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Joosung Jun

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## ABSTRACT

The effects of taxes on direct investment capital outflows are investigated using a theoretical model which integrates the investment and financial decisions of the parent and subsidiary. The resulting marginal qs and costs of capital show that intrafirm investment allocation and tax neutrality results critically hinge on the marginal financing regime. By identifying a channel(s) through which a specific tax policy affects firm decisions, the model evaluates the combined effects of the home country tax system on direct investment. Our analysis suggests that while the 1986 U.S. Tax Reform Act may have an ambiguous effect on the overall level of capital outflows, it may induce more equipment investments to be undertaken abroad.

Joosung Jun
Department of Economics
Yale University
28 Hillhouse Avenue
New Haven, CT 06520

## 1. Introduction

International direct investment, which implies a controlling interest by an investor in one country in a business enterprise or property in another country, has become an important economic phenomenon and a concern of tax policy. If long-term capital is highly mobile across national boundaries, it will no longer be rational to design tax systems without taking such capital flows into account. For example, a country with relatively high tax rates will drive domestic businesses abroad while a country with generous investment allowances will attract more investments from foreigners. The tax treatment of foreign source income is also a major factor in the foreign investment decision.

This paper investigates three major channels through which domestic tax policy affects direct investment capital outflows. First, tax policy can influence the way in which foreign source income is shared among the firm, the home country government and the host country government. In addition, it can affect the relative net profitability of investments in different countries. Lastly, tax policy can affect the relative net cost of raising external funds in different countries.

The first channel, tax policy toward foreign source income, has long been a subject of policy debate and political controversy. Most of the existing literature is also concerned with this aspect of the tax effects on international capital movements. One major concern regarding international investment is the possibility for foreign source income to be taxed twice, once by the host country government and again by the home country government. In general, the home country can adopt one of two approaches to prevent the double taxation of foreign source income. Under the 'territorial' approach, the home country does not tax foreign source income at all. Under the more common 'residence' approach, foreign source income is subject to home country taxation, but a credit or deduction is allowed for taxes

paid to the host country government. Furthermore, the home country tax can be deferred until the foreign source income is repatriated to the domestic parent. These tax deferrals, combined with the foreign tax credit, can hold important implications for an international firm's investment and financial decisions. This paper is primarily concerned with the residence approach, a system which prevails in many industrial countries including the U.S.

The second major channel through which taxation influences direct investment is the home country's tax policy towards domestic investment. The direct investment decision of international firms is affected by a variety of factors. These firms establish branches and subsidiaries abroad to secure local markets, to have easy access to raw materials, and to take advantage of lower labor costs, for example. All these factors can be summarized as representing the expectation of higher profitability from venturing abroad. Tax policy can influence the decision of investment location by affecting the relative net profitability between different places.

The third channel is related to the way taxation affects the cost of external funds for the firm. An international firm can raise funds in the host country as well as in the home country. As long as local fund raising in the host country is feasible and less costly, the parent will have an incentive to reduce its transfers and to let the subsidiary rely more on this alternative source. Since interest payments are tax deductible, a reduction in the domestic corporate tax rate implies that local borrowing in the host country becomes cheaper.

How can we combine all these aspects of the tax effects on international investment in a single theoretical framework? The strategy adopted in this paper is to "divide and conquer." The complete problem of the international firm, which is assumed to consist of the parent and a subsidiary, is analyzed in three stages: the subsidiary problem, the intrafirm problem,

and the parent problem. These three stages exactly corresponds to the three channels mentioned above of the tax effects on direct investment.

Our analysis begins in Section 2 with a presentation of the basic model of the subsidiary's intertemporal maximization. This first stage examines how the effects of foreign source income taxes on direct investment are affected by the subsidiary's financing and dividend policy. Section 3 treats the intrafirm problem by integrating the subsidiary's foreign operation and the parent's domestic operation. The tax effects through the foreign source income tax and the relative net return channels are combined to derive the criteria for intrafirm investment allocation. In Section 4, the parent problem -- the last stage of the firm problem -- is defined as minimization of the international firm's overall cost of funds, which is consistent with share value maximization in equilibrium. The relative cost of funds channel is discussed in this context. The concluding section summarizes the basic results of the model.

## 2. The Subsidiary Problem

This section presents a basic model of the subsidiary's intertemporal maximization problem. The subsidiary wishes to maximize its firm value, which can be expressed as the present discounted value of the net payments to the parent. In order to concentrate on the effects of tax rules applied to foreign source income -- the first channel -- we assume at this stage that the rate of return required by the parent on foreign investments is exogenous to the subsidiary's problem. The major focus of this section is on the way in which the subsidiary's financial policy influences the tax effects on investment incentives.

## 2.1 The Basic Model

At the first two stages, we focus on the case in which foreign investments are financed only through internal funds available within the international firm. More specifically, the subsidiary can finance its operations either by retaining earnings or by drawing funds from the parent. For simplicity, we assume that transfers by the parent consist only of equity investments and that dividends are the only form of income repatriation by the subsidiary. The model assumes that the home country corporate tax rate t is greater than the host country rate t*, since it is the more interesting and more plausible case than that where t* > t, as argued in Jun (1988). In this model, there is no uncertainty and all tax rates are perceived to be constant over time. Time subscripts are suppressed in most cases for simplicity.[1]

The after-tax return on direct investment to the parent is:

$$(1-t)[D/(1-t^*)]/V + (\dot{V} - T)/V \qquad (1)$$

where D is the subsidiary's dividend payments, T represents transfers from the parent, and V is the value of the subsidiary in the current period. Since a credit is allowed for taxes deemed to be paid in the host country, dividends are grossed up $(D/(1-t^*))$ before the home country tax is applied. From the perspective of the parent, the sole shareholder of the subsidiary in this model, $D/(1-t^*)$ represents the total dividend income while the subsidiary's retained earnings are considered capital gains. Note that domestic taxes are imposed only on repatriated income.

[1] We ignore witholding taxes on dividend payments imposed by the host country government. These taxes are similar to the home country tax in that they are imposed only when income is repatriated. They are also similar to the host country tax in that the foreign tax credit is allowed for these taxes against the firm's home country tax liability.

In equilibrium, we assume that the parent earns its required rate of return R. Then, we can write a differential equation for the value of the subsidiary V:

$$\dot{V} = RV - (1-t)D/(1-t^*) + T \qquad (2)$$

where R is assumed to be exogenous by the subsidiary. Subject to the transversality condition:

$$\lim_{s\to\infty} V_s \exp(-Rs) = 0 \qquad (3)$$

equation (2) can be solved forward to get an expression for the value of the subsidiary:

$$V = \int_0^{\infty} [\, D(1-t)/(1-t^*) - T] \exp(-Rs)\ ds \qquad (4)$$

Equation (4) shows that the value of the subsidiary is the present discounted value of net payments by the subsidiary to the parent.

The subsidiary maximizes its firm value subject to the following constraints:

$$(1-t^*)F^*(K) + T = D + IC(I) \qquad (5a)$$

$$\dot{K} = I \qquad (5b)$$

$$D \geq 0 \qquad (5c)$$

$$T \geq \bar{T},\ \bar{T} \leq 0 \qquad (5d)$$

where K is the subsidiary's capital stock, $F^*(K)$ is the subsidiary's earnings, I is direct investment, $\bar{T}$ is the maximum level of equity capital redemption, and C(I) is adjustment costs.

Equation (5a) is the cash flow identity for the subsidiary. The total cash flow available to the subsidiary in any period is either repatriated to the parent or reinvested in the host country. This equation can also be interpreted as the financing equation showing that foreign investment can be financed by retaining earnings ($(1-t^*)F^* - D$) and/or by drawing transfers from the parent (T). The production function is assumed to be concave, while the investment technology is given by a convex adjustment cost function C(I). Equation (5b) shows the evolution of the subsidiary's capital stock. There is no depreciation. Equation (5c) is a nonnegativity condition for dividends.

The subsidiary can repatriate its equity capital ($T < 0$) as well as its earnings. In principle, the redemption of equity capital is tax-exempt while the repatriated earnings are taxable in the home country. In order to prevent a firm from treating all repatriated funds as equity capital, as a general rule all remissions are treated as taxable earnings as long as accumulated repayments are less than accumulated earnings. Equation (5d) reflects the restrictions on the subsidiary's ability to repatriate tax-exempt funds to the parent.

One direct implication of assuming that $t > t^*$ in this maximization problem is that the parent is tax-penalized when the subsidiary simultaneously pays dividends and draws funds from the parent. Equations (4) and (5) show that if both $(T - \bar{T})$ and D are greater than zero, an equal reduction of both terms can increase the subsidiary's value without affecting $F^*$ or IC(I). An immature subsidiary with investment expenditures (IC(I)) in excess of after-tax earnings ($(1-t^*)F^*$) must draw funds from the parent even in this case. However, a mature

subsidiary with after-tax earnings in excess of investments should exploit the tax exempt repatriation before paying any dividends; thus, the $T \geq \bar{T}$ constraint is binding. In sum, the above argument implies that no subsidiaries, mature or immature, should pay dividends and draw funds simultaneously. This aspect of taxation has important implications for the determination of the optimal marginal source of funds.

## 2.2 Retained Earnings vs. Parent Transfers as the Marginal Source of Funds

A central issue in studying the effects of tax rules applied to foreign source income is the method of financing the marginal foreign investment. The tax effects on the subsidiary's cost of capital can vary widely depending on the choice of the marginal source of funds. Many traditional researchers either have ignored the subsidiary's retained earnings or have assumed a fixed dividend payout ratio so that they can regard parent transfers as the marginal source of funds.[2] They justify their stable dividends assumption with explanations similar to ones used to explain the financial behavior of domestic firms such as signalling or the need to maintain an optimal debt-capital ratio. However, since the subsidiary's dividend payment is an intrafirm transaction, dividend-paying motives employed in the context of the domestic firm-shareholder relationship may not be readily applied.

Noticing the lack of a good theory to explain intrafirm dividends, other researchers [e.g., Hartman (1985), Koptis (1980)] argue that retained earnings must be the marginal source of funds for mature subsidiaries since drawing transfers incurs an avoidable tax liability as we saw above. Dividends are determined simply as a residual after profitable investments are undertaken.[3]

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[2] Caves (1982) provides a summary of traditional studies on these issues.

[3] Jun (1988) presents a complete analysis of the marginal source of funds for foreign investment.

First, suppose that, as the tax capitalization view predicts, the subsidiary finances investments by retaining earnings. In this view, the transfer constraint (5d) is binding since this subsidiary cannot find a tax-exempt channel for repatriation. To characterize dividends as a residual, we rewrite the cash flow identity (5a) as:

$$D = (1-t^*)F^*(K) - IC(I) + \bar{T} \tag{6}$$

The expression for the market value of the subsidiary can be rewritten as:

$$V = \int_0^\infty \exp(-Rs)[(1-t)F^*(K) - (1-t)IC(I)/(1-t^*) + (t^*-t)\bar{T}/(1-t^*)]\, ds \tag{7}$$

The firm chooses an investment policy to maximize V subject to the capital evolution constraint (equation (5b)). The Hamiltonian for the problem is:

$$H = \exp(-Rt)\,[(1-t)F^*(K) - (1-t)IC(I)/(1-t^*) + (t^*-t)\bar{T}/(1-t^*) + qI] \tag{8}$$

where q is the shadow value of installed capital. The first-order conditions for optimality are:

$$[(1-t)/(1-t^*)]\,[C(I) + IC(I)] = q \tag{9}$$

$$\dot{q} = Rq - (1-t)F^{*\prime}(K) \tag{10}$$

$$\lim_{s\to\infty} q_s \exp(-Rs) = 0 \tag{11}$$

Equation (9) shows that investment takes place until the marginal cost of investing out of retained earnings equals the shadow price of installed capital. Since $C' > 0$ and $C'' > 0$, the equation can be inverted to derive investment I as an increasing function of q.

$$I = \dot{K} = h(q(1-t^*)/(1-t)) \qquad h' > 0, \quad h(1) = 0 \tag{12}$$

We normalized the adjustment cost function so that $h(1) = 0$, to give a better comparison of our formulation and Tobin's q theory of investment. Equation (10) describes the evolution of the shadow price of capital q. It can be shown that q equals the present value of the future stream of net marginal products of one unit of capital.

In the portfolio equilibrium, which is defined as the $\dot{q} = 0$ locus,

$$q = (1-t)F^{*\prime}/R \tag{13}$$

The equilibrium shadow price of capital is the ratio of its net marginal product to the after-tax cost of funds. Similarly, the $\dot{K} = 0$ locus depicts the investment equilibrium in which:

$$q = (1-t)/(1-t^*) \tag{14}$$

from equation (12). Since we assume that $t > t^*$, the equilibrium value of q is less than unity. The subsidiary invests until the marginal value of one dollar investments equal its opportunity cost, or the amount the parent would receive if the dollar were repatriated.

The subsidiary's cost of capital, COC, which is defined as being equal to $F^{*\prime}$ in equilibrium, can be derived from equations (13) and (14).

$$COC = R/(1-t^*) \tag{15}$$

The home country's tax policy towards foreign source income has no effect on the cost of capital. Since deferred home country taxes are an unavoidable liability, they are capitalized in the market value of the firm. The tax capitalization view implies that tax rules applied to foreign source income including the foreign tax credit have no effect on the marginal investment decision of mature subsidiaries.

Next, we consider the case in which parent transfers are the marginal source of funds. Suppose that for some reason the parent values dividends so that the mature subsidiary pays a fixed portion d of its after-tax earnings as dividends: [4]

$$D = d(1-t^*)F^*(K) \tag{16}$$

The cash flow identity (5a) can be rewritten as:

$$(1-d)(1-t^*)F^*(K) + T = IC(I) \tag{17}$$

which shows that the subsidiary needs parent transfers in addition to retained earnings to finance investments. We can rewrite the expression for the value of the foreign subsidiary:

$$V = \int_0^\infty \exp(-Rs)\ [d(1-t)F^*(K) - IC(I)+(1-d)(1-t^*)F^*(K)]\ ds \tag{18}$$

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[4] In order to reflect the benefits that the parent may derive from the subsidiary's dividend payments, one may assume that the required rate of return (R) is a decreasing function of the dividend payout ratio as Poterba and Summers (1985) do in the case of the domestic firm. However, this formulation and the fixed payout ratio are observationally the same and produce the same effects unless the function is specifically parameterized. For simplicity, we utilize the fixed payout ratio.

or

$$V = \int_0^{\infty} \exp(-R(s-t))\ [(1-ETR)F^*(K) - IC(I)]\ ds \qquad (18a)$$

where $ETR = dt + (1-d)t^*$.

Solving the maximization problem as before gives the following equations of motion:

$$I = \dot{K} = h(q) \qquad h' > 0,\ h(1) = 0 \qquad (19)$$

$$\dot{q} = Rq - (1-ETR)F^{*\prime} \qquad (20)$$

In the portfolio equilibrium in which $\dot{q} = 0$,

$$q = (1-ETR)F^{*\prime}/R \qquad (21)$$

whereas in the investment equilibrium in which $\dot{K} = 0$,

$$q = 1 \qquad (22)$$

The cost of capital can be derived from the above equilibrium conditions:

$$COC = R/(1-ETR) \qquad (23)$$

The effective tax rate ETR is the weighted average of the home and host country tax rates, where the weight equals the dividend payout ratio. This result represents the traditional view [e.g., Horst (1977) ] that the home country tax can affect foreign investment and that tax

deferral favors direct investment by reducing the effective tax rate below the home country rate.

One extreme case is when the subsidiary retains no earnings so that d = 1. Then, the effective tax rate will be the home country rate t. The same result will hold if the home country does not allow tax deferral, so that taxes are paid on an accrual basis. This no retention or no deferral case will prove to be an useful reference when the neutrality of the tax system regarding international investment is discussed.

The first three columns of Table 1 summarize the basic results of the subsidiary problem under different regimes. The first two lines show the values of q in the portfolio equilibrium and in the investment equilibrium respectively. The expressions for the cost of capital reveal the effects of tax policy toward foreign source income on direct investment -- the first tax channel. Note that the home country tax is irrelevant to the foreign investment decision under the retained earnings regime while the host country tax is irrelevant under the no retention or no deferral regime. This fact summarizes the debate on tax neutrality regarding international investment. For subsidiaries with retained earnings as the marginal source of funds, the effective tax rate is the host country tax rate t*. Domestic and foreign investors are taxed equally from the perspective of the host country. This is called 'capital import neutrality.' On the other hand, in the extreme case of no retention or no tax deferral, the effective tax rate is the home country tax rate t. From the perspective of the home country, domestic and foreign investments receive equal tax treatment. This is called 'capital export neutrality.' Under the more realistic parent transfers regime, tax deferral would reduce the effective tax rate below the home country rate, favoring capital outflows.

The above neutrality debate has important implications for the effectiveness of the two major features of the residence approach -- tax deferral and the foreign tax credit -- as policy

instruments toward direct investment. Except in the extreme case of no retention (d=1), tax deferral favors direct investment by reducing the effective tax rate. On the other hand, the effect of the credit policy can differ substantially between the two major regimes. Under the retained earnings regime, the foreign tax credit is irrelevant to the foreign investment decision. Under the parent transfers regime, the deferral and credit policies are both effective and must be combined properly. For example, eliminating foreign tax credits in order to stem capital outflows might lead subsidiaries to defer taxation by retaining more earnings, resulting in more direct investments.

## 3. The Intrafirm Problem

Although the parent is in charge of domestic operations in the home country, its major concern is the maximization of the overall profits of the international firm. Thus, to gain proper understanding of the international firm's behavior, it is imperative to integrate the subsidiary's foreign operation with the parent's domestic operation. Besides, while the practice of isolating the subsidiary's maximization problem is a convenient way of summarizing the effects of foreign source income taxes on direct investment, it can be quite misleading when we try to understand the overall effects of the home country tax system on direct investment. Tax policy can also affect direct investment through other channels, which can be best analyzed when we recognize that the subsidiary is one part of the international firm.

In this section, we introduce two different but mutually consistent approaches to integrating domestic and foreign operations in the model. First, one can stress the global objective of the parent by including its transactions with the subsidiary (i.e. intrafirm variables such as transfers by the parent and dividend payments by the subsidiary) in its

global budget constraint. Second, recognition of the ownership chain of the international firm -- the subsidiary is owned by the parent which is ultimately owned by the domestic shareholders -- will make it possible to define a proper rate of return required by each party's immediate owner. Thus, just as the parent discounts the profit stream using the rate of return required by the shareholders as in the standard finance literature, the subsidiary will base its operation on the return required by its owner, the parent. Note that in the previous section, we solved the subsidiary's maximization problem given an exogenous required rate of return.

By solving the intrafirm problem, we can explicitly derive criteria for intrafirm allocation of investments between domestic and foreign operations. The allocation criteria summarize the tax effects at the first two channels -- tax policy toward foreign source income and the relative net rates of return. It is also shown that the intrafirm allocation criteria do not include parameters associated with domestic shareholders, while in the long run the subsidiary's cost of capital can be expressed as a function of the rate of return required by the shareholders. This results implies that although the subsidiary is ultimately owned by the domestic shareholders through the ownership chain, the investment location decision is a pure intrafirm variable which is not directly affected by the shareholders. We call these results the "parent-veil." [5]

To distinguish between domestic and foreign operations, we denote variables associated with the subsidiary by stars (*). The subsidiary's dividend payments are now denoted by D* while D represents the parent's dividend payments to the shareholders. Similarly, I, K, q, COC, and F are variables related to domestic investment while the starred counterparts denote

[5] An empirical test of this "parent-veil" hypothesis is presented in Jun (1989).

those for the subsidiary. The intrafirm variable T still denotes parent transfers while E represents new share issues by the parent in the home country.

For reference, we begin with the parent's problem in the absence of foreign operations. The domestic firm problem can be represented by the arbitrage equation in equilibrium:

$$r = (1-m)D/V + (1-z)(\dot{V} - E)/V \tag{24}$$

where r is the rate of return required by the shareholders, and m and z are the marginal tax rates on dividends and capital gains respectively. Following the procedure applied to the subsidiary problem in Section 2, we can obtain an expression for the value of the firm:

$$V = \int_0^{\infty} \exp[-rs/(1-z)]\ [(1-m)D/(1-z) - E]\ ds \tag{25}$$

where V is the present discounted value of after-tax dividends less new share issues. The cash flow constraint for this domestic firm is:

$$(1-t)F(K) + E = I + D \tag{26}$$

where the adjustment cost function is suppressed for simplicity. Also for simplicity, we assume throughout the discussion that domestic investment is financed by retaining earnings at the margin, implying that E = 0. Solving the optimization problem will give the following equations of motion.

$$\dot{q} = [r/(1-z)]q - (1-t)(1-m)F'/(1-z) \tag{27}$$

$$\dot{K} = h(q(1-z)/(1-m)) \qquad h' > 0,\ \ h(1) = 0 \tag{28}$$

From these equations we can obtain the following equilibrium results which are also presented in the last column of Table 1:

| | | |
|---|---|---|
| Portfolio equilibrium: | $q = (1-t)F'/[r/(1-m)]$ | (29) |
| Investment equilibrium: | $q = (1-m)/(1-z)$ | (30) |
| Cost of capital: | $COC = r/[(1-t)(1-z)]$ | (31) |

In order to integrate the foreign and domestic operations, we introduce two approaches which are consistent with each other but which stress different aspects of the integrated firm problem.

### 3.1 The Global Approach

We can stress the global objective of the parent by expanding the parent's budget constraint (26) to include transactions with the subsidiary.

$$(1-t)[F + D^*/(1-t^*)] + E = I + T + D \tag{32}$$

The parent can receive dividends, which are grossed up to include the foreign tax credit, from the subsidiary and also make transfers to the subsidiary. The subsidiary's constraint (5a) is reproduced below for convenience with notational adjustments.

$$(1-t^*)F^* + T = D^* + I^* \tag{33}$$

These two constraints can be combined by eliminating D* to produce a global budget constraint:

$$(1-t)[F + F^*] + E = T(t-t^*)/(1-t^*) + I + I^*(1-t)/(1-t^*)] + D \qquad (34)$$

The remaining intrafirm variable T can also be eliminated through the assumption made about the marginal source of financing foreign investment. Remember that domestic investment is assumed to be financed through retained earnings (E = 0).

With retained earnings as the marginal source of financing foreign investment, the binding transfer constraint can be conveniently represented by T = 0. Then:

$$(1-t)[F + F^*] = I + I^*(1-t)/(1-t^*) + D \qquad (35)$$

Under the parent transfers regime, $T = I^* - (1-d)(1-t^*)F^*$ since $D^* = d(1-t^*)F^*$. Therefore:

$$(1-t)F + (1-ETR)F^* = I + I^* + D \qquad (36)$$

In both cases, the identities show that the sources of funds for the international firm are matched by the uses of funds. Equation (35) shows the tax capitalization aspect of the subsidiary's earnings, implying that the "trapped" money is a cheaper source of funds. Equation (36) shows that from the parent's perspective, the opportunity cost of marginal domestic investment is the same as that for foreign investment under the transfer regime.

Subject to these constraints and other necessary assumptions, the parent's maximization problem expressed in equation (26) can be solved to yield expressions for the valuation and

the cost of capital for domestic and foreign operations. Since the maximization problem of the global operations per se is not our major concern, we discuss a special case, the solution of which allows us to make a more intuitive interpretation.

Suppose that the international firm has no domestic operations so the parent's role is to be a liaison between the subsidiary and the shareholders. The subsidiary directly pays dividends (D*) to and receive transfers (i.e. issue shares: T = E) from the shareholders. In equilibrium,

$$r = (1-m)[(1-t)D^*/(1-t^*)]/V + (1-z)(\dot{V} - T)/V \qquad (37)$$

where $(1-t)D^*/(1-t^*) = D$, the before-personal-tax dividends to the shareholders. The solution to the maximization problem implied by the above differential equation is presented in the Appendix. The equilibrium results with retained earnings as the marginal source of funds for foreign investment are:

| | | |
|---|---|---|
| Portfolio equilibrium: | $q^* = (1-t)F^{*\prime}/[r/(1-m)]$ | (38) |
| Investment equilibrium: | $q^* = [(1-t)/(1-t^*)][(1-m)/(1-z)]$ | (39) |
| Cost of capital: | $COC^* = r/[(1-t^*)(1-z)]$ | (40) |

Note that in the steady state, the cost of capital for foreign investment can be expressed as a function of r, the rate of return required by the shareholders.

Integrated budget constraints and a framework for consistent firm objectives can be derived under this "global" approach, but it is difficult to focus on the intrafirm allocation of investment, which is one of our major concerns at this second stage.

3.2 The Sectoral Approach

By analyzing domestic and foreign operations separately first and later connecting the two sectors, we can not only reproduce the same consistent results as under the global approach but also provide the criteria on which intrafirm investment allocation takes place. This "sectoral" approach is also useful in reviewing the debate concerning the neutrality of the tax system toward foreign investment.

We propose that the rate of return required on foreign investment by the parent (R) is equal to the maximum domestic net return ($(1-t)F'$).

$$R = (1-t)F' \tag{41}$$

Equation (41) implies that in the portfolio equilibrium, the denominator of $q^*$ (the cost of funds for foreign investment) is equal to the numerator of q (the expected marginal product from domestic investment). This proposition is intuitively plausible since the parent and the subsidiary are very likely to be in the portfolio equilibrium simultaneously even in the short run. We prove this proposition in the retained earnings case by reproducing the integrated equilibrium represented by equations (38) to (40).

The first row in Table 2 shows foreign and domestic q values in the portfolio equilibrium ($q^* = (1-t)F^{*\prime}/R$ and $q = (1-t)F'/[r/(1-m)]$). It can be shown from these results and equation (41) that in the portfolio equilibrium:

$$q^* = F^{*\prime}/F' \tag{42}$$

and

$$q^*q = (1-t)F^{*\prime}/[r/(1-m)] \tag{43}$$

The equilibrium consequences for the investment allocation can be shown by assuming the investment equilibrium as well. The second line of Table 2 shows that in the investment equilibrium:

$$q^*q = [(1-t)/(1-t^*)][(1-m)/(1-z)] \tag{44}$$

Now, equations (43) and (44) can be combined to produce in the steady state:

$$COC^* = r/[(1-t^*)(1-z)] \tag{45}$$

The solution system under this sectoral approach (equations (43) to (45)) exactly reproduces the system obtained under the global approach (equations (38) to (40)). Note that the values of $q^*$ in equations (38) and (39) are represented by the product of $q^*$ and $q$ in equations (43) and (44). This fact holds true because in the global approach, we assume that the subsidiary can directly reach the shareholders while in the sectoral approach, the domestic operation acts as an intermediary between the foreign operation and the shareholders.

One important advantage behind the sectoral approach is that only in this context can the criterion for the intrafirm allocation of investment be derived. It can also be shown that from equation (42) and the expression for $q^*$ in the investment equilibrium ($q^* = (1-t)/(1-t^*)$):

$$(1-t^*)F^{*\prime} = (1-t)F' \tag{46}$$

Equation (46) implies that under the retained earnings regime, the firm should invest abroad until the net returns in both places are equalized. As discussed in Section 2, under this regime, tax rules applied to foreign source income are irrelevant to foreign investment. The tax rate t in the above equation denotes the effective tax rate, which determines the net return on domestic investment. Thus, even under this regime, domestic tax policy can influence direct investments by affecting relative net returns.

Table 2 summarizes the results of the intrafirm problem under different financing regimes. The first column reproduces the results obtained from the retained earnings regime. Line (4) of the table shows that in the long run the subsidiary's cost of capital can be expressed as a function of the rate of return required by the shareholders (r). Note that the results reported in this table are the sum of the tax effects through the foreign source income tax and the relative net return -- first and second -- channels. The relative net return tax channel itself is independent of the marginal source of funds. Thus, the results under each financing regime differ from each other because of the varying effects at the first channel analyzed in the previous section.

The allocation criterion under the no retention or no deferral regime shows that only gross returns matter since the tax effects of the first and the second channels exactly cancel out. From the perspective of the home country, domestic and foreign investments receive equal tax treatment; This is a restatement of capital export neutrality. Under the more realistic regimes, due to tax deferral, the relative net return effects will overwhelm the foreign source income tax effects in absolute values. Note that capital export neutrality can be destroyed not only by tax deferrals but also by, though not explicitly shown in the table, the deviation of the effective tax rate on domestic investment from the statutory rate.

4. The Parent Problem

The third channel through which tax policy can affect direct investment concerns the effect of taxation on the cost of external funds to the international firm. The discussion so far has focused primarily on issues related to intrafirm transactions and therefore on the allocation of funds available within the firm. For a domestic firm, internal funds are retained earnings while external funds are raised by issuing new shares and bonds. Similarly, internal funds for an international firm consist of the retained earnings of both the parent and the subsidiary. In addition to stock and bond issues at home, however, another major source of external funds for the international firm is local borrowing by the subsidiary in the host country.

The parent concerned with overall profit maximization is sensitive to any difference in the cost of external funds between places. The parent problem -- the third stage of the firm problem -- is conveniently defined as minimizing the overall cost of funds which is consistent with share value maximization in equilibrium. As long as local fund-raising in the host country is feasible and less costly, the parent will have an incentive to reduce its transfers and allow the subsidiary to rely more on this source.

Tax rules are always a central focus of the debate on the real effects of corporate financial policy. Since income accruing within a firm and income accruing directly to individuals receive different tax treatments, there is an incentive at the margin for the firm to favor debt financing until the benefits from the tax deductibility of interest payments equal the potential bankruptcy and agency costs associated with a higher debt-equity ratio. For the international firm, the possibility of raising funds in both countries creates another opportunity for tax arbitrage. The intuition behind this can be easily illustrated by a simple example. Suppose that both the parent and the subsidiary borrow at the margin to raise

funds. The cost of domestic and foreign funds can be defined as COF = (1-t)i and COF* = (1-t*)i* respectively where i and i* are the interest rates. A reduction in the domestic tax rate t implies that local borrowing in the host country becomes a cheaper source of external funds, other things being equal. As a result of the change in the relative cost of funds between countries, the subsidiary is more likely to resort to local borrowing and less likely to receive transfers by the parent than before.

This relative cost of funds channel has not been recognized in the existing literature but can be quite important in practice. The tax treaty between the U.S. and the Netherlands Antilles makes it possible for U.S. parents to raise funds abroad through their Netherlands Antilles finance affiliates without paying U.S withholding taxes on interest payments to foreigners.[6] Since the funds reloaned by those affiliates to their parents have been recorded as negative direct investment in U.S. balance of payments, the tax effect illustrated in the example can figure significantly.

## 5. Conclusion

Table 3 summarizes the effects of domestic tax policy on direct investment abroad. More specifically, the table shows the effects of raising the domestic corporate tax rate under the different financing regimes and tax channels. The first line shows the effects of tax policy toward foreign source income on direct investment. Under the retained earnings regime, this aspect of the tax change has no relevance to the direct investment decision. The relative net return channel is independent of the financing regime. The reduced domestic net return would drive more investments abroad. The sum of the effects through these two

6 For a more detailed discussion of the Netherlands Antilles case, see Jun (1989).

channels is presented in the third line of the table. This result is based on line (5) of Table 2. Under the extreme no retention or no deferral regime, the effects of these two channels exactly cancel each other out. Under the more realistic parent transfers regime, the relative return effect exceeds the foreign source income tax effect since tax deferral dilutes the negative tax effect on the subsidiary's cost of capital through the first channel. The relative cost of funds channel is also not affected by a specific choice of regime. The relatively cheaper domestic fund raising implied by increased tax deductions suggests more direct investment outflows. The sum of the effects through all three channels indicates that an increase in the home country tax rate will have a positive effect on direct investment abroad.

Although the model is built parsimoniously in order to obtain intuitive results, the three-channel structure of the present analysis is rich enough to yield several implications for tax policies. First, the model shows different channels through which a given policy affects direct investment. More specifically, a reduction in the home country tax rate could reduce direct investment through its effect on the subsidiary's cost of capital while increasing direct investment by affecting relative net returns and the relative cost of funds between countries. The nature and extent of such offsetting effects depend on the financing regime at the margin.

Second, this multi-channel analysis facilitates the evaluation of different types of tax policies. For example, a statutory rate change applies to all three channels while the foreign tax credit and the investment tax credit each work through only one channel, the first and the second respectively. This also suggests that we can study the effects of taxation on the composition as well as the level of direct investment. The Tax Reform Act of 1986 includes provisions reducing the statutory corporate tax rate, repealing the investment tax credit, and restricting the foreign tax credit and tax deferrals. The overall effect of these provisions on direct investment is unclear since these policies can have offsetting effects. Specifically, the rate cut, which has negative overall effects on direct investment as shown in Table 3, could

reinforce the unfavorable effects of policies regarding income repatriation and offset the favorable effects of the repeal of the investment tax credit. However, such a combination of policies may imply, for example, that relatively more equipment investment will be undertaken by foreign subsidiaries.

Third, the analysis shows that different financing regimes yield very different implications for the relative efficacy of the foreign tax credit and tax deferrals as a policy instrument. The tax capitalization view predicts that repealing tax deferral can have much stronger effects on direct investment than a change in the credit system. If parent transfers are the major financing source at the margin as argued in Jun (1988), however, both instruments can be important and must be combined properly. For example, a restriction on the foreign tax credit aimed at discouraging foreign investment could backfire since subsidiaries may retain more earnings to avoid double taxation.

In sum, the analysis presented in this paper suggests that taxation can have a significant effect on international investment. The diversity of the ways in which taxation can affect international investment suggests the importance of empirical work on these issues.

## Appendix: A Special Case Under the Global Approach

We reproduce the arbitrage condition (37) as:

$$r = (1-m)[(1-t)D^*/(1-t^*)]/V + (1-z)(\dot{V} - T)/V \qquad (A1)$$

where $(1-t)D^*/(1-t^*) = D$. Then, we can write a differential equation for V, the value of the firm:

$$\dot{V} = rV/(1-z) - [(1-m)/(1-z)][(1-t)D^*/(1-t^*)] + T \qquad (A2)$$

Subject to the transversality condition:

$$\lim_{s\to\infty} V_s \exp[-rs/(1-z)] = 0 \qquad (A3)$$

equation (A2) can be solved forward to get an expression for the firm value:

$$V = \int_0^\infty [(1-m)/(1-z)][(1-t)/(1-t^*)]D^* - T] \exp[-rs/(1-z)]\, ds \qquad (A4)$$

The subsidiary maximizes its firm value subject to the same constraints in equations (5a) to (5d), where D, I, and K now mean D*, I*, and K* respectively. The solution procedure behind the maximization problem is analogous to those in the previous cases. Under the retained earnings regime, the equations of motion will be:

$$\dot{K}^* = I^* = h([(1-t^*)/(1-t)][(1-z)/(1-m)]) \quad h' > 0,\ h(1) = 0 \qquad (A5)$$

$$q^* = rq^*/(1-z) - (1-t)(1-m)F^{*\prime}/(1-z) \quad \text{(A6)}$$

In the portfolio equilibrium ($\dot{q}^* = 0$):

$$q^* = (1-t)F^{*\prime}/[r/(1-m)] \quad \text{(A7)}$$

In the investment equilibrium ($\dot{K}^* = 0$):

$$q^* = [(1-t)/(1-t^*)]/[(1-m)/(1-z)] \quad \text{(A8)}$$

Note that $q^*$ will be less than unity both because $t > t^*$ and because $m > z$. The cost of capital can be derived from equations (A7) and (A8):

$$COC = r/[(1-t^*)(1-c)] \quad \text{(A9)}$$

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Table 1: The Subsidiary Problem (Exogenous R)

| | Foreign Operation | | | Domestic Operation |
|---|---|---|---|---|
| | Retained Earnings | Parent Transfers (0<d<1) | No Retention/ No Deferral (d=1) | Retained Earnings |
| Portfolio Equilibrium: ($\dot{q}$=0): | | | | |
| (1) q | $\frac{(1-t)F^{*\prime}}{R}$ | $\frac{(1-ETR)F^{*\prime}}{R}$ | $\frac{(1-t)F^{*\prime})}{R}$ | $\frac{(1-t)F'}{r/(1-m)}$ |
| Investment Equilibrium: ($\dot{K}$=0): | | | | |
| (2) q | $\frac{(1-t)}{(1-t^*)}$ | 1 | 1 | $\frac{(1-m)}{(1-z)}$ |
| Steady State ($\dot{q}$ = $\dot{K}$ = 0): | | | | |
| (3) COC | $\frac{R}{(1-t^*)}$ | $\frac{R}{(1-ETR)}$ | $\frac{R}{(1-t)}$ | $\frac{r}{(1-t)(1-z)}$ |
| (4) Tax Neutrality | Capital Import Neutrality | - | Capital Export Neutrality | - |
| (5) $\frac{\partial I}{\partial t}$ | 0 | < 0 | < 0 | - |

Note: ETR = dt + (1-d)t*
m, z: marginal tax rates on dividends and capital gains, respectively
R: rate of return required on direct investment by the parent
r: rate of return required on domestic investment by the shareholders
t, t*: home and host country tax rates

Table 2: The Intrafirm Problem ($R = (1-t)F'$)

| | Retained Earnings | Parent Transfers ($0 \le d \le 1$) | No Retention or No deferral ($d=1$) |
|---|---|---|---|
| Portfolio Equilibrium: ($\dot{q}=\dot{q}^*=0$): | | | |
| (1) $q^*$ | $\frac{F^{*\prime}}{F'}$ | $\frac{(1-ETR)F^{*\prime}}{(1-t)F'}$ | $\frac{F^{*\prime}}{F'}$ |
| (2) $q^*q$ | $\frac{(1-t)F^{*\prime}}{r/(1-m)}$ | $\frac{(1-ETR)F^{*\prime}}{r/(1-m)}$ | $\frac{(1-t)F^{*\prime}}{r/(1-m)}$ |
| Investment Equilibrium: ($\dot{K}=\dot{K}^*=0$): | | | |
| (3) $q^*q$ | $\frac{(1-t)(1-m)}{(1-t^*)(1-z)}$ | $\frac{(1-m)}{(1-z)}$ | $\frac{(1-m)}{(1-z)}$ |
| Steady State ($\dot{q}=\dot{q}^*=\dot{K}=\dot{K}^*=0$): | | | |
| (4) COC* | $\frac{\quad I \quad}{(1-t^*)(1-z)}$ | $\frac{\quad I \quad}{(1-ETR)(1-z)}$ | $\frac{\quad I \quad}{(1-t)(1-z)}$ |
| (5) Alloc. Criterion | $(1-t^*)F^{*\prime}=(1-t)F'$ | $(1-ETR)F^{*\prime}=(1-t)F'$ | $F^{*\prime}=F'$ |
| (6) Tax Neutrality | Capital Import Neutrality | | Capital Export Neutrality |

Note: 1. Domestic investment is financed by retaining earnings.
2. $ETR = dt + (1-d)t^*$
3. Unlike in Table 1, we now distinguish between the subsidiary and parent variables. (e.g. q and $q^*$)

Table 3: Tax Effects on Direct Investment Abroad ($\partial I^*/\partial t$)

| | Retained Earnings | Parent Transfers ($0<d<1$) | No Deferral or No Retention ($d=1$) |
|---|---|---|---|
| Tax policy toward foreign source income (the first channel) | 0 | - | - |
| The relative net return (the second channel) | + | + | + |
| The sum of the first two channels (from Table 7 (5)) | + | + | 0 |
| The relative cost of funds (the third channel) | + | + | + |
| The sum of all three channels | + | + | + |