)}{S_1\ \psi'(S_1)} > 0 \qquad 28$$

From (25) we can infer that $\frac{dS_1/S_1}{dS_2/S_2}$ is larger, the smaller is S_1 relative to S_2.

2. If S_1 and S_2 both lie to the left of their respective points of minima, $\psi'(S_1)$ and $\psi'(S_2)$ will be negative. In this case,

$$\frac{dS_1/S_1}{dS_2/S_2} = \frac{\hat{S}_1}{\hat{S}_2} > 0 \qquad 29$$

and will be larger, the larger is S_1 relative to S_2.

It is evident from Fig 2.2 that if both S_1 and S_2 lie to the right of their respective minima or to the left, $S_1 > S_2$.

3. It S_1 and S_2 lie on opposite sides of their respective minima i.e. if $\psi'(S_1)$ and $\psi'(S_2)$ have opposite signs

$$\frac{dS_1/S_1}{dS_2/S_2} = \frac{S_2\,\psi'(S_2)}{S_1\,\psi'(S_1)} < 0 \qquad 30$$

In this case very little can be said in concrete terms.

We shall concentrate on case I as this is economically meaningful. The interpretation of the condition $(1/\beta - \eta) > 0$ is taken up in the subsequent discussion.

From equation (17) we have

$$S_1^{1/\beta-\eta} + t_1\,S_1^{1/\beta} = S_2^{1/\beta-\eta} + t_2\,S_2^{1/\beta}$$

If $t_1 < t_2$, the above expression implies that $S_1>S_2$ i.e. the country with access advantage will have a larger market share. This is also evident from Fig (2.1). A possible set of equilibrium points are indicated by L and M. Given $t_1<t_2$, it is evident that $S^*_1>S^*_2$.

It is also interesting to see the effect of income growth on the market shares of the two countries. From equation (25)

$$\frac{\hat{S}_1}{\hat{S}_2} = \frac{dS_1/S_1}{dS_2/S_2} = \frac{\delta(S_2) - \eta\ \beta\ (S_2/S_1)^{1/\beta-\eta}}{\delta(S_1) - \eta\ \beta}$$

Where $\delta(S_1) = \delta(S_2)$

We can infer that $\hat{S}_1 > \hat{S}_2$ if $(S_2/S_1)^{1/\beta-\eta} < 1$ or $S_1 > S_2$.

We have already seen that if $t_1 < t_2$, then $S_1 > S_2$. Thus, as the common market grows, the market share of the country with access advantage will increase. The relative increase in the sales volume of country 1 is greater than the relative increase in the sales volume of country 2.

The condition $1/\beta - \eta > 0$ is a variation of the Marshallian stability condition for the case in which there is a change in the price of the other product also. Since η is the elasticity of cost with respect to output, $1/\eta$ may be interpreted as the production cost elasticity of supply or as the elasticity of supply, since t_1 and t_2 are taken as fixed. In this, $\beta = \epsilon_0 + \epsilon_c$ is the sum of own and cross price elasticity of demand.

If there are increasing returns at the level of the industry, the supply curve will be downward sloping. The Marshallian stability requirement is that the supply curve cut the demand curve from below. This is illustrated in Fig 2.3. It can also be seen from Fig 2.3, that to the right of the equilibrium point E, the supply price exceedes the demand

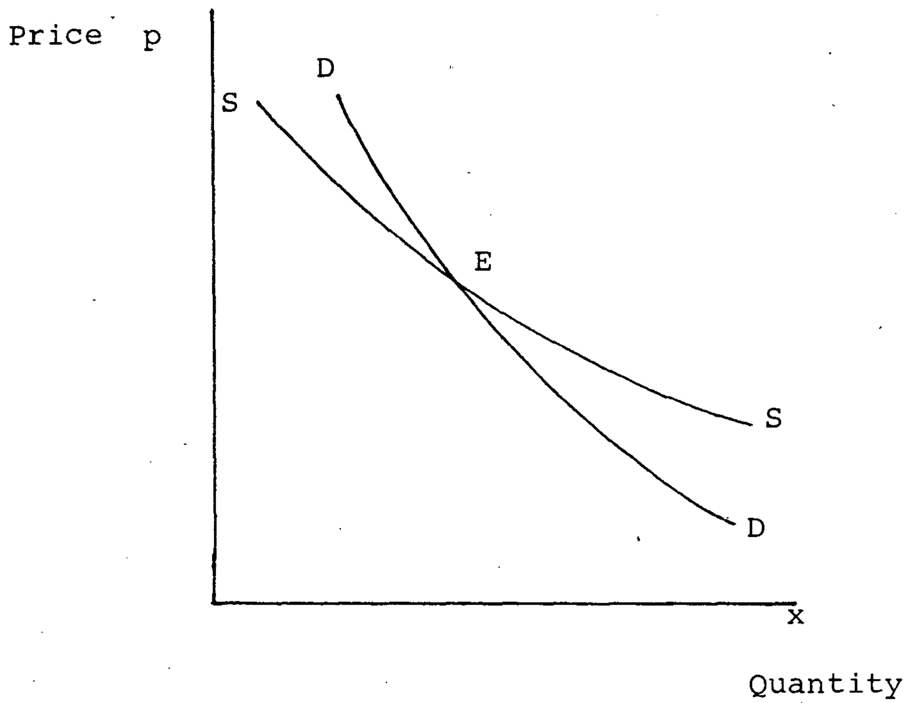


FIG.2.3

price while the converse is true to the left of point E. In terms of elasticities, the requirement is that the elasticity of supply should be greater than the elasticity of demand. The condition $1/\beta - \eta > 0$ or $1/\eta > \beta$ is a variant of the Marshallian stability condition when we take into account the effect on demand of a change in the price of the other product.

It can be shown that, an increase in access advantage for country 1 will lead to an increase in its sales volume and a decline in the sales volume of the other country. This is evident from the signs of dS_1/dt_1 and dS_2/dt_1. Total differentation of equations 7 and 8 assuming a fixed Y yields:

$$\frac{1}{S_1}\left[1 - \frac{\eta\,\epsilon_o\,C(S_1)}{C(S_1)+t_1}\right]\frac{dS_1}{dt_1} + \frac{\eta\,\epsilon_c\,C(S_2)}{S_2[C(S_2)+t_2]}\frac{dS_2}{dt_1} = -\frac{\epsilon_o}{C(S_1)+t_1} \qquad 31$$

$$\frac{1}{S_1}\frac{\eta\,\epsilon_c\,C(S_1)}{[C(S_1)+t_1]}\frac{dS_1}{dt_1} + \frac{1}{S_2}\left[1 - \frac{\eta\,\epsilon_o\,C(S_2)}{C(S_2)+t_2}\right]\frac{dS_2}{dt_1} = \frac{\epsilon_c}{C(S_1)+t_1} \qquad 32$$

By solving equations (31) and (32) we get,

$$\frac{dS_1}{dt_1} = \frac{1}{\Delta}\left[\frac{-(1-\eta\,\beta)\,\epsilon_o\,C(S_1) - \epsilon_o\,t_2 - \eta\,\beta\,\epsilon_c\,C(S_2)}{S_2[C(S_1)+t_1]\,[C(S_2)+t_2]}\right] < 0 \qquad 33$$

$$\frac{dS_2}{dt_1} = \frac{1}{\Delta} \left[\frac{\epsilon_c}{S_1[C(S_1)+t_1]} \right] > 0$$

Where,

$$\Delta = [1-\eta \ \epsilon_0] \ t_2 \ C(S_1) + [1-\eta \ \epsilon_0] \ t_1 \ C(S_2) + t_1 \ t_2$$

$$+ C(S_1) \ C(S_2) \ [1-\eta \ \beta] \ [1-\eta \ \epsilon_0 + \eta \ \epsilon_c] > 0$$

From the analysis, we can infer that, the larger the market in which the two countries compete, the larger will be the share of the country with access advantage. Exactly the same kind of analysis would go through if it is assumed that economies of scale are internal and markets are contestable. There would then be a single firm in each country.

CHAPTER 3

MODEL WITH STATIC SCALE ECONOMIES

The previous Chapter looked at Competition in a Common market and how differential access costs affect market shares. Economies of scale were assumed to be external to the firm. In this chapter we have a model adapted from Krugman (1984). Here economies of scale are internal to the firm and take the form of declining marginal cost, i.e., the cost of producing an extra unit of output falls as the total production by the firm rises.

Since internal economies of scale are incompatible with perfect competition, we have to employ models of imperfect competition. We shall follow Krugman in assuming a multimarket duopoly. We have two firms h and f serving a world market contained entirely in two markets 1 and 2. The markets are segmented. Each firm produces a single product which it sells, in competition with the other, in these two markets. Firm h is located in country H while firm f is located in country F.

Each firm has to choose a vector of deliveries $x = (x_1, x_2)$ where x_1 is sales volume in market 1 and x_2 is sales volume in market 2. Volume of sales of firm h in market i is denoted by x_i and of firm f is denoted by x_i^* [1] x_i. We shall use the Cournot model of oligopoly. Each firm in determining its sales volume in each market takes the volume of sales of the other firm

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1. All variables pertaining to firm h are unstarred while those pertaining to f are starred.

in each market as given. A Cournot-Nash equilibrium point in this game is a pair of strategies (x^c, x^{*c}), such that x^c is a best reply strategy to x^{*c} and vice-versa. In other words, the Cournot equilibrium has the property that no single firm h can increase its profit by choosing an output vector different from x^c, given that the other firm is choosing x^{*c}.

First, we shall look at the case in which both firms produce a homogenous good. We assume linear inverse demand functions and a quadratic cost function. The purpose behind using such specific functional forms is to generate explicit results. We shall show that the firm with an access advantage in one market sells more than the other firm in both markets, although both have the same access cost to the other market.

Let the inverse demand functions in the two markets be:

$$P_1 = a_1 - b_1 (x_1 + x^*_1) \quad a_1, b_1 > 0 \qquad 1$$

$$P_2 = a_2 - b_2 (x_2 + x^*_2) \quad a_2, b_2 > 0 \qquad 2$$

Where P_1 and P_2 are the prices of the product in markets 1 and 2 respectively.

Both firms have the same quadratic cost function:

$$C = \alpha\ y - 1/2\ \beta\ y^2 + \eta \qquad \alpha\ ,\ \beta,\ \eta > 0 \qquad 3$$

Where y denotes the output of the firm. Each firms total cost is a sum of two components: Production cost and cost of market access. Market access cost includes transport costs, tariffs and quotas, information cost etc. Let t_i and t^*_i denote the access cost per unit to market i for firms h and f respectively. We further assume that firm h has an access advantage in market 1 i.e. $t_1 < t^*_1$, while both firms have the same access cost to market 2 i.e. $t_2 = t^*_2$ (2).

The objective functions of the two firms are as follows:

$$\max_{x_1, x_2} \Pi = a_1 x_1 - b_1 (x_1+x^*_1) x_1 + a_2 x_2 - b_2(x_2+x^*_2)x_2 - t_1 x_1 - t_2 x_2 - c(x_1+x_2) \quad 4$$

$$\max_{x^*_1, x^*_2} \Pi^* = a_1 x^*_1 - b_1(x_1+x^*_1)x^*_1 + a_2 x^*_2 - b_2(x_2+x^*_2)x^*_2 - t^*_1 x^*_1 - t_2 x^*_2 - c(x^*_1+x^*_2) \quad 5$$

Where Π and Π^* are the profits of the two firms. The first order conditions are:

$$\frac{\partial \Pi}{\partial x_1} = a_1 - b_1(2x_1+x^*_1) - t_1 - u = 0 \quad 6$$

$$\frac{\partial \Pi}{\partial x_2} = a_2 - b_2(2x_2+x^*_2) - t_2 - u = 0 \quad 7$$

---

2. Henceforth t^*_2 will be denoted by t_2 using the assumption $t_2=t^*_2$.

$$\frac{\partial \pi^*}{\partial x_1^*} = a_1 - b_1(x_1+2x^*_1) - t^*_1 - u^* = 0 \qquad 8$$

$$\frac{\partial \pi^*}{\partial x_2^*} = a_2 - b_2(x_2+2x^*_2) - t_2 - u^* = 0 \qquad 9$$

Where u and u^* are the marginal costs of firms h and f respectively.

From 6 and 8 we obtain,

$$x_1 = \frac{[a_1+t^*_1 - 2t_1]}{3b_1} + \frac{[u^*-2u]}{3b_1}$$

and

$$x^*_1 = \frac{[a_1+t_1-2t^*_1]}{3b_1} + \frac{[u-2u^*]}{3b_1}$$

Similarly, from 7 and 9 we get,

$$x_2 = \frac{[a_2-t_2]}{3b_2} + \frac{[u^*-2u]}{3b_2}$$

$$x^*_2 = \frac{[a_2-t_2]}{3b_2} + \frac{[u-2u^*]}{3b_2}$$

Hence the outputs of the two firms denoted by x and x^* are:

$$x = x_1 + x_2 = \frac{[a_1 + t^*_1 - 2t_1]}{3b_1} + \frac{[a_2 - t_2]}{3b_2} +$$

$$[u^* - 2u]\,[1/3b_1 + 1/3b_2] \qquad 10$$

$$x^* = x^*_1 + x^*_2 = \frac{[a_1 + t_1 - 2t^*_1]}{3b_1} + \frac{[a_2 - t_2]}{3b_2}$$

$$+ [u - 2u^*]\,[1/3b_1 + 1/3b_2] \qquad 11$$

One way of interpreting equations 10 and 11 is that u and u^* are certain estimates of marginal cost for the two firms. These equations then tell us what the total output of each firm would be, given the estimates of marginal cost. From 10 and 11 we can infer that lower the estimate of its own marginal cost, the larger would be the output of a firm.

We, thus, have a relation between the marginal costs and the firm's output. There is another relation too. Given a declining marginal cost function, the firm's ~~output would be larger if its~~ actual marginal cost is lower, the larger its output. A quadratic cost function yields a linear marginal cost function. The marginal cost functions of the two firms are as follows:

$$u = \alpha - \beta x \qquad \alpha , \beta > 0 \qquad 12$$

$$u^* = \alpha - \beta x^* \qquad 13$$

We can compute the equilibrium in the following way. We start with certain estimates of marginal cost for the two firms and compute their output levels x and x^*. These outputs, in turn, imply certain marginal costs for the two firms vide equations 12 and 13 . These implied marginal costs can be used as estimates for a second round and so on.

Equations 10 and 12 give the equilibrium for firm h conditional on the marginal cost of firm f. Similarly, 11 and 13 give the equilibrium for firm f. This is indicated in Figure 3.1(a) & (b).

In Figure 3.1(a), QQ gives the relation between firm h's output, x, and the estimate of own marginal cost u, given the other fim's marginal cost u^*. MM gives the relation between output and actual marginal cost for firm h. Q' Q' and M' M' in Figure 3.1(b) are the relevant curves for firm f. QQ (Q' Q') must be steeper than MM (M' M'), both being negatively sloped. The logic behind this requirement is as follows: given u^*, suppose firm h were to start with a certain estimate of marginal cost say u_1, the firm will then produce an output x_1. This level of output implies a marginal cost of u_2. In the next round, the firm will produce an output x_2 and so on. Thus, starting from any point on QQ other than E we finally converge to E. The dynamic path is indicated by the arrows.

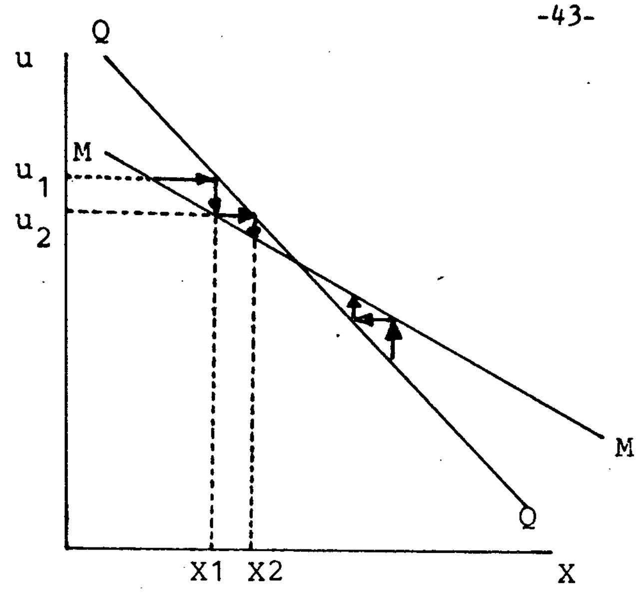


FIG. 3.1(a)

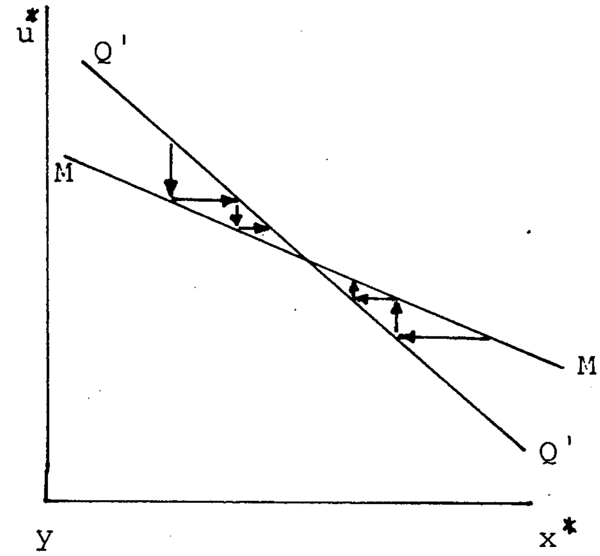


FIG. 3.1 (b)

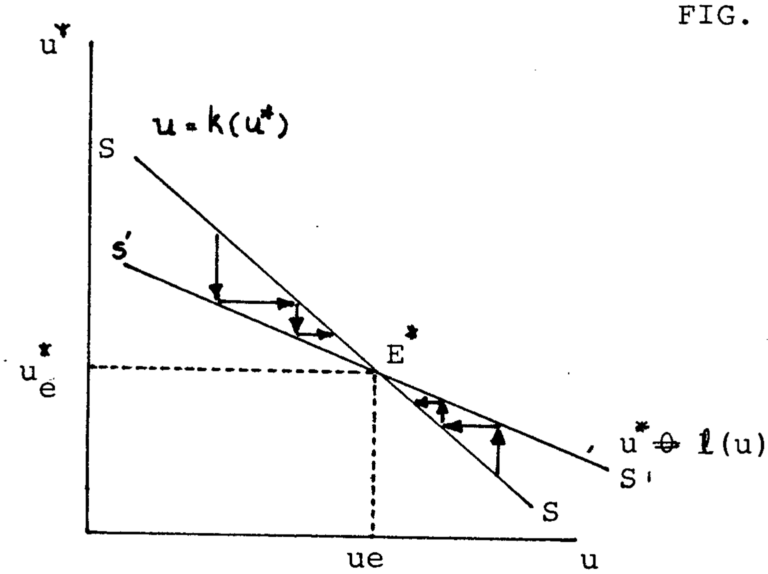


FIG. 3.2

On solving 10 and 12 we obtain,

$$u = \frac{Q}{K} - \frac{R}{K}u^* \qquad 14$$

Where

$$Q = \alpha\ (3b_1)(3b_2) - \beta\ (3b_2)(a_1+t^*_1-2t_1) - \beta(3b_1)(a_2-t_2)$$

$$K = (3b_1)(3b_2) - 2\ \beta\ (3b_1+3b_2)$$

and $R = \beta\ (3b_1+3b_2)$

From 11 and 13 we get,

$$u^* = \frac{L}{K} - \frac{R}{K}u \qquad 15$$

Where $L = \alpha\ (3b_1)(3b_2) - \beta\ (3b_2)(a_1+t_1-2t^*_1) - \beta\ (3b_1)(a_2-t_2)$

The requirement that QQ be steeper than MM implies

$$K > 0 \qquad 16$$

The next step in determining the equilibrium is to solve equations 14 and 15 simultaneously. These two equations indicate that each firm's marginal cost is declining in the other firm's marginal cost. These are represented in Figure 3.2 by SS and S' S' respectively. Stability requires that SS should be steeper than S' S'. The dynamic path from any position of disequilibrium is indicated by the arrows in Figure 3.2. In this case, starting from any position of disequilibrium, there will be a convergence to equilibrium. This requirement gives the following condition:

$$M = K^2 - R^2 > 0 \qquad 17$$
$$= (K+R)\ (K-R) > 0$$

Therefore,

$$K-R = (3b_1)\ (3b_2)-3\ \beta\ (3b_1+3b_2) > 0$$

Hence 16 and 17 together imply

$$K+R = (3b_1)\ (3b_2)-\ \beta\ (3b_1+3b_2) > 0 \qquad 18$$

The solutions for u and u^* are:

$$u = \frac{K.Q - R.L}{M} = \frac{T}{M} \qquad 19$$

Where T = K.Q - R.L

and $u^* = \frac{Q}{R} - \frac{K}{R} \cdot \frac{T}{M}$ 20

The attempt is to show that if firm h has an access advantage in market 1, everything else being the same for both firms, it will be able to sell more in both markets i.e. $x_1 > x^*_1$ and $x_2 > x^*_2$. Looking at the expressions for $(x_1 - x^*_1)$ and $(x_2 - x^*_2)$:

$$(x_1 - x^*_1) = \frac{1}{b_1} [t^*_1 - t_1] + \frac{1}{b_1} [u^* - u] \qquad 21$$

From equations 19 and 20 we have

$$(u^* - u) = \frac{1}{M} [K+R] [L-Q] \qquad 22$$

Where

$$(L-Q) = 3 \ \beta(3b_2) \ (t^*_1 - t_1) \qquad 23$$

Hence on Substituting equations 22 and 23 in equation 21 we get

$$(x_1-x^*_1) = \frac{(t^*_1-t_1)}{b_1} \left[1 + \frac{3 \beta(3b_2)(K+R)}{M}\right] > 0 \qquad 24$$

as $t^*_1 > t_1$

Similarly, it can be shown that

$$(x_2 - x^*_2) = \frac{1}{b_2}[u^* - u] > 0$$

Thus, firm h sells more in both markets than firm f.

We shall now look at the general case. In this, we use general (unspecified) demand and cost functions. Although each firm produces a single product, the products may but need not be perfect substitutes. Suppose the revenue functions of firm h in markets 1 and 2 respectively are:

$$R = R(x_1, x^*_1) \quad \text{and} \quad L = L(x_2, x^*_2)$$

Where x_1 and x_2 denote the sales volume of the firm h in markets 1 & 2 respectively, while x^*_1 and x^*_2 denote the sales volume of the firm f in markets 1 & 2. The revenue functions of firm f are denoted by,

$$R^* = R^*(x_1, x^*_1) \quad \text{and} \quad L^* = L^*(x_2, x^*_2)$$

Following Krugman, it is assumed that each firm's marginal revenue is decreasing in the other firm's output. This is true of every market i = 1, 2. Using subscripts to denote derivatives we have,

$$R_{12} < 0 \; ; \; R^*_{21} < 0 \; ; \; L_{12} < 0 \; ; \; L^*_{21} < 0 \qquad 25$$

It is also assumed that 'own' effects on marginal revenue are stronger than 'cross' effects, i.e.,

$$D_1 = R_{11} \; R^*_{22} - R_{12} \; R^*_{21} > 0 \qquad 26$$

$$D_2 = L_{11} \; L^*_{22} - L_{12} \; L^*_{21} > 0 \qquad 27$$

This condition ensures stability. The objective functions of the two firms are as follows:

$$\max_{x_1,\, x_2} \pi = R(x_1, x^*_1) + L(x_2, x^*_2) - t_1 x_1 - t_2 x_2 - c(x_1+x_2)$$

$$\max_{x^*_1,\, x^*_2} \pi^* = R^*(x_1, x^*_1) + L^*(x_2, x^*_2) - t^*_1 x^*_1 - t^*_2 x^*_2 - c^*(x^*_1+x^*_2)$$

Where π and π^* denote profits; c and c^* production costs; While t_1 and t^*_1 denote access cost per unit to market 1 for firms h and f respectively. Similarly t_2 and t^*_2 denote access unit per unit to market 2 for firms h and f.

On the Cournot behavioural assumption, the first order conditions are:

$$\frac{\partial \pi}{\partial x_1} = R_1 - u - t_1 = 0$$

$$\frac{\partial \pi}{\partial x_2} = L_1 - u - t_2 = 0$$

$$\frac{\partial \pi^*}{\partial x^*_1} = R^*_2 - u^* - t^*_1 = 0$$

$$\frac{\partial \pi^*}{\partial x^*_2} = L^*_2 - u^* - t^*_2 = 0$$

Where u and u^* denote marginal production costs for firms h and f respectively.

It is interesting to see what happens if t_1 were to decline with t_2, t^*_2 and t^*_1 remaining unchanged. Total differentiation of the first order conditions yields:

$$R_{11}\, dx_1 + R_{12}\, dx^*_1 - du - dt_1 = 0 \qquad 28$$

$$L_{11}\, dx_2 + L_{12}\, dx^*_2 - du = 0 \qquad 29$$

$$R^*_{21}\, dx_1 + R^*_{22}\, dx^*_1 - du^* = 0 \qquad 30$$

$$L^*_{21}\, dx_2 + L^*_{22}\, dx^*_2 - du^* = 0 \qquad 31$$

On solving 28 and 30 simultaneously we get,

$$dx_1 = \frac{R^*_{22}}{D_1} du - \frac{R_{12}}{D_1} du^* + \frac{R^*_{22}}{D_1} dt_1$$

$$dx^*_1 = \frac{-R^*_{21}}{D_1} du + \frac{R_{11}}{D_1} du^* - \frac{R^*_{21}}{D_1} dt_1$$

Similarly, from 29 and 31 we get,

$$dx_2 = \frac{L^*_{22}}{D_2} du - \frac{L_{12}}{D_2} du^*$$

$$dx^*_2 = \frac{-L^*_{21}}{D_2} du + \frac{L_{11}}{D_2} du^*$$

From the above expressions we get,

$$dx = dx_1 + dx_2 = du\left[\frac{R^*_{22}}{D_1} + \frac{L^*_{22}}{D_2}\right] - du^*\left[\frac{R_{12}}{D_1} + \frac{L_{12}}{D_2}\right] + \frac{R^*_{22}}{D_1}\, dt_1 \qquad 32$$

$$dx^* = dx^*_1 + dx^*_2 = -du\left[\frac{R^*_{21}}{D_1} + \frac{L^*_{21}}{D_2}\right] + du^*\left[\frac{R_{11}}{D_1} + \frac{L_{11}}{D_2}\right] - \frac{R^*_{21}}{D_1}\, dt_1 \qquad 33$$

Where dx and dx^* are the changes in the output of the two firms. Equations 32 and 33 may be interpreted as giving the changes in the output of the two firms consequent upon some hypothetical changes in u and u^* as well as a given change in t_1.

In terms of Figure 3.1, a decline in t_1 will lead to a rightward shift in QQ and a leftward shift in Q' Q'. The magnitude and the direction of the shift may be inferred from equations 32 and 33 by putting $du = 0$ and $du^* = 0$.

Therefore, $dx = \frac{R^*_{22}}{D_1}\, dt_1 > 0$ and $dx^* = -\frac{R^*_{21}}{D_1}\, dt_1 < 0$

This is shown in Figure 3.3.

Given the marginal cost function of the firm, a change in its output will lead to a change in its marginal cost. If the marginal cost functions are given by $u = u(x)$ and $u^* = u^*(x^*)$ we have:

$$du = u' \, dx \qquad u', u^{*\prime} < 0 \tag{34}$$

$$du^* = u^{*\prime} \, dx^* \tag{35}$$

The requirement that QQ (Q' Q') be steeper than MM (M' M') gives the following conditions:

$$\left[\frac{1}{u'} - \frac{R^*_{22}}{D_1} - \frac{L^*_{22}}{D_2}\right] < 0 \tag{36}$$

and

$$\left[\frac{1}{u^{*\prime}} - \frac{R_{11}}{D_1} - \frac{L_{11}}{D_2}\right] < 0 \tag{37}$$

From equations 32, 33, 34, and 35 we get,

$$\left[\frac{1}{u'} - \frac{R^*_{22}}{D_1} - \frac{L^*_{22}}{D_2}\right] du + \left[\frac{R_{12}}{D_1} + \frac{L_{12}}{D_2}\right] du^*$$

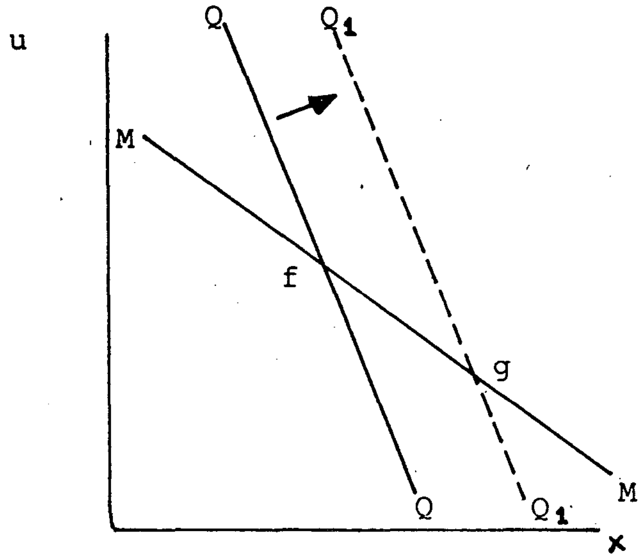


FIG. 3.3 (a)

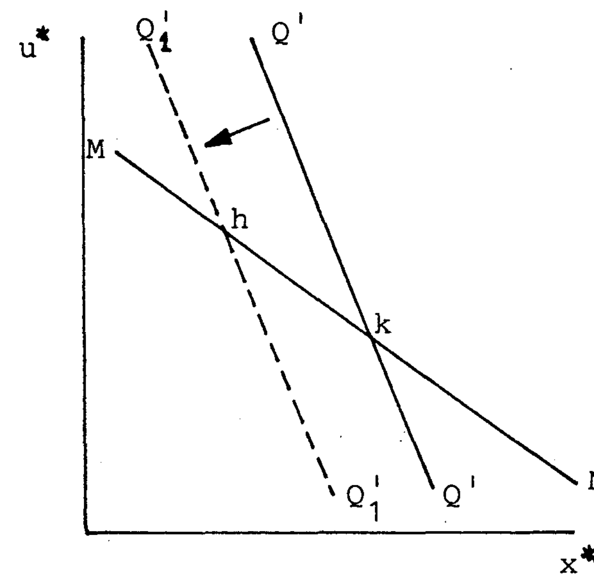


FIG.3.3 (b)

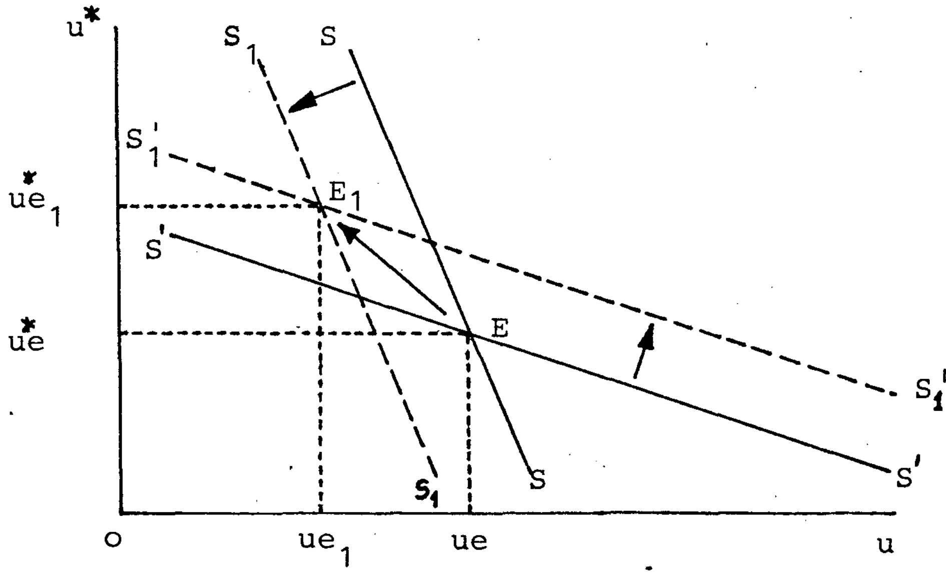


FIG.3.4

$$= \frac{R^*_{22}}{D_1} dt_1 \qquad 38$$

$$\left[\frac{R^*_{21}}{D_1} + \frac{L^*_{21}}{D_2}\right] du + \left[\frac{1}{u^{*'}} - \frac{R_{11}}{D_1} - \frac{L_{11}}{D_2}\right] du^*$$

$$= \frac{-R^*_{21}}{D_1} dt_1 \qquad 39$$

In terms of Figure 3.2, a decline in t_1 leads to a leftward shift in SS while S' S' shifts to the right. This is indicated in Figure 3.4. The stability requirement that SS be steeper than S' S' implies:

$$D = \left[\frac{1}{u'} - \frac{R^*_{22}}{D_1} - \frac{L^*_{22}}{D_2}\right]\left[\frac{1}{u^{*'}} - \frac{R_{11}}{D_1} - \frac{L_{11}}{D_2}\right]$$

$$- \left[\frac{R_{12}}{D_1} + \frac{L_{12}}{D_2}\right]\left[\frac{R^*_{21}}{D_1} + \frac{L^*_{21}}{D_2}\right] > 0 \qquad 40$$

Solving equations 38 and 39 simultaneously we get,

$$du = \frac{dt_1}{(D)\ (D_1)}\left[R^*_{22}\left(\frac{1}{u^{*'}} - \frac{R_{11}}{D_1} - \frac{L_{11}}{D_2}\right) + R^*_{21}\left(\frac{R_{12}}{D_1} + \frac{L_{12}}{D_2}\right)\right] < 0$$

If $dt_1 < 0$ 41

While

$$du^* = \frac{dt_1}{(D)(D_2}\left[- R^*_{21}\left(\frac{1}{u'} - \frac{R^*_{22}}{D_1} - \frac{L^*_{22}}{D_2}\right)\right.$$

$$\left. - R^*_{22}\left(\frac{R^*_{21}}{D_1} + \frac{L^*_{21}}{D_2}\right)\right] > 0 \qquad 42$$

If $dt_1 < 0$

Hence with a decline in t_1, the marginal production cost for firm h declines while that for firm f increases. It can be shown that:

$$\frac{dx}{dt_1} = \frac{du}{dt_1}\left[\frac{R^*_{22}}{D_1}+\frac{L^*_{22}}{D_2}\right] - \frac{du^*}{dt_1}\left[\frac{R_{12}}{D_1}+\frac{L_{12}}{D_2}\right] + \frac{R^*_{22}}{D_1} < 0$$

$$\frac{dx^*}{dt_1} = -\frac{du}{dt_1}\left[\frac{R^*_{21}}{D_1}+\frac{L^*_{21}}{D_2}\right] + \frac{du^*}{dt_1}\left[\frac{R_{11}}{D_1}+\frac{L_{11}}{D_2}\right] - \frac{R^*_{21}}{D_1} > 0$$

Also,

$$\frac{dx_1}{dt_1} = \frac{du}{dt_1} \quad \frac{R^*_{22}}{D_1} + \frac{R^*_{22}}{D_1} - \frac{du^*}{dt_1} \quad \frac{R_{12}}{D_1} < 0$$

$$\frac{dx^*_1}{dt_1} = \frac{du^*}{dt_1} \quad \frac{R_{11}}{D_1} - \frac{du}{dt_1} \quad \frac{R^*_{21}}{D_1} - \frac{R^*_{21}}{D_1} > 0$$

$$\frac{dx_2}{dt_1} = \frac{du}{dt_1} \quad \frac{L^*_{22}}{D_2} - \frac{du^*}{dt_1} \quad \frac{L_{12}}{D_2} < 0$$ and

$$\frac{dx^*_2}{dt_1} = \frac{du^*}{dt_1}\frac{L_{11}}{D_2} - \frac{du}{dt_1}\frac{L^*_{21}}{D_2} > 0$$

We have shown that with a decline in t_1 i.e. the unit access cost to market 1 for firm h, the volume of sales of firm h in both markets will increase while the volume of sales of firm f declines. Hence gaining an access advantage in one market enables firm h to increase its sales volume in all markets.

In the specific case where everything is symmetric, the equilibrium will be one in which both firms produce the same output and have equal market shares. This equilibrium is possible in two situations:

(1) If both firms produce identical products, have the same cost functions and also face equal access costs.

(2) In a Spence - Dixit - Stiglitz kind of setting with equal access costs.

Starting from this position, if an access advantage appears for one firm, it will lead to an increased production from that firm. This establishes that a country with only an access advantage in one market will be producing and selling more, thereby penetrating all markets.

CHAPTER-4

CONTESTABLE MARKETS

Economies of scale internal to the firm are incompatible with perfect competition. In the previous chapter, we had a model of duopoly. In this chapter, we shall deal with a different kind of market structure namely, contestable markets. The objective is to study the implications of differential access cost in this context.

In imperfectly competitive markets, there is no reason to expect that price will be equated to average cost. However, as shown by Baumol, Panzar and Willig (1982) [1], under certain circumstances, average cost pricing will be the norm even when economies of scale lead to the presence of only a few firms or even a single firm in the market. Such markets are described as contestable markets. Baumol defines it as follows: "A contestable market is one into which entry is absolutely free, and exit is absolutely costless[2]". Freedom of entry means, that the entrant suffers no disadvantage in terms of production technique or perceived product quality relative to the incumbent. As Baumol puts it, "In short, it is a requirement of contestability that there is no cost discrimination against entrants[3]".

A contestable market offers only a normal rate of profit even if it is oligopolistic or monopolistic. Firms will be unable to exploit their

1. Baumol, W.J, Panzar, J.C, and Willing, R.D, Contestable markets and the Theory of Industrial Structure, San Diego: Harcourt Brace Jovanovich, 1982.

2. Baumol, W.J., "Contestable Markets : An uprising in the Theory of Industrial Structure" American Economic Review, Vol.72, No.1, March 1982, pp 3.

3. Ibid, pp4.

market power when the market is contestable. This is mainly due to the presence of potential competitors who are able to enter and exit rapidly from the market. The established firms have no cost advantage over these potential competitors. Any economic profit earned by an incumbent constitutes an earning opportunity for an entrant. A positive profit means an entrant can set-up business, produce the same output as the incumbent and at the same cost, undercut the incumbent's price slightly and still earn a profit. The contestable market hypothesis assumes Bertrand behaviour. Each oligopolist or player in the game assumes the other player's price to given and looks for a profitable opportunity to undercut. It is the combination of free entry and exit and Bertrand behaviour which leads to the outcome of zero profits in equilibrium.

The theory of contestable markets analyzes the determination of industrial structure endogenously. This derives from the second welfare property of contestable market equilibria, namely, their incompatibility with inefficiency of any sort including inefficiency in industrial organization. Hence the industrial structure will be the one which is most efficient for the production of a given output vector. If economies of scale hold throughout the relevant range, single firm production will be most economical - we have a natural monopoly. Similarly, if two firms can produce the given output vector at a total cost lower than it can be done by three or more firms the industry is a natural duopoly for the given output vector.

We first look at the equilibrium in the market for a single product in a closed economy.[4] The demand for the product is given by D (p), where p denotes the price of the product. We assume that there are a number of firms potentially able to produce the product having the same average cost function: $c(w,x_j)$ where w is the vector of factor prices and x_j is the output of the jth firm. The product is produced with increasing returns to scale.

A contestable market equilibrium is defined by three things: i) the number of firms in the market, m; ii) the output of these firms $(x_1, .. x_m)$; and iii) the market price, p.

There are three conditions for equilibrium:

First, the market must clear

$$\sum_{j=1}^{m} x_j = D(p) \tag{1}$$

Second, the equilibrium must be feasible in the sense that no firm is making losses:

$$p \geqslant c(w,x_j) \qquad \text{for } j=1, \ldots\ldots m \tag{2}$$

Third, the equilibrium must be sustainable in the sense that no firm can profitably undercut the market price:

4. Discussion is based on Helpman and Krugman (1985) Ch.4.

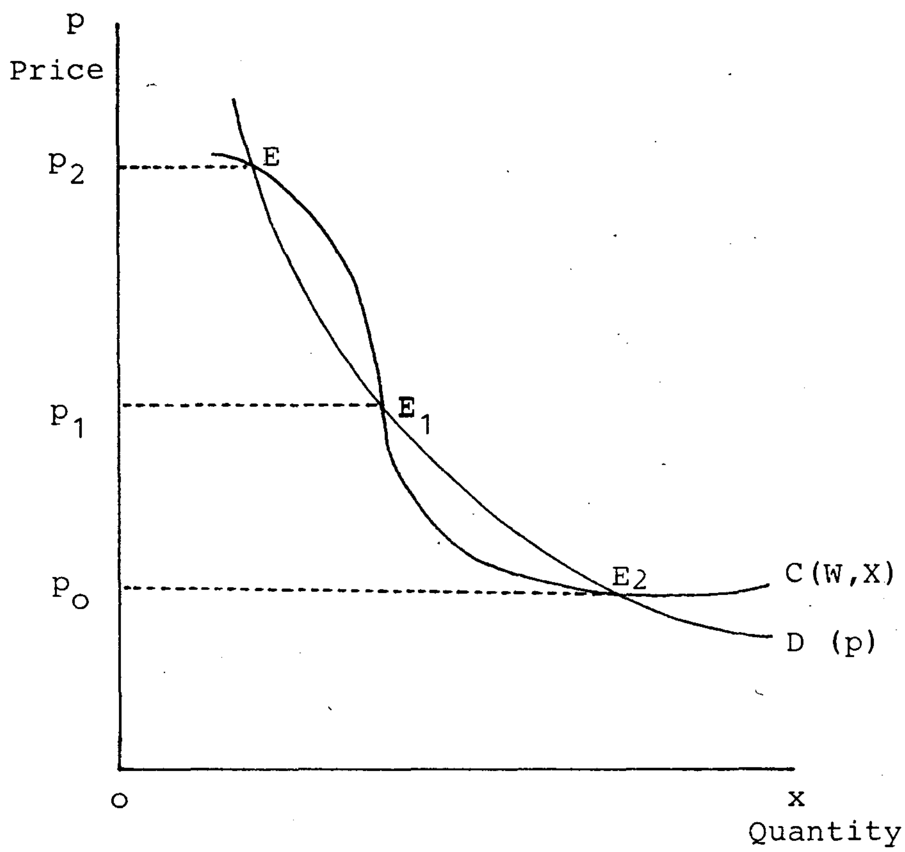
for all $p^e \leqslant p$ (3)

$p^e \leqslant c(w,x^e)$; where $x^e = D(p^e)$ and p^e is the price charged by the entrant.

This definition of equilibrium suggests that in a closed economy, any good subject to increasing returns, must be produced by a single monopolist and priced at average cost. Any departure of price from average cost provides the entrant with an opportunity to profitably undercut the incumbent.

There may be more than one level of output at which price equals average cost. In fig. 4.1, there are three price output combinations for which prie = average cost or $p = c[w,D(p)]$. Applying the Marshallian stability criteria, one may say that there are two stable equilibria at E and E_2. The supply curve cuts the demand curve from below at these points. In contestable markets, prices above p_0 will not be sustainable because there exists a range of prices from p_0 to p_1, where price exceeds average cost. In such a case, the contestable market equilibrium is the lowest of these prices.

Thus if there are multiple intersections between the demand curve for the good and the unit cost curve of the lowest-cost monopolist, the contestable market equilibrium will be given by the lowest price at which price will be equal to average cost. In other words, the price is minimized subject to a break-even constraint.



Multiple Equilibria

FIGURE 4.1

Let us consider an open economy. Suppose there are $k \geq 2$ countries and let w^k be the factor prices of country k and vector of numbers of firms $(m^1 \; .... \; m^k)$ where m^k is the number of firms in country k, the vector of output is given by

$$(x^1_1 \; ... \; x^1_{m^1} \; ; \; ..... \; ; \quad x^k_1 \; ..... \; x^k_{m^k} \;)$$

The three conditions for equilibrium are:

First, market must clear;

i.e., $\sum_{k \in K} \sum_{j=1}^{m^k} x^k_j = D(p)$ where D(p) is the world demand.

Second, equilibrium must be feasible:

$$p \geq c \; (\; w^k, \; x^k_j, \text{ for all } k \in K \text{ and } j=1, \; .....m^k$$

Third, the equilibrium must be sustainable, for all $p^e \leq p$

$$p^e \leq c \; (w^k, \; x^e) \text{ for all } k \in K \text{ where } x^e = D \; (p^e)$$

Given this definition of equilibrium, the theory of contestable markets implies that every good subject to increasing returns will be produced by a single firm and priced at average cost. Its production will be located in whichever country offers the minimum price consistent with zero profits.

It is interesting to see what this theory implies for the frame work of the previous chapter of two firms h and f competing in two markets 1 and 2. We assume that firm h has an access advantage in market 1 i.e. its unit access cost to market 1, t_1 is lower than that of firm f, t_1^*. We assume also that both firms have the same unit access cost to market 2 i.e. $t_2 = t_2^*$ where t_2 and t_2^* are the unit access costs to market 2 for firms h and f respectively. It is further assumed that both firms produce identical poducts and have the same unit production cost functions. The cost per unit of output sold in any market will be a sum of unit production cost and unit access cost to that market for the firm concerned. Let c(s) and $c(s^*)$ denote the unit production cost functions for firms h and f respectively, where s and s^* are the outputs of these firms. The cost per unit of output sold in market 1 is $[c(s) + t_1]$ for firm h, and $[c(s^*) + t_1^*]$ for firm f. Similarly, the cost per unit of output sold in market 2 is $[c(s) + t_2]$ for firm h and $[c(s^*) + t_2]$[5] for firm f.

Economies of scale are internal to the firm and markets are contestable. Let the demand functions in the two markets be represented by $D_1 = f_1 (p_1)$ and $D_2 = f_2 (p_2)$, whereD_1 and D_2 denote demand while p_1 and p_2 are the priicces of the product in markets 1 and 2 respectively. The conditions for contestable market equilibrium are : i) markets must clear; ii) the equilibrium must be feasible; iii) the equilibrium must be sustainable.

---

5. We are using the assumption that both countries have the same unit access cost to market 2 i.e. $t_2 = t_2^*$.

Let S_{11} and S_{21} denote the volume of sales in market 1, S_{12} and S_{22} denote the volume of sales in market 2 of firms h and f respectively. We have $S = S_{11} + S_{12}$ ad $S^* = S_{21} + S_{22}$ i.e. output of each firm is the sum of sales in both markets. We denote supply in market 1 by S_1 and that in market 2 by S_2. Since supply in each market will be the sum of sales volume of both firms, we have $S_1 = S_{11}+S_{21}$ and $S_2=S_{12}+S_{22}$. Market clearance requires that supply equals demand in each market, i.e,

$$S_1 = D_1 = f_1(p_1) \text{ and } S_2 = D_2 = f_2\ (p_2)$$

For the firm to break even, the price in each market must be equal to the sum of unit production cost and unit access cost to that market. Since firm h has an access advantage in market 1, it can match and profitably undercut any price offered by firm f in that market.. Suppose firm f sells an output of $\bar{S}_{21}$ in market 1 at a price of p_1 such that $p_1 = c\ (\bar{S}_{21} + \bar{S}_{22}) + t_1^*$ where $\bar{S}_{22}$ is its sales volume in market 2. Firm h can replicate the same level of output at the same cost, sell at a slightly lower price in market 1 and yet make a profit because of its access advantage. Therefore, firm h corners the first market. With this, firm h finds itself in a position to match and profitably undercut any price offered by firm f in market 2 also. Thus, both markets will be serviced by the country with access advantage.

In the analysis so far we are assuming that the country with access advantage has enough capacity to meet the demand i.e. there are no capacity constraints operative. It is interesting to speculate what the outcome would be if there were capacity constraints. Suppose both countries can produce a maximum of $\bar{S}$ and no more. If the limited capacity can be acquired by a firm at a cost lower than its competitive market price by some kind of non-market process, then it will constitute a barrier to entry and might generate rents (or excess profits) for the incumbents. This would be contrary to the assumption of the Contestable Market Hypothesis. Therefore, in order to preserve the spirit of the theory, we must assume that the limited capacity has to be acquired through the competitive bidding process which dissipates whatever rents the holders of capacity might otherwise get. An example of such a situation is where a firm depends on a fixed supply of a natural resource or a capital good which sets a rigid limit to output. The firm has to bid for such resources against potential rivals. Alternatively, the government might license capacity in the industry subject to a ceiling and auction the licenses to the highest bidder. In these cases, the excess profits accrue to the person supplying the scarce resource or to the government if capacity is licensed.

We are assuming that both countries can produce a maximum output of $\bar{S}$. If the demand is sufficient to accommodate two firms operating at full capacity, there would be a natural duopoly. Problem arises if demand is insufficient to accommodate two firms operating at full capacity. There would be three possibilities: i) firm h operates at full capacity while firm f operates below capacity; ii) firm f operates at full capacity while h operates below capacity; iii) firms f and h both operate below capacity. If the criteria of lowest total cost for producing a given output vector is used, possibility of firm h operating below capacity gets rejected. Possibility of both operating below capacity will not lead to a stable outcome. This is because each firm, by expanding its output, can produce more cheaply and undercut the price of the other firm. This leaves us with the possibility of firm h operating at full capacity while firm f operates below capacity.

At first sight, it appears that possibility (i) will violate the zero profit condition as firm h will make excess profits. Given competitive bidding for the limited capacity, these excess profits will accrue to the suppliers of capacity or scarce resources in the country with access advantage. This provides an incentive for the suppliers of scarce resources to increase their supply. If ceiling on capacity is due to government licensing, it provides a signal to the government to increase capacity. Even if one were to start with identical capacity constraints for both countries the country with access advantage will have larger capacity in the next period and will be able to increase its penetration in all markets.

CHAPTER-5

SUMMARY AND CONCLUSIONS

In this dissertation, an attempt has been made to show, in a variety of models with different market structures, that access advantage confers benefits in the form of economies of scale on the manufacturing industry. This gives the industry a competitive edge even in markets where it does not have an access advantage. The combination of access advantage and scale economies helps in part, to explain success in export markets.

We have tried to study the implications of differential market access in a variety of market structures : perfect competition, Cournot duopoly and contestable markets. In Chapter 2 we had a model of competition between two countries in a common market. Economies of scale were assumed to be external. The focus was mainly on the consequences of growth in income which is interpreted as analogous to the growth of the market. In the specific case where the market is Marshal stable, we found that with a growth in the market, the country with access advantage increases its market share. If t_1 and t_2 denote the unit access costs of countries 1 and 2 to the common market while S_1 and S_2 denotes their sales volume, we found that $t_1 < t_2$ implies that $S_1 > S_2$. With a growth in income, $dS_1/S_1 > 1$, implying that the relative increase in the sales volume of country 1 is greater than the relative increase in the sales volume of country 2.

Generalization of the model to competition in several markets rather than a single one would enhance the effect of advantageous market access on market shares. It should be possible to show that, growth of one market in which the country concerned has an access advantage enables its industry to enjoy scale economies and increase its market share in other markets too, in which it may not have an access advantage.

Internal economies of scale are incompatible with perfect competition. Therefore, in modelling the implications of differential access costs when economies of scale are internal to the firm, we used two models: Cournot duopoly and contestable markets. In Chapter 3 we had two firms h and f located in countries H and F and competing in two markets 1 and 2. The model used was based on Krugman (1984). We showed, in the restrictive case with linear inverse demand functions and marginal cost functions that the firm with an access advantage in only one market sells more than the other firm in both markets. In the general case it was shown that an increase in access advantage for firm h in market 1 enables it to expand its sale volume in both markets. Thus, a firm with an access advantage in one market only produces and sells more and penetrates all markets. In the model, scale economies took the form of declining marginal cost of production. This decline in marginal cost was due to an increase in the output of the firm. Marginal costs can also be reduced through prior investment in R&D or if there are learning effects. The presence of all or some of these factors would enhance the effect of access advantage on the output and the market share of the firm in all markets.

We finally looked at a different kind of market structure i.e. contestable markets. The work in this area is fairly recent and it has been described by Baumol as an "Uprising in the theory of Industrial Structure". We used the same two country, two market framework. It was shown that both markets will be serviced by the firm with access advantage. This was on the assumption of existence of sufficient capacity to cater to both markets. In the presence of capacity constraints and insufficient demand to enable two firms to operate at full capacity, we argued that the firm with access advantage will operate at full capacity while the other firm operates below capacity. Crucial to this kind of reasoning is the assumption that there is competitive bidding for the limited capacity which ensures that any excess profits accruing to the firm with access advantage are siphoned off by the suppliers of scarce resources which set a limit on capacity or by the government if capacity is licensed. This provides an incentive to the supplier of scarce resources to increase the supply. Even if we were to start with identical capacity constraints for both countries, in the next period the country with access advantage will have larger capacity and it will be able to progressively penetrate other markets.

Other kinds of market structure like Monopolistic Competition and also other types of oligopoly assumptions, can be used to analyse the effect of differential access cost. It is very likely that these would also give similar conclusions.

This kind of analysis helps to explain the peculiar locational concentration of successful high export growth regimes. A recent example of such concentration is in the Pacific, the countries concerned are Republic of Korea, Hongkong, Taiwan and Singapore. This locational concentration of industrial exporting countries was true even in the 19th Century. We find development is concentrated in geographically proximate countries in particular periods. An example is the spread of the Industrial Revolution from Great Britain.

This analysis also has implications for trade strategy. The conventional belief in the superiority of free trade requires rethinking in the light of the fact that many of the assumptions underlying the conventional analysis are unrealistic in the present day context. Krugman attempts to model the idea that exports can also be built up by protecting domestic market. Perhaps exports can be built up by starting from import substitution in areas where economies of scale are significant. If there is no exogenous locational advantage, one could give domestic firms at least an access advantage in their own market. Of course, there is no guarantee that protection will not foster a high cost; low quality industrial struture. What is being suggested is not blanket protection but protection of a few activities where economies of scale are significant. However, the analysis is too rudimentary to be able to draw any policy conclusions. Hence, except for drawing attention to a few issues, no attempt is made to draw on any policy conclusions.

APPENDIX 1

1. Proof of the proposition that consequences of income growth for the sales volumes of the two countries can be inferred from :

$$\frac{dS_1/S_1}{dS_2/S_2} = \frac{S_2\, \psi'\,(S_2)}{S_1\, \psi'\,(S_1)}$$

$$S_1 = Y^{\epsilon_y}[\, S_1^{-\eta} + t_1]^{-\epsilon_o}[\, S_2^{-\eta} + t_2]^{\epsilon_c} \qquad \text{A.1}$$

$$S_2 = Y^{\epsilon_y}[\, S_2^{-\eta} + t_2]^{-\epsilon_o}[\, S_1^{-\eta} + t_1]^{\epsilon_c} \qquad \text{A.2}$$

If we take all terms except Y^c to the left hand side, we get :

$$Y^{\epsilon_y} = S_1\,[\, S_1^{-\eta} + t_1]^{\epsilon_o}\,[\, S_2^{-\eta} + t_2]^{-\epsilon_c} \qquad \text{A.3}$$

$$Y^{\epsilon_y} = S_2\,[\, S_2^{-\eta} + t_2]^{\epsilon_o}\,[\, S_1^{-\eta} + t_1]^{-\epsilon_c} \qquad \text{A.4}$$

If we take logarithms on both sides of the above expression, we get :

$$\epsilon_y \ln Y = \ln S_1 + \epsilon_o \ln [\, S_1^{-\eta} + t_1] - \epsilon_c \ln [\, S_2^{-\eta} + t_2] \qquad \text{A.5}$$

$$\epsilon_y \ln Y = \ln S_2 + \epsilon_o \ln [\, S_2^{-\eta} + t_2] - \epsilon_c \ln [\, S_1^{-\eta} + t_1] \qquad \text{A.6}$$

Total differentiation of A.5 and A.6 yields :

$$\frac{\epsilon_y}{Y} dY = \frac{1}{S_1} dS_1 + \frac{\epsilon_o [-\eta S_1^{-\eta-1}] \, dS_1}{[S_1^{-\eta}+t_1]} - \frac{\epsilon_c [\, -\eta S_2^{-\eta-1}] \, dS_2}{[S_2^{-\eta}+t_2]} \qquad \text{A.7}$$

$$\frac{\epsilon_y}{Y} dY = \frac{1}{S_2} dS_2 + \frac{\epsilon_o [-\eta S_2^{-\eta-1}] \, dS_2}{[S_2^{-\eta}+t_2]} - \frac{\epsilon_c [\, -\eta S_1^{-\eta-1}] \, dS_1}{[S_1^{-\eta}+t_1]} \qquad \text{A.8}$$

This may be written as :

$$\frac{\epsilon_y}{Y} = \frac{1}{S_1}\frac{dS_1}{dY} - \frac{\eta\epsilon_o S_1^{-\eta}}{[S_1^{-\eta}+t_1]S_1}\frac{1}{}\frac{dS_1}{dY} + \frac{\eta\epsilon_c S_2^{-\eta}}{[S_2^{-\eta}+t_2]S_2}\frac{1}{}\frac{dS_2}{dY} \qquad \text{A.9}$$

$$\frac{\epsilon_y}{Y} = \frac{1}{S_2}\frac{dS_2}{dY} - \frac{\eta\epsilon_o S_2^{-\eta}}{[S_2^{-\eta}+t_2]S_2}\frac{1}{}\frac{dS_2}{dY} +$$

$$\frac{\eta\epsilon_c S_1^{-\eta}}{[S_1^{-\eta}+t_1]S_1}\frac{1}{}\frac{dS_1}{dY} \qquad \text{A.10}$$

If we equate the right hand side of A.9 and A.10 we get:

$$\frac{1}{S_1}\frac{dS_1}{dY}\left[1 - \frac{\eta\epsilon_o S_1^{-\eta}}{[S_1^{-\eta}+t_1]} - \frac{\eta\epsilon_c S_1^{-\eta}}{[S_1^{-\eta}+t_1]}\right]$$

$$= \frac{1}{S_2}\frac{dS_2}{dY}\left[1 \quad \frac{-n\epsilon_o S_2^{-\eta}}{[S_2^{-\eta}+t_2]} - \frac{n\epsilon_c S_2^{-n}}{[S_2^{-\eta}+t_2]}\right] \qquad \text{A.11}$$

$$= \frac{1}{S_1}\frac{dS_1}{dY}\left[1 - \frac{\eta\,\beta S_1^{-\eta}}{S_1^{-\eta}+t_1}\right] = \frac{1}{S_2}\frac{dS_2}{dY}\left[1 - \frac{\eta\;\beta\;S_2^{-\eta}}{S_2^{-\eta}+t_2}\right] \qquad \text{A.12}$$

$$= \frac{1}{S_1}\frac{dS_1}{dY}\left[\frac{(1-\eta\;\beta)\;S_1^{-\eta}+t_1}{S_1^{-\eta}+t_1}\right] = \frac{1}{S_2}\frac{dS_2}{dY}\left[\frac{(1-\eta\;\beta)S_2^{-\eta}+t_2}{S_2^{-\eta}+t_2}\right]$$

A.13

$$\therefore \quad \frac{dS_1/dY}{dS_2/dY} = \frac{S_1[S_1^{-\eta}+t_1]}{S_2[S_2^{-\eta}+t_2]} \cdot \frac{[(1-\eta\ \beta)\ S_2^{-\eta}+t_2]}{[(1-\eta\ \beta)\ S_1^{-\eta}+t_1]} \qquad A.14$$

Since $S_1\ [S_1^{-\eta}+t_1]\ \beta = S_2\ [S_2^{-\eta}+t_2]\ \beta$

We have $\dfrac{[S_1^{-\eta}+t_1]}{[S_2^{-\eta}+t_2]} = \dfrac{S_2^{1/\beta}}{S_1^{1/\beta}}$ A.15

Substuting equation (A.15) in (A.14) we get

$$\frac{dS_1/dY}{dS_2/dY} = \frac{S_2^{1/\beta-1}\ [(1-\eta\ \beta)\ S_2^{-\eta}+t_2]}{S_1^{1/\beta-1}\ [(1-\eta\ \beta)\ S_1^{-\eta}+t_1]} \qquad A.16$$

$$\frac{dS_1/dY}{dS_2/dY} = \frac{\psi'(S_2)}{\psi'(S_1)} \qquad A.17$$

(A.17) may also be written as,

$$\frac{dS_1/S_1}{dS_2/S_2} = \frac{S_2\ \psi'(S_2)}{S_1\ \psi'(S_1)} \qquad A.18$$

2. To show that

$$\frac{dS_1/S_1}{dS_2/S_2} = \frac{S_2\ \psi'(S_2)}{S_1\ \psi'(S_1)} = \frac{\psi(S_2)-\eta\ \beta\ S_2^{1/\beta-\eta}}{\psi(S_1)-\eta\ \beta\ S_1^{1/\beta-\eta}} \qquad A.19$$

We know that

$$\psi'(S_1) = S_1^{\,1/\beta-1}\,[(1/\beta-\eta)\,S_1^{-\eta} + t_1/\beta] \qquad \text{A.20}$$

and

$$\psi'(S_2) = S_2^{\,1/\beta-1}\,[(1/\beta-\eta)\,S_2^{-\eta} + t_2/\beta] \qquad \text{A.21}$$

From (A.20) and (A.21) we find that

$$S_1\,\psi'(S_1) = S_1^{\,1/\beta}\,[(1/\beta-n)\,S_1^{-\eta} + t_1/\beta] \qquad \text{A.22}$$

$$= [(1/\beta-\eta)\,S_1^{\,1/\beta-\eta} + \frac{t_1}{\beta}\,S_1^{\,1/\beta}]$$

$$= 1/\beta\,[S_1^{\,1/\beta-\eta} + t_1\,S_1^{\,1/\beta}] - \eta\,S_1^{\,1/\beta-\eta}$$

$$= \frac{\psi\,(S_1)}{\beta} - \eta\,S_1^{\,1/\beta-\eta} \qquad \text{A.23}$$

and similarly

$$S_2\,\psi'(S_2) = \frac{\psi(S_2)}{\beta} - \eta\,S_1^{\,1/\beta-\eta} \qquad \text{A.24}$$

We know that

$$\frac{dS_1/S_1}{dS_2/S_2} = \frac{S_2\,\psi'(S_2)}{S_1\,\psi'(S_1)}$$

On substituting for $S_1\,\psi'(S_1)$ and $S_2\,\psi'(S_2)$ from (A.24) we get,

$$\frac{dS_1/S_1}{dS_2/S_2} = \frac{\psi(S_2)-\eta\,\beta\,S_2^{\,1/\beta-\eta}}{\psi(S_1)-\eta\,\beta\,S_1^{\,1/\beta-n}}$$

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