CHAPTER II

REVIEW OF RELATED LITERATURE AND THEORETICAL FRAMEWORK

The elaborate tax incentive programs in each country have been so designed to promote both domestic and foreign investments. Normally, no practical distinction exists between domestic and foreign investments in terms of eligibility for promotional status and the types and extent of incentives to be granted. This is the reason why domestic and foreign investors are treated the same when we measure the effects of tax incentives on the cost of capital services to firms. Insofar as we are solely concerned with domestic investment or investment in any one country, the differential incentives applicable to various sectors or regions which may have resulted from tax incentives-related measures can affect the allocation of resources in the economy. When the differential incentives prevail between countries, these differentials should lead to the reallocation of resources between countries.

The effect of a country's tariff system on the allocation of resources can be captured by the theory of effective protection. This theory has been devised to measure the effects of output market distortions, such as tariffs and quotas, on the allocation of resources. In general form, the effective protection rate for a given sector j (EPRj) can be expressed as a percentage by which the value added with distortions (protective value added) exceeds the free-trade value added (non-protective value added), that is,

$$EPRj = \frac{VA_p - VA_{np}}{VA_{np}}$$

where VA_p = protective value added (value added in domestic market price)

VA_{np} = non-protective value added (free-trade value added).

While the EPR measure has taken into account the effects of tariffs, quotas and taxes on resource allocation, it has generally excluded the effects of factor market distortions (factor-based incentives) from the analysis. Factor-based incentives (i.e. investment incentives) provide an alternative form of protection and, hence, may be considered as determinants of resource allocation. The rental cost of capital measure has been developed to take account of these factor-based incentives, and tries to measure the effects of such incentives on resource allocation in an economy.

When differential tax incentives exist across countries and are deliberately created so as to attract investment, this should result in the reallocation of resources across countries. In the narrowly defined case of allocation of capital, differential incentives provided to capital investments should lead to the flow of capital across countries. The theories of foreign direct investment provides a sound explanation for the location decision of foreign firms which may be influenced by investment incentives in host countries.

The first section of this chapter deals with a brief review of the theories of foreign direct investment, while the theoretical framework used in the study is introduced in the second section.

The Theories of Foreign Direct Investment [1]

Over the past twenty years the positive theory of international

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[1] This section draws heavily upon various writings by Professor John H. Dunning.

economic involvement has, for most of the period, comprised two quite separate strands.[2] The first concerned explanation of trade flows; there were two main approaches to this strand : the neofactor theories, and the neotechnology and scale economy theories. The second strand of research centred on explaining the growth and composition of foreign direct investment, or of production financed by such investment. Earlier but less helpful approaches to this strand were based either on orthodox location theory or neoclassical investment doctrine. The more recent approaches to explaining international production were based on industrial organization theory, which focuses on the distinctive features of foreign direct investment in terms of ownership advantages, and the theory of market failure. By the late 1970s, there was a theoretical breakthrough which sought to integrate earlier competing theories of foreign direct investment into a general theory which is known as the 'eclectic approach.'

The remainder of this section briefly reviews newer theories of foreign direct investment and, finally, reference will be made to the eclectic theory.

A. Industrial Organization and Market Structure

The industrial organization approach to understanding 'why international production?' concentrates on identifying the characteristics of multinational enterprises that give them a net competitive

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2 For an excellent survey of various approaches to explaining international production and international direct investment prior to the early 1970s, see John H. Dunning, "The Determinants of International Production," Oxford Economic Papers 25 (November 1973) : 289-336.

advantage over other firms that might otherwise supply the same foreign markets. It was in his doctoral dissertation that Hymer, based on Bain's notion of barriers to entry, refined and formalized the distinctive features of foreign direct investment in terms of ownership advantages of foreign firms into a theory of foreign investment.[3] Out of this approach, later refined and extended by Caves,[4] several hypotheses, focusing on particular kinds of ownership advantages of multinational enterprises, were put forward : for example, access to superior technology,[5] better capabilities for product differentiation.[6] Of the ownership advantages which seem to best explain such investment, superior technology and innovative capacity and product differentiation consistently appear to have the best explanatory power.

Ownership-specific endowments are internal to particular enterprises; they consist of tangible and intangible resources, such as natural resources, manpower and capital, organizational and entre-

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[3] Stephen Hymer, The International Operations of National Firms : A Study in Direct Investment (unpublished doctoral dissertation, M.I.T., 1960), quoted in John H. Dunning, International Production and the Multinational Enterprise (London : Allen & Unwin, 1981), Ch.4, p.73.

[4] Richard E. Caves, "International Corporations : The Industrial Economics of Foreign Investment," Economica 38 (February 1971) : 1-27.

[5] Harry G. Johnson, "The Efficiency and Welfare Implications of the International Corporation," in The International Corporation, ed. C.P. Kindleberger (Cambridge, Mass. : MIT Press, 1970), pp.35-56.

[6] Caves, "International Corporations : The Industrial Economics of Foreign Investment," Economica.

preneurial skills, and technology. Most of these benefits, both individually and collectively, have been used by economists to explain the participation of affiliates of multinational enterprises in the output of industries in host countries, but as Dunning has put it: "These theories, too, have been subject to some testing, but again it seems clear that no single hypothesis offers a satisfactory explanation of non-trade involvement." [7]

B. Internalization Hypothesis

There has also been a major new theoretical thrust in seeking an explanation for international production as an extension to the theory of the firm. The main approach has been to apply the theory of market failure to explaining foreign activities of multinational enterprises, using the principles based on information markets and the economics of transaction costs. The thesis is that the international competitiveness of a country's products is attributable not only to the possession of superior resources and, in some cases, the necessity of its enterprises but also to the desire and ability of those enterprises to internalize the advantages resulting from this possession; and that servicing a foreign market through foreign production confers unique benefits of this kind. [8] The incentives of firms to internalize activities are basically to avoid the disadvantages of or capitalize on the advantages of imperfections or disequilibria in external mechanisms of resource allocation; these mechanisms are mostly of two kinds - the price system

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[7] Dunning, International Production and the Multinational Enterprise, Ch.2, p.23.

[8] Ibid., p.28.

and public authority fiat. Other reasons for internalizing their operations across boundaries include, for example, the desire to minimize the risk and/or costs of fluctuating exchange rates; to be able to take advantage of differential interest rates; and to adjust the distribution of their short-term assets between different currency areas.[9]

Hirsch first took up systematically the problem of choosing between a different set of options of servicing a foreign market by producing a model identifying the conditions under which a firm might exploit its ownership advantages through exports or foreign direct investment.[10] In the late 1970s, various economists, for example, Buckley and Casson,[11] and Magee[12] sought to explain the propensity of firms to engage in foreign direct investment, rather than to license

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[9] Alan M. Rugman, "Internalization as a General Theory of Foreign Direct Investment : A Reappraisal of the Literature," Weltwirtschaftliches Archiv 116 (1980) : 365-379.

[10] Seev Hirsch, "An International Trade and Investment Theory of the Firm," Oxford Economic Papers 28 (July 1976) : 258-279.

[11] P.J. Buckley and M.C. Casson, The Future of the Multinational Enterprise (London : Macmillan, 1976).

[12] S.P. Magee, "Information and the Multinational Enterprise : An Appropriability Theory of Direct Foreign Investment," in The New International Economic Order, ed. J.N. Bhagwati (Cambridge, Mass. : MIT Press, 1977), pp.317-340.

or sell their proprietary assets to foreign firms, in terms of market disequilibrium. This approach helps explain by which route a firm chooses to exploit any advantages it possesses over its foreign competitors.

C. The Eclectic Approach

Due to the dissatisfaction with partial explanations of international production by these new theories, and the lack of a formal model relating it either to trade or other modes of resource transfer, economists have turned to favour a more eclectic approach to the subject. The credit for a theoretical breakthrough in the late 1970s goes to Dunning who sought to integrate the theories of foreign direct investment into a general theory, which is subsequently known as the 'eclectic theory.'[13] In his eclectic approach he hypothesizes that foreign direct investment (international production) is a function of ownership, internalization and locational advantages. He puts these variables in the form of three conditions which a firm has to satisfy in order to undertake a particular foreign direct investment. The eclectic approach draws upon and integrates three strands of economic theory, viz. industrial organization theory, the theory of property rights and the economics of transaction costs, and theories of trade and location, to explain the ability and willingness of firms to serve markets, and the reason why they choose to exploit

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[13] John H. Dunning, "Trade, Location of Economic Activity and the MNE : A Search for an Eclectic Approach," in The International Allocation of Economic Activity, eds. B. Ohlin, Per Ove Hesselborn and Per Magnus Wijkman (London : Macmillan, 1977), Ch.12; John H. Dunning, "Explaining Changing Patterns of International Production : In Defence of the Eclectic Theory," Oxford Bulletin of Economics and Statistics 41 (November 1980):269-296

this advantage through foreign production rather than by domestic production, exports or portfolio resource flows. Industrial organization theory mainly explains the nature of ownership advantages. The theory of property rights and the economics of transaction costs explain why firms should choose to internalize these advantages. Theories of location and trade explain the factors determining the location of production.

The three conditions that a firm has to satisfy in order to undertake a particular foreign direct investment can be briefly stated: multinationals will invest outside their boundaries when they have ownership (O) advantages over the indigenous firms in the country in which they operate, which they find it beneficial to internalize rather than lease to local firms, and which they use in combination with immobile resource endowments located in foreign countries. The eclectic theory suggests that all forms of international production by all countries can be explained by reference to the above conditions.

Although the foregoing discussion of the eclectic theory of international production is entirely concerned with home country (i.e. investing country) characteristics, we can still make use of the approach to explain the location decision of foreign firms by referring to and focusing on the third kind of advantage, i.e. location-specific advantages. The eclectic approach hypothesizes that at least some of the three kinds of advantages will not be evenly spread across countries, industries and enterprises. Given ownership-specific and internalization incentive advantages-both of which are entirely specific to and possessed by the investing firm, and therefore cannot be influenced directly by policies of host countries - the more location-specific advantages favour a foreign location, the more likely the investing

firm will locate its production unit abroad. When we are concerned with more than one host country for foreign investment, the locational cost-based criterion may serve to explain the location decision of foreign firms. That is, if the locational advantages do not favour a domestic production unit (which may result from, say the provision of less attractive tax incentives relative to those offered in host countries) and these advantages are not evenly spread across host countries, then, ceteris paribus, foreign firms are expected to locate their operations in the host country where costs are lowest. [14] This plausible proposition is in fact a supply-oriented approach of location theory which constitutes part of the eclectic theory. Based on this proposition, we turn in the next section to the theoretical framework used in the study and examine how the effect of investment incentives on capital investment in host countries can be measured.

Theoretical Framework

A. The Rental Cost of Capital Measure

The rental cost, or user cost, of capital is defined as the cost per one period of using a unit of capital (where the interest cost of fund, tariffs and taxes, and the tax treatment of corporate income are taken into account). The rental cost of capital model to be presented in this section was developed by Bond and Guisinger in 1983 for an open

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[14] Of course, there is a host of factors which influence cost considerations of firms in any location, but investment incentives are by far one of the most important that can affect the incentive of firms to invest in fixed capital.

economy.[15] The model can be used to incorporate various types of investment incentives into a single index that indicates the combined effect of these incentives on the cost of capital services to firms. In addition, the model can be useful in making cross-country comparisons of the level of investment incentives.

Before we shall proceed with the derivation of the expression for the rental cost of capital, let us first specify the general relationship among the rental cost of capital and the variables that determine it. The rental cost of capital would depend on several factors. First, it would be affected by the price of a unit of capital good (q) and the (real) rate of interest (r).[16] The higher the supply price of capital, the higher the rental cost; and the higher the interest cost of fund, the higher the rental cost. Second, it would be dependent upon the rate of economic depreciation (δ). The higher the rate of economic depreciation, the higher the maintenance and replacement cost of equal-quality capital service and, hence, the higher the rental cost. Third, the rental cost would be contingent upon the way in which capital usage is treated in the framework of tax and tariff policy.

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[15] Bond and Guisinger, "The Measurement of Investment Incentives Using the Rental Cost of Capital Model."

[16] Actually, a distinction should be made here among alternative rates of interest in order to take account of the differential rates applying to the sources of financing of capital expenditures. But this refinement is ignored here since we assume that the only source of financing is equity issues.

Assuming that capital goods are imported, and these capital goods are subject to the tariff at rate τ .[17] It should be clear that a rise in the tariff rate will cause an increase in the domestic price of the capital goods. Since most capital investment is undertaken by the corporate sector, the tax variable is the corporate tax rate (u). Using the connotation that the corporate income tax is considered as an extra cost of using capital, it should be apparent that an increase in the corporate tax rate will result in a rise in the cost of capital services. On the contrary, the corporate tax system allows the firm a depreciation deduction for tax purposes in arriving at taxable corporate income. The more rapidly firms are allowed to depreciate capital, the higher the present value of depreciation allowances (denoted by z), and, therefore, the lower the rental cost of capital.[18] In addition, firms may be permitted to deduct a certain proportion of the purchase price from their new capital purchases; this tax provision is known as the investment tax credit (or investment grant). Therefore, the investment tax credit at rate k lowers the rental cost to the firm.

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17 The assumption of imported capital goods is largely justified since most developing countries acquire most of their capital goods through imports.

18 Rapid depreciation of capital expenditures depends on : a useful life for tax purposes of capital; an initial allowance; an annual allowance;type of the asset; and the method by which depreciation is calculated.

The above comments can now be condensed by specifying the rental cost of capital as a function of the variables mentioned. Denoting rental cost by c, the function is given by

$$c = c(q, r, \delta, \tau, k, u, z)$$

where

$$\frac{\partial c}{\partial q}, \quad \frac{\partial c}{\partial r}, \quad \frac{\partial c}{\partial \delta}, \quad \frac{\partial c}{\partial \tau}, \quad \frac{\partial c}{\partial u} > 0$$

and

$$\frac{\partial c}{\partial k}, \quad \frac{\partial c}{\partial z} < 0.$$

Having discussed the relationship among the rental cost and its determining variables, we now set forth to derive a particular equation for the rental cost expressing it as dependent upon these variables. The rental cost of capital measure used by Bond and Guisinger is based on the assumption of a profit-maximizing firm in a competitive environment, so that investment is undertaken up to the point where the discounted cash flow from operating a unit of capital equals the cost of the capital good.[19] We shall first examine how the rental cost in the absence of tariffs and taxes, i.e. the free-trade rental cost, is determined. The rental cost with distortions is looked at next, and then we turn to the construction of the rental cost index. The rental cost for foreign

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[19] This model assumes a marginal investor who undertakes investment up to the point where the marginal condition is fulfilled, at which point the marginal contribution from the investment in an additional unit of capital is equated to its implicit rental value. The justification of the rental price of capital as expressed by the condition in (2) is given in David J. Ott, Attiat F. Ott and Jang H. Yoo, Macroeconomic Theory (Tokyo : McGraw Hill Kogakusha, 1975), Ch.5, pp.112-113.

investment is to be mentioned last. Throughout we shall maintain all notations used earlier in this subsection.

1. The free-trade rental cost. In the absence of tariffs and taxes, the equality between the cost of a unit of capital good and the discounted value of all future services derived from this capital good is given by

$$q^* = \int_0^\infty ce^{-(i - \pi + \delta) s} ds \qquad (2)$$

where q^* = the world price of the capital good, δ = the exogenously given rate of capital depreciation, i = the nominal rate of interest, π = the (correctly anticipated) rate of inflation. The real cash flow in each period, c, that will make the discounted value of all future capital services equal to the price of the capital good is implicit in the above expression. It is assumed that the nominal cash flow grows at the rate of inflation to maintain a constant real cash flow. Letting $r = i - \pi$ be the real rate of interest, the price of capital services in the free-trade case implicit in (2) is

$$c_F = q^* (r + \delta - \dot{q}^*/q^*) \qquad (3)$$

If asset prices are expected to remain constant, the free-trade rental cost of capital is then

$$c_F = q^* (r + \delta) \qquad (4)$$

The cost of capital to the firm in the absence of tariffs and taxes is the opportunity cost of funds invested in the machine (rq^*) plus the value of the machine used up in production (δq^*).

2. The rental cost with tariffs, taxes and incentives. Expression (4) derived above may be extended to take account of taxation in the analysis. The tax and tariff structure affects the rental cost of

capital through its impact on the cost of capital goods to the firm and the discounted cash flow. If the statutory corporate tax rate is constant over time at rate u, [20] the present value of after-tax returns at time s is $c(1-u)e^{-(r+\delta)s}$. However, the firm is allowed a depreciation deduction for tax purposes; if D_s is the depreciation allowance per dollar of initial investment at time s, the present value of depreciation allowances can be expressed as [21]

$$z = \int_0^\infty D_s e^{-is} ds \qquad (5)$$

The taxes not paid in each period for each dollar of capital good purchases due to the depreciation deduction claimed is uD_s, with the latter exprassed as a fraction D_s of the cost of the asset at time s. [q(s)]. Over the life of the asset, D_s sums to unity. Or, looking at it from another perspective, the tax deductibility of depreciation raises the present value of the future after-tax income by uz for each dollar of capital good purchases.

For two depreciable assets, viz. equipment and structures, the formula for the present value of depreciation allowances is given by

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[20] In the case of tax holidays, during which profits from certain new enterprises are exempt from corporate taxes, we must explicitly recognize that the expected tax rate varies over time.

[21] Note that in the calculation of z, the relevant discount rate is the nominal rather than the real rate of interest because the depreciation allowances are based on historical cost, rather than on replacement cost, and are not increased with inflation.

$$z_E = \int_0^{N_E} D_{Es} e^{-is}\, ds \qquad (5.1)$$

and

$$z_S = \int_0^{N_S} D_{Ss} e^{-is}\, ds \qquad (5.2)$$

where subscripts E,S are used to represent equipment and structures, and N_E and N_S is the useful life for tax purposes of equipment and structures, respectively.

In the presence of the tariff rate on imported capital good (τ), the investment tax credit or capital grant (k) and the tax deductibility of depreciation (uz), the price of the capital good to the firm can be effectively viewed as $q^*(1+\tau)(1-k-uz)$. The rental cost of capital with taxes and tariffs is the value of c that solves

$$q^*(1+\tau) = \int_0^{\infty} [c(1-u)e^{-(r+\delta)s} + q^*(1+\tau)\, uD_s e^{-is}]\, ds + kq^*(1+\tau) \qquad (6)$$

or alternatively,

$$q^*(1+\tau) = \int_0^{\infty} c(1-u)e^{-(r+\delta)s} ds + q^*(1+\tau)(k+uz) \qquad (6.1)$$

If capital gains are transitory, solving (6.1) and rearranging terms yields [22]

$$c_D = \frac{(1+\tau)\, q^*\, (1-k-uz)\, (r+\delta)}{1-u} \qquad (7)$$

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[22] This expression assumes that the depreciation base is not reduced by the amount of the tax credit, and that there is no debt in the financial structure, so that there are no deductions for interest payments on debt.

From Eq. (7) it is clear that the acquisition cost per unit is $q^*(1+\tau)(1-k-uz)$. This is equal to the domestic price per unit of capital ($q^*(1+\tau)$) less the sum of (1) the tax savings via the investment tax credit ($kq^*(1+\tau)$) and (2) the tax savings via depreciation deductions which, over time, sum to the price of the asset ($uz\, q^*(1+\tau)$). The economic rationale for the rental cost of capital is that the marginal after-tax rate of return per dollar paid for capital rental per unit of capital - $c_D(1-u)/(1+\tau)q^*(1-k-uz)$ - must just cover the real rate of return plus the rate of economic depreciation - $r+\delta$.

The rental cost expression given in (7) can be generalized to obtain the expression for the two types of capital goods. For equipment, the rental cost can be expressed as

$$c_{ED} = \frac{q_E^*(1+\tau_E)(1-k_E-uz_E)(r+\delta_E)}{1-u} \qquad (7.1)$$

And for structures,

$$c_{SD} = \frac{q_S^*(1+\tau_S)(1-uz_S)(r+\delta_S)}{1-u} \qquad (7.2)$$

Note that the term k_S does not appear in (7.2) because investment tax credit is not usually allowed for expenditure on structures.

3. The rental cost of capital index

The investment incentives as prescribed by most investment incentives laws all involve the values of incentive variables k, z, τ, and u, all of which are policy instruments, and the cost of funds to the firm are unaffected by these incentives. It is now possible to compare the cost of capital under a regime of taxation with the cost in the absence of any taxation. More precisely, an index can be

formulated by dividing Eq. (7) by Eq. (4), i.e. dividing the cost of capital services with distortions by the no-distortion cost:

$$I = \frac{c_D}{c_F} = \frac{(1 + \tau)\ (1 - k - uz)}{1 - u} \qquad (8)$$

The capital cost index I in (8) can be interpreted as the extent to which the tax and investment incentive system raises the price of a capital good above what it would be if there were no taxes.[23] An index with a value greater than 1 indicates a net tax position to the firm, while an index less than 1 implies a net subsidy position. It is this index which will be used to compare the cost of capital goods of firms that receive special incentives to those firms within the same country that receive the generally available (universal) incentives. More specifically, for the i^{th} firm (i = 1, 2, ...,m) locating in the j^{th} country (j = 1, 2, ...,n), the capital cost index for this typical firm will be

$$I^{ij} = \frac{c_D^{ij}}{c_F^{ij}} = \frac{(1 + \tau^{ij})\ (1 - k^{ij} - u^{ij}z^{ij})}{1 - u^{ij}}, \quad i = 1,2,...,m; \quad j = 1,2,...,n \qquad (9)$$

It is again possible to generalize the rental cost index I in (8) for equipment and structures.[24] For equipment, the index can be written as

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[23] Eric Bond, "International Differences in the Rental Cost of Capital : Evidence from the Philippines, U.K., Canada and Mexico," a mimeographed copy of unpublished report conducted while the author was serving as a consultant to the International Finance Corporation.

[24] Subscripts i and j have been left out to avoid reiterating the expressions.

$$I_E = \frac{(1 + \tau_E)(1 - k_E - uz_E)}{1 - u} \tag{8.1}$$

And the index for structures is

$$I_S = \frac{(1 + \tau_S)(1 - uz_S)}{1 - u} \tag{8.2}$$

The index to be used for final calculation of capital cost takes the form

$$I_{weighted} = k_E I_E + (1 - k_E) I_S \tag{10}$$

where k_E and $(1 - k_E)$ is the firm's respective share of each type of capital good, and I_E and I_S are given by (8.1) and (8.2). The capital cost index in (10) can be calculated from the tariff and tax policies in each country that determine directly or indirectly the values of τ, k, u and z, together with the (assumed) percentage composition of each type of capital good.

In making cross-country comparisons of the level of investment incentives, the (weighted) capital cost index I in (10) may not be appropriate since it compares the existing tax system in each country with one in which taxes are raised by a lump-sum tax. Under a lump-sum or head tax system, the liability on the taxpayer is the same whatever the taxpayer's economic characteristics and response. If the government wants to collect a certain amount of revenue through the imposition of a lump-sum tax, that planned amount of revenue can be collected from taxpayers without causing inefficiencies in resource allocation, which also implies that there is no excess burden in the economy.[25] The

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[25] A detailed theoretical exposition of excess burden and efficiency cost arising from various taxes is treated in Richard A. Musgrave and Peggy B. Musgrave, Public Finance in Theory and Practice (Tokyo : McGraw Hill Kogakusha, 1980) Ch.14, pp.301-326.

burden placed on the economy equals what the government gets in revenue. However, when attempts are made to compare investment incentives across countries, the no-excess burden condition implicitly assumes that the tax systems in all countries are the same and that tax incidences are similar, which actually might not be the case. To take account of differences in the size of the government sector across countries, a benchmark tax is required for cross-country comparison purposes to allow for different tax systems that might affect the location decision of firms so that they can be comparable. Since lump-sum taxes are difficult to design and are probably not politically feasible, a second-best situation is one in which revenues are raised by some broad-based tax such as a non-distorting sales or value-added tax that does not discriminate between factors of production. Taking government expenditure as given, the benchmark sales tax rate, t_B, is chosen to be the one that would raise the same amount of revenue as would be obtained from factor taxes, [26] and is as such assumed to minimize efficiency cost or excess burden. Or to put it the other way, the benchmark sales tax rate is a tax by which the current level of government revenue can be raised with the burden placed on the economy being approximately equal to what the government gets in revenue.

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[26] For practical use, the benchmark tax rates for each country were calculated as direct plus indirect taxes as a proportion to gross national product (GNP). Tax and GNP data are data during the period 1980-1986. Over this period, the percentage of direct and indirect taxes to GNP remained fairly constant for all three countries; the figure for each country was taken as an average over the period and calculated at 0.25 for Malaysia, 0.16 for Singapore and 0.14 for Thailand.

In the benchmark sales tax case, the cost of capital goods to the firm will be raised by the amount of the sales tax, t_B, yielding a rental cost

$$c_B = q^*(1 + t_B)(r + \delta) \tag{11}$$

A similar index to that of (8) can also be constructed from (7) and (11), and the capital cost index relative to the benchmark sales tax is expressed by

$$I_B = \frac{c_D}{c_B} = \frac{(1 + \tau)(1 - k - uz)}{(1 - u)(1 + t_B)} = \frac{I}{1 + t_B} \tag{12}$$

The index I_B may be more appropriate for making cross-country comparisons of capital cost indexes since it takes account of differences in the size of the government sector across countries.[27] The index may be interpreted as the degree of which the tax and incentive system raises the cost of capital goods from that which would occur if all government revenue was raised by a sales tax. In the calculation of the cost of capital indexes for each country, both I and I_B will be reported.

4. The rental cost for foreign investment. The rental cost of capital which has so far been discussed is for a domestic firm since attention is paid entirely on the corporate tax system in the host country. In order to calculate the rental cost for a foreign investor, we must take into account, in addition to the treatment of corporate

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[27] When we are making comparisons within the same country, no adjustment for the benchmark tax rate is necessarily be made.

income taxation in the host country, the tax laws in the home country because the parent firm may be liable for taxes on its foreign-source income. This consideration has been noted by, for example, Hufbauer in his study on the taxation of export profits of industrialized countries.[28] If the taxes due in the home country are less than the liability in the host country, the differences must be paid to the home country at the time when dividends are repatriated. If we assume that the tax rate in the host country, u, is less than that in the home country, say $\hat{u}$, then the current tax liability will equal the home country rate for that portion of income paid as dividends and will equal the host country rate for the portion of income retained in the subsidiary. Symbolically, if ρ is the share of income paid as dividends, so that $(1 - \rho)$ is the portion of income retained in the subsidiary, the effective tax rate for foreign investment will then be $\rho\hat{u} + (1 - \rho)u$. The resultant rental cost for a foreign investor could then be obtained by substitution of this effective tax rate in (8.1) and (8.2) or (12).

Actually, this is what should be done in the case of foreign investment in a host country. But our main interests here lie chiefly on policies of the host countries which affect investing firms regardless of country of origin. So, we are making a crucial assumption in this study concerning the tax laws in the home country of the investing firms that the patterns of tax treatment of foreign-source income in the home country are assumed to be given and do not differ between countries. This amounts to say that, assuming the investing firms of equal size

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[28] Hufbauer, "The Taxation of Export Profits," National Tax Journal.

(or the firms are operating in a country with a flat-rate taxation system), the same domestic tax rate (i.e. the tax rate in the host country) is applicable to both domestic and foreign firms. However, this does not mean the corporate tax rates among the host countries will necessarily be the same.

B. Formulas for Calculating the Present Value of Depreciation Allowances

The present value of depreciation allowances per dollar of capital goods purchased at time 0 given in (5) is

$$z = \int_0^{\infty} D_s e^{-is}\, ds \qquad (5)$$

There are currently at least three depreciation formulas that could be employed for tax purposes : straight-line, sum of the years' digits and double declining balance. The latter two methods are known as accelerated depreciation methods, which offer greater depreciation allowances in the earlier years of the asset's life and less depreciation allowances in the later years than the straight-line method. To obtain the appropriate cost of capital index for each formula, it is necessary to calculate the present value of depreciation allowances for each one.[29] Throughout we assume that the asset has a depreciable life of N years and has no scrap value.

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[29] Formulas for calculating the present value of depreciation allowances are taken with minor changes of notations from Robert E. Hall and Dale W. Jorgenson, "Tax Policy and Investment Behavior," American Economic Review 57 (June 1967) : 393-394.

For straight-line depreciation, the present value of the allowances is :

$$z = \frac{1}{iN}(1-e^{-iN}) \tag{13}$$

For sum of the years' digits, the present value of the allowances is :

$$z = \frac{2}{iN}\left[1 - \frac{1}{iN}(1-e^{-iN})\right] \tag{14}$$

For double declining balance depreciation, the present value of the allowances is :

$$z = \frac{\frac{2}{N}}{i+\frac{2}{N}}\left[1-e^{-(i+(2/N))N^{+}}\right] + \frac{1-e^{-(2/N)N^{+}}}{i(N-N^{+})}\left(e^{-iN^{+}} - e^{-iN}\right) \tag{15}$$

where N^{+} denotes the point where the firm may switch to straight-line depreciation.

Under static expectations the formulas for the capital cost index for the three methods of depreciation are :

straight-line :

$$I = \frac{1+\tau}{1-u}\left[1 - k - \frac{u}{iN}(1-e^{-iN})\right] \tag{16}$$

sum of the years' digits:

$$I = \frac{1+\tau}{1-u}\left[1 - k - u\,\frac{2}{iN}\left(1-\frac{1}{iN}(1-e^{-iN})\right)\right] \tag{17}$$

double declining balance :

$$I = \frac{1+\tau}{1-u}\left[1 - k - uz_{DDB}\right] \tag{18}$$

where Z_{DDB} is given by (15).

The three formulas above can equally be generalized to cover both equipment and structures.

C. The Effect of a Tax Holiday on the Cost of Capital [30]

Although the analytical framework of Equations (10) and (12) is able to encompass tax incentives such as exemptions from or reductions in import duties and business taxes, and investment tax credits, the use of income tax holidays for pioneer firms causes technical difficulties. The reason is that, throughout the derivation of Equations (10) and (12), we assumed the statutory tax rate u to be constant over time, while tax holidays imply variable tax rates. [31] Tax holidays can be incorporated into the cost of capital framework by calculating the constant annual tax rate that yields the same present value of tax payments as a zero tax rate until time N_0 (the length of the tax holiday) and a tax at rate u thereafter (from time N_0 until the end of a useful life of capital).[32] Since this approximation is only usefully applicable to the case where the tax holiday involves a zero tax rate (and, therefore, excludes the case of tax rate reduction during the holiday period), an alternative

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[30] The expression for the effective tax rate under a tax holiday is taken from Eric Bond, "Tax Holidays and Industry Behavior," Review of Economics and Statistics 63 (February 1981) : 88-95.

[31] That is, the expected tax rate is usually equal to zero during the holiday period, while it equals the statutory rate u after the expiration of the tax holiday.

[32] We thereby transform the variable holiday tax rate into an average effective tax rate on all accruing income from time 0 onward.

approach is to consider the present value of the returns net of direct taxation as comprising two separate components : the first is the present value of the returns accruing from time 0 to N_0, and the second, from time N_0 to ∞ . That is, the present value of the returns from a unit of capital purchased at time 0 will be [33]

$$V = \int_0^{N_0} c(1-u')e^{-(r+\delta)s}\,ds + \int_{N_0}^{\infty} c(1-u)e^{-(r+\delta)s}\,ds \qquad (19)$$

where u' denotes the tax rate during the tax holiday, and N_0 is the length of the holiday period.

The tax holiday program is equivalent to paying the firm a subsidy at rate $\sigma = (u - u')$ on each unit of machinery for the low-tax (or tax-exempt) period. Normalizing so that V = 1 (which equals the price of a unit of the capital good) and solving for the case u # u' yields

$$c = \frac{r+\delta}{1-u_H} \qquad (20)$$

where $$u_H = u - \sigma(1-e^{-(r+\delta)N_0}) \qquad (21)$$

and $$\frac{\partial u_H}{\partial \sigma} < 0, \quad \frac{\partial u_H}{\partial r} < 0, \quad \frac{\partial u_H}{\partial N_0} < 0, \quad \frac{\partial u_H}{\partial \delta} < 0.$$

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[33] The import tariff rate, the investment tax credit and the tax deductibility of depreciation have been left out to simplify the expressions, but their indlusion would not alter the results.

The expression for u_H in (21) gives the effective tax rate under the tax holiday. The effect of the tax holiday is to reduce the firm's tax rate from u to u_H,[34] where u_H depends on (i) the length of the tax holiday (N_0), (ii) the real rate of interest (r), (iii) the rate of economic depreciation (δ), and (iv) the size of the subsidy (ζ).

By substituting the derived expression for u_H instead of the statutory tax rate u in the cost of capital formulas (Eqs.(8.1) and (8.2) or (12)), it is possible to use these equations in the cost of capital calculations in the tax holiday case.[35]

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[34] If $u' = 0$, i, e. the zero tax rate is applied to pioneer profits during the holiday period, the expression for u_H simply reduces to $ue^{-(r + \delta)N_0}$.

[35] If it is assumed that the pioneer firm deducts unused depreciation allowances accumulated during the tax holiday from the profits earned during the first period after the expiration of the holiday period, the treatment of depreciation allowances during the tax holiday must take account of the postponement of depreciation allowances during the period, and the relevant depreciation allowances in the tax holiday case is given by uze^{-rN_0}.