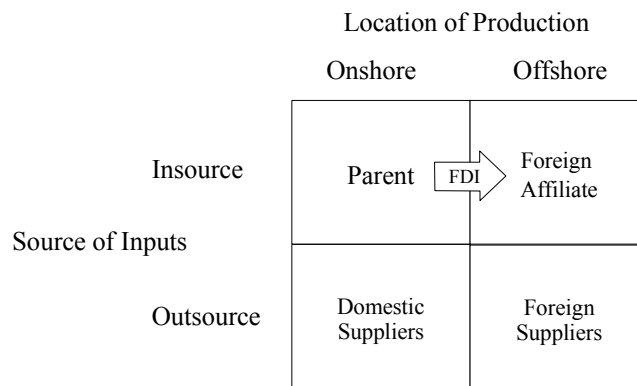

Global Value Chains, Foreign Direct Investment, and Taxation

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1.0 Introduction

This research volume is concerned with the causes and consequences of global value chains—the fragmentation of production across firms and international boundaries. Figure 1 provides a schema for thinking about these phenomena. The total value of inputs used in producing a given level of output can be represented by the large box. Some or all of the intermediate inputs used in producing the final product can be produced within the firm (insource) or purchased from another firm (outsource). These inputs can be obtained within the domestic economy (onshore) or from abroad (offshore). The box labelled “Parent” represents the inputs or tasks that are performed by the firm which controls production of the final product. Some inputs or tasks can be purchased at arms length from other firms operating in the domestic economy. These inputs are represented by the box labelled “Domestic Suppliers”. Alternatively, a firm can obtain some of its intermediate inputs offshore. Inputs supplied by a foreign subsidiary are represented by the box labelled “Foreign Affiliate”. This source of inputs gives rise to foreign direct investment (FDI). Alternatively, the firm could obtain inputs from an outside firm operating in another country, which is represented by the box labelled “Foreign Suppliers”.

Figure 1: Location and Sources of Inputs in the global value chain



* I would like to thank Erik Ens, Johannes Becker, Theiss Buettner, seminar participants at CESifo in Munich, and anonymous referees for their comments on preliminary drafts of this chapter.

From Figure 1 we can see that the role of FDI in the global value chain will be determined by the boundaries defining the production by the “Parent”, “Domestic Suppliers”, and “Foreign Suppliers” in the global value chain. Recently, trade economists have made important advances in explaining the determinants of these boundaries. See for example Grossman and Helpman (2002), Antras (2003), Helpman, Melitz, and Yeaple (2004), and Antràs and Helpman (2004), Helpman (2006), Baldwin and Robert-Nicoud (2006), Antràs, Garicano, and Rossi-Hansberg (2006), and Grossman and Rossi-Hansberg (2008).

Rather than deal with the wide range of forces that are bending and stretching the links in the global value chain, this chapter focuses on one issue—the effect of taxation on the volume and location of FDI by multinational enterprises (MNEs). The recent models developed by the trade economists analyze some of the forces shaping the global value chain, but these models have ignored the role that taxation may be playing. On the other hand, public finance economists have generally ignored the trade economists’ models of FDI and outsourcing. This chapter takes up the challenge of linking the two fields. We begin in Section 2 by developing a theoretical model of the effects of taxes on FDI within a modified version of the Grossman and Rossi-Hansberg (2008) (GRH) task trading framework. Then in Section 3 we survey the empirical literature on taxation and FDI from the perspective of the task trading framework. The final section of the paper briefly discusses the implications of global value chains for tax policy.

2.0 A Model of Global Value Chains, FDI, and Taxation

Intra-firm trade is an important component of world trade and is intimately connected with FDI.¹ However, most theoretical models of the effects of taxation on FDI treat capital flows between countries as if they were portfolio investments rather than part of an MNE’s global value chain. In this section, we use a modified version of the GRH framework to model the effects of taxes on the flow of intermediate inputs between a parent and its foreign subsidiary.² Section 2.1 provides a brief overview of a modified version of the GRH task trading model. Then in Section 2.2, we use this model to analyze the effects of tariff reductions on trade and FDI. In Section 2.3, the effect of host and home country corporate income taxes (CITs) on FDI is decomposed into a “shore” and a “scale” effect. The analysis highlights the important role that the transfer prices used to value intra-firm trade play in determining the effects of a CIT rate increase on FDI. Our analysis indicates a CIT rate increase often has ambiguous shore and scale effects. Therefore, in Section 2.4 we present some computations of the tax sensitivity of FDI under a range of parameter values (including assumptions about transfer prices) to give some indication of the direction and magnitudes of these effects. In Section 2.5 we consider two extensions of the model. First, we consider an MNE which operates in three countries and how their tax rates affect the allocation of tasks among these countries. Later in that section, we assume that the tasks vary in their capital intensity and allow the MNE to contract with foreign suppliers for the performance of some tasks. Aspects of international taxation, such as double dip financing arrangements, may give an MNE’s

¹ Antras (2003) notes that roughly one third of world trade is intra-firm trade. Around 80 percent of Canada’s trade with the United States is intra-firm trade.

² Becker, Fuest and Riedel (2009) also use the GRH task trading framework to analyze the effects of taxes on FDI.

foreign subsidiary a lower cost of capital than domestic firms in the host country, giving a foreign subsidiary an advantage in performing capital intensive tasks. This may help to explain why MNEs tend to import labour intensive intermediate inputs from foreign suppliers, while capital intensive intermediate inputs are obtained through intra-firm trade with foreign affiliates. Section 2.6 concludes with some predictions from the trading in tasks model about the effects of taxes on FDI and the global value chain.

2.1 A Task Trading Model with Taxes

As in the original GRH model, we assume that the tasks involved in producing a unit of output can be indexed by $i \in [0, 1]$. For simplicity, we treat i as a continuous variable. The MNE can perform the tasks in an affiliate operating in a foreign country or in the parent company in the MNE's home country. The after-tax cost of performing task i by the affiliate is given below:³

$$c_a(i) = (\alpha_L (1 - u_a) w_a + \alpha_K \rho_a) \beta t(i) = c_a \beta t(i) \quad (1)$$

where:

α_L is the amount of labour required to produce one unit of task i ;

u_a is the corporate income tax rate in the host country where the affiliate is located;

w_a is the wage rate paid by the affiliate in the host country;

α_K is the amount of capital required to produce one unit of task i ;

ρ_a is the after-tax cost of capital for the affiliate in the host country (to be defined in a later section);

$t(i)$ is the cost of coordinating task i in the affiliate by the MNE;

β is a shift variable reflecting changes in the cost of coordinating tasks in the affiliate.

It is assumed that the activities can be ranked in terms of their coordination cost and that $t'(i) > 0$.⁴ In this version of the GRH model, we make the simplifying assumptions that the input coefficients are fixed (there is no substitution of labour for capital) and the same for each task. (In Section 2.5, we relax the latter assumption and allow the capital intensity of the tasks to vary.)

The after-tax cost of performing the tasks in the home country is:

$$c_h(i) = (\alpha_L (1 - u_h) w_h + \alpha_K \rho_h) = c_h \quad (2)$$

where:

u_h is the corporate income tax rate in the home country;

w_h is the wage rate paid by the MNE in the home country;

ρ_h is the after-tax cost of capital for the MNE in the home country.

³ The GRH model does not contain taxes and in their paper the inputs used to generate tasks are high and low skilled labour because they were interested in the effects of outsourcing on the home country's labour market.

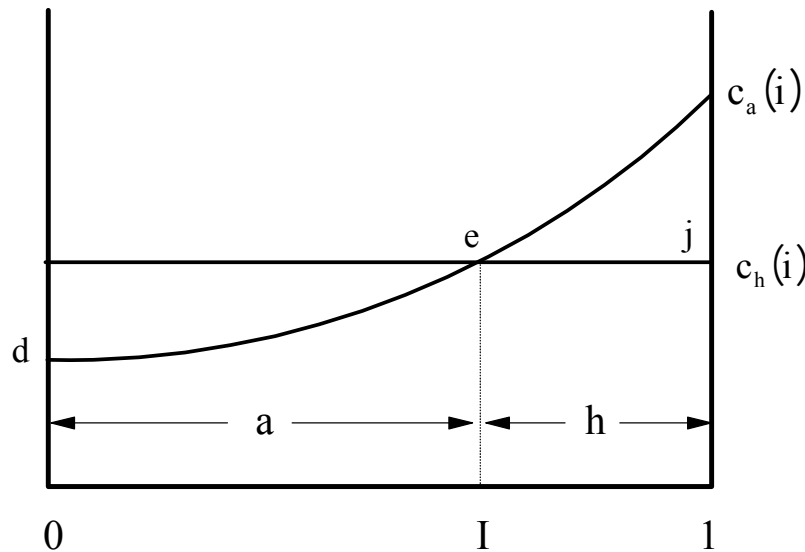
⁴ The GRH model assumes that tasks are non-sequential and can be combined in any order. See Harms, Lorz, and Urban (2009) for a task trading model with sequential tasks.

To simplify the analysis, we have assumed that each task can be produced at a constant after-tax marginal cost, c_h , by the parent in the home country.

Note that α_L and α_K are the same for $c_a(i)$ and $c_h(i)$. This reflects the key idea in the GRH model that the MNE is able to transfer technology across international boundaries and use the same technology in both the affiliate and the parent corporation. The differences in the costs of performing tasks in the affiliate and the parent are due to differences in the after-tax costs of labour and capital in the host and home countries and the coordination costs that are incurred in performing the tasks in the affiliate located in the host country.

The MNE allocates tasks between the affiliate and the parent in order to maximize its total after-tax profits. In the absence of taxes and assuming $c_a(0) < c_h$, the MNE would allocate tasks from 0 to I to the affiliate, such that $c_a(I) = c_h(I)$. This situation is illustrated in Figure 2. The symbol I represents the fraction of the tasks that are performed in the affiliate. The tasks from I to 1 are undertaken by the parent in the home country because of the high cost of coordinating these activities in the affiliate. Reductions in communication and coordination costs would be reflected in a reduction in the value of the shift parameter, β , which would lead to a downward shift in the $c_a(i)$ curve and an increase in the range of the tasks that would be performed in the affiliate.

Figure 2: The GRH Task Trading Model



The marginal cost of producing a unit of output is equal to the area under the $c_a(i)$ from 0 to I plus the area under the c_h curve from I to 1, or the area dej in Figure 2, and is given by the following equation:

$$MC(I) = MC_a(I) + (1 - I)c_h \quad \text{where} \quad MC_a(I) = \int_0^I c_a \beta t(i) di \quad (3)$$

Let Q be total output of the final product. The total foreign direct investment by the parent in the affiliate is:

$$FDI = \alpha_K \cdot I \cdot Q \quad (4)$$

It is assumed that the MNE has some monopoly power in the market for its product and that the demand for its product is given by:

$$Q = Ap^\varepsilon \quad A > 0, \varepsilon < -1 \quad (5)$$

where A reflects the size of the market for the MNE's product, p is the price of the product, and ε is the price elasticity of demand.

It will be useful to distinguish between changes in the tax systems of the host and home countries that affect FDI through changes in I , holding Q constant, and through changes in Q , holding I constant. We will use the terms *shore effect* to refer to changes in the range of tasks undertaken in the affiliate, and *scale effect* to refer to the effects of changes in the cost of the labour and capital in both countries on total production and therefore the need for investment in the affiliate. The corporate income tax rates in both the host and home countries will affect the level of FDI and intra-firm trade in intermediate inputs in complex ways. However, before analyzing these effects, however, we will explore the effects of tariff reform on FDI and the volume of intra-firm trade.

2.2 The Effects of a Tariff Reduction on FDI and Exports

In order to sell its product in a foreign market, a firm can either export the product to the foreign country or it can set up a subsidiary and produce the product in the foreign market. In this traditional view, FDI is a substitute for exports from the home country.⁵ For example, Levitt (1970, p.159) claimed that US FDI in Canada and other countries after World War II was “a means of jumping tariff and other barriers to trade erected in the 1930s....” However, since the 1950s, the average tariff rates imposed by Western countries have fallen by over 20 percentage points, stimulating trade, but at the same time FDI has also increased.⁶ Therefore the notion that FDI is a substitute for exports seems to be inconsistent with the empirical evidence which indicates that FDI and trade are positively correlated. We can use the model to investigate under what conditions a tariff reduction (a move to free or freer trade) reduces or increases the level of FDI.

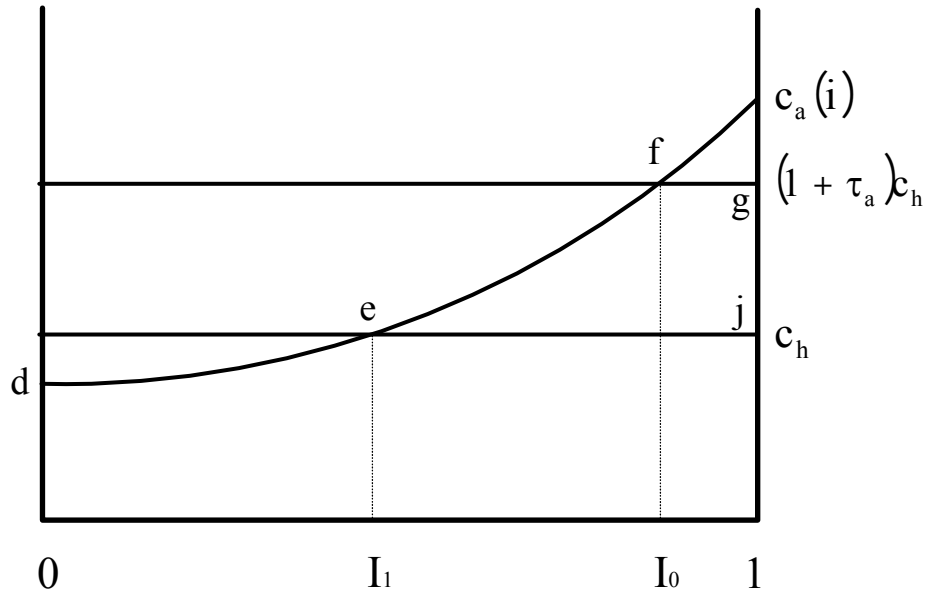
In this section of the paper we assume $u_a = u_h = 0$ in order to focus on the effect of tariff reductions on FDI. The only tax levied by the host country is a tariff, τ_a , on imports from the home country. This tariff applies to both the final product or the intermediate products imported from the home country.

⁵ See Head and Ries (2004) and Caves (2007, pp.35-42) for a discussion of these issues. See also Kemsley (1998) who finds that foreign income tax affects export decisions by US multinationals.

⁶ See OECD (2007a, Table 1.1 page 14 and Figure 2.1 page 26)

In Figure 3, it is assumed that the tariff is not prohibitive and that the initial FDI is determined by the condition $c_a(I_0) = (1 + \tau_a)c_h$. If the tariff on imports from the home country is eliminated, the fraction of tasks that will be conducted in the host country will decline to I_1 . This would directly reduce FDI and increase of exports intermediate goods from the home country, which is consistent with the view that FDI and exports are substitutes. However, the reduction in the tariff will reduce the marginal cost of production from MC_0 , which is equal to the area defg, to MC_1 , which is equal to the area dej. This will induce the MNE to cut the price of its final product to expand sales, which will imply an increase in the amount of capital invested in the affiliate. Thus the tariff reduction will have an ambiguous effect on FDI because the shore effect, which reduces FDI, will be offset by the scale effect caused by the reduction in the marginal cost of production.

Figure 3: The Effect of a Tariff on the Allocation of Tasks in an MNE



To further investigate these effects, we will define an index of the relative level of FDI with free trade compared to the situation where a tariff is imposed on imports from the home country:

$$\frac{FDI_1}{FDI_0} = \frac{I_1}{I_0} \cdot \left(\frac{MC_1(I_1)}{MC_0(I_0)} \right)^\varepsilon \quad (6)$$

where $I_1 < I_0$ and $MC_1 < MC_0$. Note that the scale effect will be larger the more elastic the demand for the MNE's product, and therefore we would expect that free trade

will tend to promote both FDI and trade in intermediate products when the demand for the final product is relatively elastic.

In order to gauge the relative importance of these two effects, we have adopted the following functional form for the coordination cost function:

$$t(i) = e^{mi} \quad m > 0 \quad (7)$$

With this coordination cost function:

$$I_0 = m^{-1} \ln \left(\frac{(1 + \tau_a)c_h}{\beta c_a} \right) \quad (8)$$

$$I_1 = m^{-1} \ln \left(\frac{c_h}{\beta c_a} \right) \quad (9)$$

$$MC_0 = \beta c_a \left(\frac{e^{mI_0} - 1}{m} \right) + (1 - I_0)(1 + \tau_a)c_h \quad (10)$$

$$MC_1 = \beta c_a \left(\frac{e^{mI_1} - 1}{m} \right) + (1 - I_1)c_h \quad (11)$$

Table 1 shows computations of relative FDI and exports with the elimination of a 20 percent tariff on imported intermediate inputs for various values of ϵ and combinations of m and β which determine the slope of the $t(i)$ curve. In these computations, $c_a = c_h = 1$. With $m = 0.5$, the $t(i)$ curve is almost linear. In the first row with $\beta = 0.882$, a 20 percent tariff implies that $I_0 = 0.62$ and with free trade $I_1 = 0.25$, indicating a relatively large shore effect. With free trade and $\epsilon = -1.5$, FDI declines to 47.9 percent of its pre-free trade value, while home country exports more than double. With this set of parameter values, FDI always declines if $\epsilon > -8.32$. In general, these calculations illustrate a case where exports are highly responsive to the elimination of the tariff and are a substitute for FDI.

The effect of a tariff reduction depends on the slope of $t(i)$ curve. With $m = 4$, the $t(i)$ curve is steeper, resulting in a smaller change in I in response to the elimination of a 20 percent tariff on host country's imports. In the fourth row, free trade only reduces the input share of the affiliate from 0.30 to 0.25, indicating a relatively small shore effect. The elimination of the tariff increases FDI because the reduction in cost, and consequently the reduction in the price of the product, boosts the scale of production and the amount of capital invested in the affiliate. With these parameter values, FDI increases as long as $\epsilon < -1.13$. When demand for the product is highly price elastic, FDI more than doubles with free trade. These calculations illustrate a situation in which FDI and exports from the home country are complementary in the sense that free trade promotes both FDI and exports of intermediate inputs. This latter case may help to explain the empirical studies

which find that FDI and trade are complementary if one of the driving forces is the reduction in tariffs on intermediate inputs by the host country.⁷

Table 1: The Effects on FDI and Home Country Exports of Eliminating a 20 Percent Tariff

			FDI ₁ /FDI ₀			X ₁ /X ₀		
			ε			ε		
			-1.5	-3	-6	-1.5	-3	-6
I ₀	I ₁	β	m = 0.5					
0.62	0.25	0.882	0.479	0.564	0.779	2.291	2.694	3.724
0.86	0.50	0.779	0.636	0.701	0.85	4.056	4.467	5.416
1.00	0.75	0.687	0.772	0.793	0.838	∞	∞	∞
			m = 4.0					
0.30	0.25	0.368	1.057	1.320	2.061	1.330	1.662	2.594
0.55	0.50	0.135	1.105	1.333	1.939	1.327	1.601	2.328
0.79	0.75	0.050	1.077	1.231	1.609	1.396	1.596	2.085

2.3 The Effects of Corporate Income Tax Rates on FDI

Corporate income tax rates affect the after-tax cost of capital in the home and host country. In this paper, we use the following standard specification for the after-tax cost of capital for the affiliate taxes which ignores withholding taxes and the various ways in which MNEs can structure the financing of their affiliates, such as using double dip arrangements:⁸

$$\rho_a = (r_a + \delta)(1 - \phi) \left[1 - u_a \frac{a}{r_a + a} \right] \quad (12)$$

where r_a is the opportunity cost of funds invested in the affiliate (to be defined below), δ is the economic rate of depreciation, ϕ is the investment tax credit rate, and a is the rate of depreciation for tax purposes (capital cost allowance rate). The opportunity cost of funds is given by the after-tax return required by investors, or:

$$r_a = (1 - u_a)b_i + (1 - b)\rho_e \quad (13)$$

⁷ Antràs and Caballero (2009) also show that trade liberalization can make capital flows and trade complements in a model based on differences in financial market development between countries. Removing trade barriers in their model increases the return to capital in countries with under-developed financial sectors, thereby increasing both trade and capital flows. Their model does not involve FDI or trade in intermediate inputs by multinationals, which drives the possibility of complementarity of trade and FDI in our modified version of the GRH model.

⁸ See OECD (2007b), Dahlby (2008), and Chen and Mintz (2008) on how the cost of capital invested in foreign affiliates is affected by these types of financing mechanisms. Arnold (2009, pp. 256-259) contains a description of how double dip financing can be structured by an MNE.

where b is the fraction of the investment that is financed by debt, i is the interest rate on debt used to finance the FDI, and ρ_e is the opportunity cost of funds for shareholders. Note that the user cost of capital for the affiliate, $ucc_a = \rho_e / (1 - u_a)$. It is assumed that the ucc_a is increasing in u_a .⁹

The corporate income tax also affects the after-tax revenues generated by sales of the final product, as well as the rate at which the intermediate inputs can be deducted from taxable income. Consequently, we need to consider two case—one where the sales of the final product are attributed to the affiliate, and a second case where the sales of the final product are attributed to the parent.

*Case 1: Final Product Sales by the Affiliate*¹⁰

In this case, we assume the good or service produced by the MNE is sold in the host country, or in a third country, and the revenues generated by the sale of the MNE's product is attributed to the affiliate. The parent company exports intermediate inputs or tasks to the affiliate, and this will give rise to transfer payments from the affiliate to the parent. Later, we will discuss the valuation of the tasks performed by the parent, but for the time being we will represent the total transfer payments from the affiliate to the parent by $P(1 - I)Q$, where P is the transfer price that would be assigned to a unit of the final product if it were exported from the parent to the affiliate. We assume that the total transfer payment is proportional to the sales of the final product and based on the fraction of the inputs provided by the parent. It is best to think of $P(1 - I)Q$ as the transfer payment for a bundle of services or components and not a payment for a specific task.

The after-tax profit of the affiliate is:

$$\Pi_a = (1 - u_a)R(Q) - (1 - u_a)P \cdot Q \cdot (1 - I) - Q \cdot MC_a(I) \quad (14)$$

where $R(Q)$ is the revenue generated by the sale of the product. The after-tax profit of the parent is:

$$\Pi_h = ((1 - u_h)P - c_h)(1 - I)Q \quad (15)$$

The transfer payment for the tasks performed by the parent is a deduction for the affiliate and represents the taxable income of the parent. Consequently the MNE's total after-tax profit is:¹¹

$$\Pi = \Pi_a + \Pi_h = (1 - u_a) \cdot R(Q) + \Delta u \cdot P \cdot Q \cdot (1 - I) - MC(I) \cdot Q \quad (16)$$

⁹ Also note that the marginal effective tax rate (METR_a) can be related to the ucc_a as follows: $METR_a = (ucc_a - (i + \delta)) / (ucc_a - \delta)$.

¹⁰ Mankiw and Swagel (2006, p. 22) note that only “11 percent of the total output of US firms’ foreign affiliates goes to the US market. Instead, 65 percent goes to the local market—the same country as the affiliate—while another 24 percent goes to third party foreign markets.” It is not known whether there is a similar distribution of sales by Canadian foreign affiliates.

¹¹ It is assumed that the home country exempts dividends from the active business income of the foreign subsidiary, and no additional tax is levied by the home country on the income earned by the foreign subsidiary. Most of the dividend income from foreign subsidiaries of Canadian corporation is treated in this way.

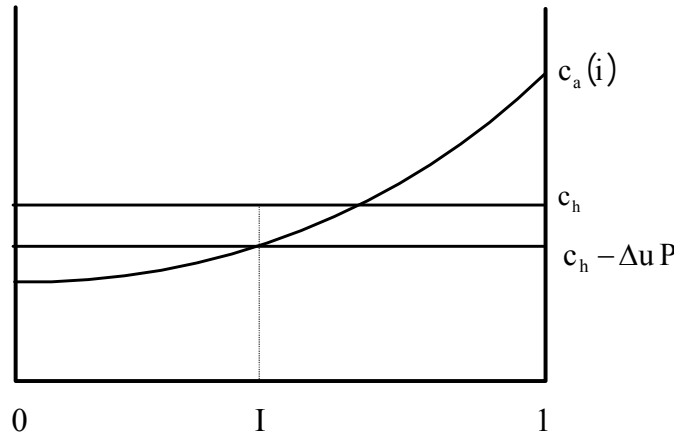
where $\Delta u = u_a - u_h$ is the CIT rate differential between the host and the home country and $MC(I)$ is given in (3). The MNE's total after-tax profits are increasing (decreasing) in the transfer payments made by the affiliate if u_a is greater than (less than) u_h . We will discuss the determination of the transfer price in this model later in this section, but for moment we will take P as given.

The MNE maximizes its after-tax profits through its choice of I and Q . Taking the partial derivative of Π with respect to I , and the optimal allocation of tasks within the MNE is determined by the following condition:¹²

$$c_a(I) = c_h - \Delta u \cdot P \quad (17)$$

This condition describing the optimal source of the tasks is illustrated in Figure 4 where it is assumed that $\Delta u > 0$. Task I can be performed at an after-tax cost of c_h in the home country, which exceeds the after-tax cost of performing the task in the host country, $c_a(I)$. However, because of a positive tax rate differential, exporting task I to the affiliate results in a tax deduction in the host country at the rate $u_a P$, which is greater than the additional tax imposed on the income received by the parent in the home country, $u_h P$. This reduces the total after-tax cost of performing the task at home to the point where it is the same as the after-tax cost of performing it in the host country. The above condition indicates that tax rate differentials between host and home countries can influence the allocation of tasks within the MNE through their effects on the after-tax costs of labour and capital in the two countries and through the transfer price. An important contribution of this model is that it shows how the allocation of tasks depends on the transfer prices that are adopted for intra-firm trade if there is a tax rate differential between host and home countries.

Figure 4: The Optimal Allocation of Tasks in an MNE when the Host Country CIT Rate Exceeds the Home Country CIT Rate



¹² This condition for the optimal allocation of tasks was derived by Becker, Fuest, and Riedel (2009). A similar condition was derived by Horst (1971) for the optimal allocation of production in a horizontal MNE with plants in more than one country.

The profit-maximizing level of output for the MNE is determined by the following equation:

$$(1 - u_a) \frac{\partial R}{\partial Q} + \Delta u (1 - I)P = MC(I) \quad (18)$$

At the optimal output level, after-tax marginal revenue of the affiliate, $(1 - u_a) \partial R / \partial Q$, plus the additional after-tax profit resulting from producing an additional unit of output through the transfer price mechanism, $\Delta u (1 - I)P$, is equal to the marginal after-tax cost of producing the product, $MC(I)$. Consequently, if there is a positive tax rate differential between the host and the home country, the transfer price mechanism will increase output and FDI, and this effect will be larger the higher the transfer price.

From (18), the profit-maximizing price for an MNE's product is:

$$p = \left(\frac{\varepsilon}{1 + \varepsilon} \right) \left[\frac{MC(I) - \Delta u (1 - I)P}{1 - u_a} \right] \quad (19)$$

where the expression in round brackets is the optimal mark-up rate, which is lower the more elastic the demand for the MNE's product, and the expression in square brackets is the before-tax marginal cost of production, $MC(I)/(1 - u_a)$, less the transfer price effect, $\Delta u (1 - I)P / (1 - u_a)$. Thus a positive tax rate differential, holding I constant, will tend to lower the profit-maximizing price of the product, and this effect will be larger the higher the transfer price for the tasks performed by the parent. The total output of the MNE will be:

$$Q = A \left(\frac{\varepsilon}{1 + \varepsilon} \right)^\varepsilon \left[\frac{MC(I) - \Delta u (1 - I)P}{1 - u_a} \right]^\varepsilon \quad (20)$$

and from (4) total FDI is:

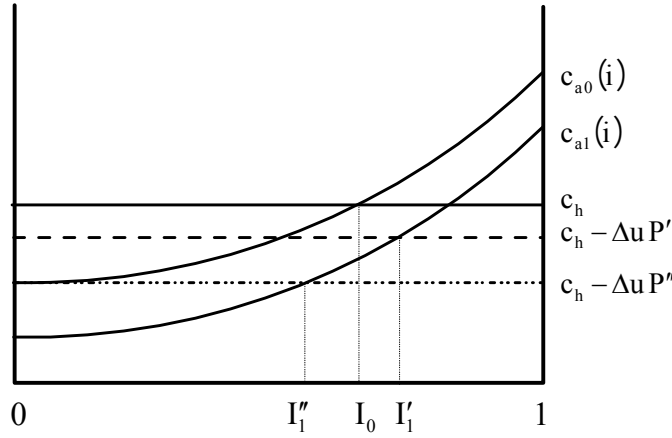
$$FDI = \alpha_K \cdot A \cdot I \cdot \left(\frac{\varepsilon}{1 + \varepsilon} \right)^\varepsilon \left[\frac{MC(I) - \Delta u (1 - I)P}{1 - u_a} \right]^\varepsilon \quad (21)$$

where I is determined by the condition in (17).

We can now analyze the effects of an increase in the host or the home country's CIT rate. To simplify the analysis, we assume that initially the host and home countries impose the same CIT rate, and therefore $\Delta u_0 = 0$ and I_0 is the fraction of the tasks that are initially performed in the affiliate. Figure 5 shows that an increase in u_a has an ambiguous shore effect. An increase in u_a , holding u_h constant, reduces the after-tax cost of performing the tasks in the affiliate, and the $c_a(i)$ curve shifts down to $c_{a1}(i)$, which tends to increase the range of tasks performed in the affiliate and to increase FDI. However, the increase in u_a creates a positive tax rate differential between the host and home countries, $\Delta u_1 > 0$, and

this tends to lower the net after-tax cost of performing tasks in the home country. If the transfer price is relatively low, such as P' in Figure 5, the shore effect of the increase in u_a is positive. However, with a higher transfer price, such as P'' , the shore effect is negative and tends to reduce FDI. This illustrates the key importance of the transfer price for determining whether the shore effect promotes or inhibits FDI. Note that when there is a positive tax rate differential, it is in the MNE's interest to use a high transfer price. This suggests that if MNEs have considerable scope in setting the transfer price, the shore effect of an increase in the host country's CIT rate will tend to reduce FDI.

Figure 5: The Shore Effect of an Increase in the Host Country CIT Rate



The scale effect depends on how the increase in u_a affects the MNE's before-tax marginal cost of production, $(MC(I) - \Delta u(1 - I)P)/(1 - u_a)$. Holding I constant at I_0 , the change in the pre-tax marginal cost of production from an increase in u_a is:

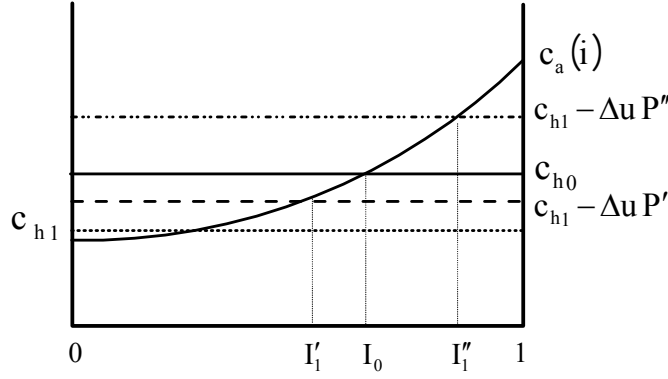
$$\Delta PTMC = \left(\frac{C_1(I_0)}{1 - u_{a1}} - \frac{C_0(I_0)}{1 - u_{a0}} \right) - \left[\frac{u_{a1} - u_{a0}}{1 - u_{a1}} \right] (1 - I_0)P \quad (22)$$

where it is assumed that $u_{a0} = u_h$. The first term in round brackets is positive since we are assuming that the user cost of capital is increasing in the host country's tax rate. The second term is also positive and is larger when the transfer price is higher. Therefore, the scale effect also has an ambiguous sign and depends on the transfer price. Note that the transfer price has offsetting impacts on FDI through the shore and scale effects. With an increase in u_a , a higher transfer price causes FDI to decline by a greater amount through the shore effect, but it tends to moderate the decline in FDI through the scale effect or to convert it into a positive effect.

An increase in the home country CIT rate, u_h , also has an ambiguous shore effect. As shown in Figure 6, an increase in u_h shifts the c_h curve down to c_{h1} . However, the tax rate differential is now negative, which raises the net after-tax cost of sourcing inputs in home

country. If the transfer price is relatively low, such as P' , then more tasks will be provided by the parent, and FDI will decline with the increase in u_a . However, with a high transfer price, such as P'' , the share of tasks performed by the parent will decline, and the shore effect of an increase in u_h will increase FDI. Note that in this case when u_h exceeds u_a , it is in the MNE's interest to set a low transfer price, and the shore effect of an increase in u_h will tend to reduce FDI.

Figure 6: The Shore Effect of an Increase in the Home Country CIT Rate



Case 2: Final Product Sales by the Parent

Now we will consider the case where the sales of the final product are in the home country, or in a third country with the revenues attributed to the parent. The foreign affiliate exports intermediate inputs or tasks to the parent, and this gives rise to transfer payments from the parent to the affiliate. The transfer payment for the tasks performed by the affiliate is a deduction for the parent and represents the taxable income of the affiliate. The after-tax profits of the affiliate and the parent are:

$$\Pi_a = (1 - u_a)(P \cdot I \cdot Q) - MC_a(I) \cdot Q \quad (23)$$

$$\Pi_h = (1 - u_h)(R(Q) - P \cdot I \cdot Q) - c_h(1 - I)Q \quad (24)$$

The MNE's total after-tax profit is:

$$\Pi = \Pi_a + \Pi_h = (1 - u_h)R(Q) - \Delta u PQI - MC(I)Q \quad (25)$$

where, as before, $\Delta u = u_a - u_h$.

When the revenues are attributed to the parent and taxed by the home country, the optimal sourcing condition is the same as in the case when the revenues are attributed to the affiliate. That is, condition (17) determines the optimal I in both cases. However, the condition for profit-maximizing output is now given by:

$$(1 - u_h) \frac{\partial R}{\partial Q} - \Delta u \cdot I \cdot P = MC(I) \quad (26)$$

Now a higher transfer price will reduce (increase) the profit-maximizing output of the final product if u_a is greater than (less than) u_h , with the size of this effect increasing in the transfer price. As in the previous situation, where the revenues were attributed to the affiliate, the shore effect of an increase in u_a or u_h on FDI is ambiguous.

Transfer Prices and the Effects of Corporate Income Taxes on FDI

The shore and scale effects of a CIT rate increase depend on the transfer price used to value the tasks performed either by the parent or by the affiliate. If the final product is sold by the affiliate, the MNE's after-tax profits are increasing in the transfer price P if $u_a > u_h$ and decreasing in P if $u_a < u_h$, implying that the MNE would want to set a high transfer price when the $u_a > u_h$ and a low transfer price when $u_a < u_h$. Conversely, if the final product is sold by the parent, the MNE would want a low transfer price for the tasks performed by the affiliate if $u_a > u_h$ and a high transfer price if $u_a < u_h$. There is a long established and large literature on taxation and transfer pricing by MNEs starting with Horst (1971) and Copithorne (1971). The theoretical analysis of transfer pricing and the practice and conduct of transfer pricing is covered extensively in Eden (1985, 1998), Diewert (1985), and Caves (2007, 245-249).¹³ It is interesting to note that in the context of a vertically integrated MNE, which is the situation that we are modelling, Copithorne (1971) concluded that transfer prices would not affect the allocation of resources within the MNE. However, explicitly modelling the provision of tasks by the parent and the affiliate using the GRH framework shows that transfer prices affect the allocation of task (and consequently the level of FDI) within the MNE when there is a CIT rate differential between the home and host countries.

Developing a full model of transfer pricing decisions is beyond the scope of this paper. While an MNE has an incentive to manipulate transfer prices in response to a CIT rate differential, its ability to manipulate transfer prices may be constrained by tax officials in the home and host countries, who have conflicting interests in establishing transfer prices.¹⁴ An aggressive transfer pricing policy may be very costly because the firm will have to use resources, such as outside consultants, to justify its transfer prices. Also, zero after-tax profits for the parent or the affiliate may place upper and lower bounds on the feasible transfer prices because tax officials may challenge the appropriateness of the transfer prices adopted by the MNE if they result in either the parent or the affiliate consistently

¹³ The empirical literature on transfer pricing and profit-shifting is reviewed in Section 3.

¹⁴ Tax motivated transfer prices may distort the allocation of resources within the MNE if they are used in decentralized decision-making. In addition, Keuschnigg and Devereux (2009, p.31) argue that transfer prices "serve an important economic function and are not merely a tool for tax minimization." They develop a model in which, in the absence of tax considerations, the optimal transfer price departs from the arm's length price in order to shift profits to the subsidiary when the firm faces constraints on financing investment because of asymmetric information. Forcing firms to use arms length prices results in a reduction in investment and production and a global welfare loss. See also Gresik and Osmundsen (2008) on the use of the cost-plus method of determining transfer prices in vertically integrated industries where there are no independent arms-length transactions and Dischinger and Riedel (2009) on the use of transfer prices to reduce the free cash flow of subsidiaries to overcome agency problems.

operating at a loss. We use this conjecture about the feasible range of transfer prices to define a Low Transfer Price scenario and a High Transfer Price scenario for each of the two cases identified above.

In Case 1, where the sales of the final product are attributed to the affiliate, $P = c_h/(1 - u_h)$ in the Low Transfer Price scenario, which implies that the parent in the home country earns zero after-tax profits from its provision of tasks. This scenario might arise if the parent performs “standard” tasks that are also performed by other firms in competitive markets and these arms-length prices can be used to value its tasks. Alternatively, in the High Transfer Price scenario, the after-tax profit of the affiliate is zero and $P = (1 - I)^{-1}(p - MC_a(I))/(1 - u_a)$. This may be a reasonable upper bound for the transfer price because any higher price would imply that the affiliate would be operating at a loss, and this could cause tax officials in the host country to challenge the appropriateness of the transfer prices adopted by the MNE. Note that if $u_a > u_h$, the MNE would have a higher total after-tax profit with the high transfer price and would prefer the low transfer price if $u_a < u_h$.

In Case 2, where the sales of the final product are attributed to the parent, $P = MC_a(I)/[I(1 - u_a)]$ in the Low Transfer Price scenario, which implies that the affiliate earns zero after-tax profits. In the High Transfer Price scenario, the after-tax profit of the parent is zero and $P = (p - (1 - I)c_h/(1 - u_h))/I$. In this case if $u_a > u_h$, the MNE would have a higher total after-tax profit with the low transfer price and would prefer the high transfer price if $u_a < u_h$.

Table 2 shows the equations which determine the shore and scale effects for the two cases under the Low and High Transfer Price scenarios. Note that the equation determining the scale effect is the same in the Low Transfer Price scenarios whether the sales of the final product are attributed to the affiliate or the parent. Table 3 shows the predicted effects of increases in the home and host country tax rates, starting from a situation where the CIT rates are the same. The shore effect has an ambiguous sign under both transfer price scenarios when final product sales are made by either the affiliate or the parent. The scale effect is negative in the Low Transfer Price scenarios in both cases for an increase in either the home or host country CIT rate. In the High Transfer Price scenario, the scale effect of an increase in either the home or host country CIT rate is always ambiguous.

Table 2: The Equations Determining of the Shore and Scale Effects

	Case 1: Sale of the Final Product Attributed to the Affiliate	
	Shore effect	Scale Effect
Low Transfer Price Scenario	$c_a(u_a, I) = \left(\frac{1 - u_a}{1 - u_h} \right) \cdot c_h(u_h, I)$	$Q = A \cdot \left(\frac{\varepsilon}{1 + \varepsilon} \right)^{\varepsilon} \left[\frac{MC_a(u_a, I)}{1 - u_a} + \frac{(1 - I) \cdot c_h(u_h, I)}{1 - u_h} \right]^{\varepsilon}$
High Transfer Price Scenario	$c_a(u_a, I) = c_h(u_h, I) - \frac{u_a - u_h}{1 - I} \left(p - \frac{MC_a(u_a, I)}{1 - u_a} \right)$	$Q = A \cdot \left(\frac{\varepsilon}{1 + \varepsilon} \right)^{\varepsilon} \left[\frac{\frac{1 - u_h}{1 - u_a} \cdot \frac{MC_a(u_a, I)}{1 - u_a} + (1 - I) \cdot \frac{c_h(u_h, I)}{1 - u_h} \right]^{\varepsilon} \left[\frac{1 + \varepsilon}{\varepsilon} + \frac{u_a - u_h}{1 - u_a} \right]$
	Case 2: Sale of the Final Product Attributed to the Parent	
	Shore effect	Scale Effect
Low Transfer Price Scenario	$c_a(u_a, I) = c_h(u_h, I) - u_a - u_h, I \cdot \left(\frac{1}{I} \cdot \frac{MC_a(u_a, I)}{1 - u_a} \right)$	$Q = A \cdot \left(\frac{\varepsilon}{1 + \varepsilon} \right)^{\varepsilon} \left[\frac{MC_a(u_a, I)}{1 - u_a} + \frac{(1 - I) \cdot c_h(u_h, I)}{1 - u_h} \right]^{\varepsilon}$
High Transfer Price Scenario	$c_a(u_a, I) = \left[\frac{1 - u_h + (1 - I)u_a}{I \cdot (1 - u_h, I)} \right] c_h(u_h, I) - \frac{u_a - u_h}{I} \cdot p$	$Q = A \cdot \left[\frac{\frac{MC_a(u_a, I)}{1 - u_h} + \left(\frac{1 - u_a}{1 - u_h} \right) \cdot \frac{(1 - I) \cdot c_h(u_h, I)}{1 - u_h}}{\frac{1 + \varepsilon}{\varepsilon} - \frac{u_a - u_h}{1 - u_h}} \right]^{\varepsilon}$

Table 3: Summary of the Effects of Increases in CIT Rates on FDI

	Case 1: Final Product Sales by Affiliate	
Scenario	Increase in the Host Country Tax Rate, u_a	
	Shore effect	Scale Effect
Low Transfer Price	Ambiguous	Negative
High Transfer Price	Ambiguous	Ambiguous
	Case 2: Final Product Sales by Parent	
Scenario	Increase in the Host Country Tax Rate, u_a	
	Shore effect	Scale Effect
Low Transfer Price	Ambiguous	Negative
High Transfer Price	Ambiguous	Ambiguous
	Increase in the Home Country Tax Rate, u_h	
	Shore effect	Scale Effect
Low Transfer Price	Ambiguous	Negative
High Transfer Price	Ambiguous	Ambiguous

2.4 Computation of the Semi-Elasticities of FDI with respect to CIT Rates

Because the shore effect is always ambiguous over the range of transfer prices that we are considering and because the scale effect is ambiguous in the High Transfer Price scenario, we have resorted to numerical computations to provide insights concerning the predicted effects of CIT rate increases on FDI.

Tables 4 shows calculations of the semi-elasticities of I , Q , and FDI with respect to the host country and home country CIT rates when the final product sales are attributed to the affiliate. (These semi-elasticities indicate the percentage changes in these variables for a one percentage point increase in u_a or u_h) We have calculated these semi-elasticities for a capital intensive product, where labour costs are 25 percent of the total cost of production (calculated at the host country's input prices) and a labour intensive product where labour costs are 75 percent of total costs. The computations are based on the assumption that initially both the home and the host countries' CIT rates are 0.30, and then the responses in I , Q , and FDI were calculated for a one percentage point increase in u_a or u_h .

The first row of the Table 4 shows the case where initially 25 percent of the tasks are performed by the affiliate. A one percent increase in host country CIT rate would reduce FDI by 3.57 percent in the capital intensive (CIP) case and by 1.20 percent in the labour intensive (LIP) case. Although our model does not allow us to provide an unambiguous

sign for the shore effect, in these calculations the semi-elasticity of I with respect to u_a is always negative. The semi-elasticity of Q with respect to u_a is negative (as predicted) in the Low Transfer Price scenario and positive in the High Transfer Price scenario. While the increase in output would tend to increase FDI, in these calculations the negative shore effect dominates, and the FDI declines sharply in response to the host country's tax rate increase for both capital intensive and labour intensive projects.

Table 4: Semi-Elasticities of I , Q , and FDI with respect to CIT Rates: Final Product Sales by the Affiliate

		An Increase in u_a					
		Capital Intensive Product Case			Labour Intensive Product Case		
		I	Q	FDI	I	Q	FDI
I_0	β	Low Transfer Price Scenario, $\Pi_h = 0$					
0.25	0.882	-3.29	-0.29	-3.57	-1.10	-0.10	-1.20
0.50	0.779	-1.65	-0.57	-2.21	-0.55	-0.19	-0.74
0.75	0.687	-1.10	-0.87	-1.96	-0.37	-0.29	-0.66
		High Transfer Price Scenario, $\Pi_a = 0$					
0.25	0.882	-10.53	1.84	-8.89	-8.38	2.03	-6.52
0.50	0.779	-6.70	1.52	-5.28	-5.65	1.91	-3.85
0.75	0.687	-6.69	1.11	-5.65	-6.04	1.70	-4.44

		An Increase in u_h					
		Capital Intensive Product Case			Labour Intensive Product Case		
		I	Q	FDI	I	Q	FDI
I_0	β	Low Transfer Price Scenario, $\Pi_h = 0$					
0.25	0.882	3.29	-0.93	2.33	1.10	-0.31	0.78
0.50	0.779	1.65	-0.65	0.99	0.55	-0.22	0.33
0.75	0.687	1.10	-0.35	0.75	0.37	-0.12	0.25
		High Transfer Price Scenario, $\Pi_a = 0$					
0.25	0.882	11.21	-3.10	7.77	8.96	-2.49	6.25
0.50	0.779	7.55	-2.86	4.47	6.38	-2.44	3.79
0.75	0.687	11.12	-2.98	7.82	9.89	-2.70	6.92

Notes: $u_{a0} = 0.30$, $u_{h0} = 0.30$, $\varepsilon = -3$, $m = 0.5$; CIP case $\theta_{La} = 0.25$, LIP case $\theta_{La} = 0.75$

The calculations also suggest that aggressive transfer pricing may make FDI more responsive to host country tax rate increases. The MNE's after-tax profits are on average 1.4 percent higher in the High Transfer Price (HTP) scenario than in the Low Transfer Price (LTP) scenario, indicating that there is a potentially strong incentive to adopt a high transfer price when the host country's tax rate is higher than the home country's rate.

An increase in the home country CIT rate increases the fraction of tasks performed by the affiliate, but reduces the total sales of the final product because of the increase in the cost of production. However, FDI increases in response to an increase in the home country CIT rate in both and transfer price scenarios.

Table 5 shows the semi-elasticities of I , Q , and FDI with respect to the host and home country's CIT rates when the revenues from the final product are attributed to the

parent. With an increase in u_a , both I and Q decline in the capital intensive product case in both transfer price scenarios, leading to declines in FDI. With a labour intensive product, the shore effect changes sign in the Low Transfer Pricing scenario when the initial I goes from 0.25 to 0.50. However, the FDI always declines when u_a increases in the labour intensive product case.

Table 5: Semi-Elasticities of I , Q , and FDI with respect to CIT Rates: Final Product Sales by the Parent

		An Increase in u_a					
		Capital Intensive Product Case			Labour Intensive Product Case		
		I	Q	FDI	I	Q	FDI
I_0	β	Low Transfer Price Scenario, $\Pi_a = 0$					
0.25	0.882	-2.63	-0.29	-2.91	-0.42	-0.10	-0.51
0.50	0.779	-0.99	-0.57	-1.56	0.11	-0.19	-0.08
0.75	0.687	-0.47	-0.88	-1.34	0.27	-0.30	-0.03
		High Transfer Price Scenario, $\Pi_h = 0$					
0.25	0.882	-50.13	-3.41	-51.83	-40.27	-2.95	-42.03
0.50	0.779	-7.01	-2.77	-9.59	-5.82	-2.40	-8.08
0.75	0.687	-2.84	-3.03	-5.78	-2.08	-2.46	-4.49

		An Increase in u_h					
		Capital Intensive Product Case			Labour Intensive Product Case		
		I	Q	FDI	I	Q	FDI
I_0	β	Low Transfer Price Scenario, $\Pi_a = 0$					
0.25	0.882	2.58	-0.93	1.63	0.40	-0.31	0.09
0.50	0.779	0.97	-0.65	0.32	-0.12	-0.22	-0.34
0.75	0.687	0.45	-0.35	0.10	-0.27	-0.12	-0.39
		High Transfer Price Scenario, $\Pi_h = 0$					
0.25	0.882	20.75	1.06	22.03	18.87	1.68	20.87
0.50	0.779	5.95	1.46	7.49	4.91	1.90	6.90
0.75	0.687	2.58	1.79	4.42	1.87	2.03	3.94

Notes: $u_{a0} = 0.30$, $u_{h0} = 0.30$, $\varepsilon = -3$, $m = 0.5$; CIP case $\theta_{1,a} = 0.25$, LIP case $\theta_{1,a} = 0.75$.

With an increase in the home country tax rate, I increases under both transfer price scenarios in the case of a capital intensive project, while Q is negative in the LTP scenario and positive in the HTP scenario. The overall effect on FDI of an increase in the home country tax rate is positive under both transfer price scenarios in the capital intensive product case. In the labour intensive product case, the effect on I switches from positive to negative as I increases in the LTP scenario and as does the overall effect on FDI. In the conventional tax competition model, which does not incorporate input flows (other than capital) between the parent and the subsidiary, transfers prices do not play any role and an increase in the home country's tax rate causes "capital flight" which can be interpreted as an increase in FDI. Therefore, the trading in tasks model's prediction that FDI may decline with an increase in the home country tax rates is novel feature.

2.5 Extensions of the Model

The Global Value Chain with Multiple Affiliates

To this point, the model has only dealt with the case where there is a parent and one foreign affiliate. However, the classic examples of global value chains, such as the design, manufacture, and sale of a Barbie Doll, involve tasks performed in several countries.¹⁵ In this section, we will extend the model to a case where tasks are performed by two affiliates, located in different countries, as well as by the parent in the home country. The model shows that the location of the tasks depends on the tax rates in all three countries as well as the transfer prices used to allocate profits within the MNE.

To capture the idea of a global value chain, we assume that some tasks are performed by an affiliate located in country 1 (e.g. production of basic inputs such as plastic pellets), and then this intermediate input is transferred to an affiliate located in country 2, which performs another range of tasks (e.g. manufacturing the toy) before transferring the semi-finished product to the home country where additional tasks are performed (e.g. advertising and distribution) and the final product is sold. We assume that country 1 has low after-tax labour and/or capital costs, but that the cost of coordinating tasks in this country increases rapidly, perhaps because of distance or language differences. In particular, we will assume $t'_1(I) > t'_2(I)$ where the subscript indexes the coordination costs in countries 1 and 2. The affiliate in country 1 performs the task from 0 to I_1 , the affiliate in country 2 performs the tasks from I_1 to I_2 , and the remaining tasks, I_2 to 1, are performed in the home country by the parent where the product is sold. The after-tax profits earned by the three units are given below:

$$\Pi_1 = (1 - u_{a1})P_1 I_1 Q - MC_{a1} \cdot Q \quad (27)$$

$$\Pi_2 = (1 - u_{a2})(P_2(I_2 - I_1) - P_1 I_1)Q - MC_{a2} \cdot Q \quad (28)$$

$$\Pi_h = (1 - u_h)(R(Q) - P_2(I_2 - I_1)Q) - c_h(1 - I_2) \cdot Q \quad (29)$$

where P_1 is the transfer price for the tasks performed by affiliate 1, P_2 is the transfer price for the tasks performed by affiliate 2, and:

$$MC_{a1} = \int_0^{I_1} c_{a1} \beta t_1(i) di \quad (30)$$

$$MC_{a2} = \int_{I_1}^{I_2} c_{a2} \beta t_2(i) di \quad (31)$$

It should also be recalled that c_{a1} , c_{a2} , and c_h are decreasing in the tax rates of their respective countries. The MNE's total after-tax profit is therefore equal to:

¹⁵ Grossman and Rossi-Hansberg (2006, p.60) on the links in the global value chain that produces a Barbie doll.

$$\Pi = (1 - u_h)R(Q) + (u_{a2} - u_{a1})P_1 I_1 Q + (u_h - u_{a2})P_2 (I_2 - I_1)Q - MC(I_1, I_2)Q \quad (32)$$

where:

$$MC(I_1, I_2) = \int_0^{I_1} c_{a1} \cdot \beta \cdot t_1(i) di + \int_{I_1}^{I_2} c_{a2} \cdot \beta \cdot t_2(i) di + (1 - I_2) \cdot c_h \quad (33)$$

Differences in the CIT rates in the three countries will affect the allocation of tasks—the location of the links in the global value-added chain. The values of I_1 and I_2 which maximize the MNE's total after-tax profits will be determined by the following conditions:

$$c_{a1} \cdot \beta \cdot t_1(I_1) - c_{a2} \cdot \beta \cdot t_2(I_1) = (u_{a2} - u_{a1}) \cdot P_1 + (u_{a2} - u_h) \cdot P_2 \quad (34)$$

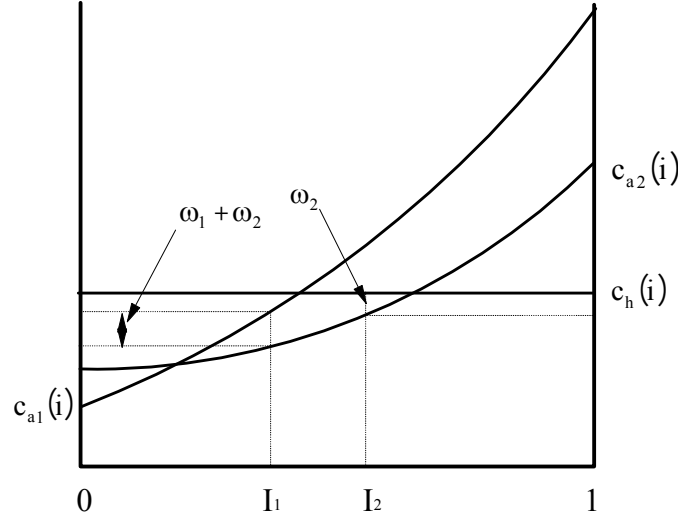
$$c_{a2} \cdot (\beta \cdot t_2(I_2)) - c_h = -P_2 \cdot (u_{a2} - u_h) \quad (35)$$

For concreteness, suppose country 2 is a high tax country, with $u_{a2} > u_{a1} > u_h$. The cost of performing the marginal task in affiliate 1 will exceed the cost of performing that task in affiliate 2 by an amount that reflects the tax savings from reducing the tasks performed by affiliate 2 and increasing the tasks performed in affiliate 1 and also by the parent. The cost of performing the marginal task in affiliate 2 will be less than the marginal cost of performing it in the home country by the parent by an amount that reflects the tax savings from earning more income in the parent and less income in affiliate 2. The slicing up of the global value chain in this situation is illustrated in Figure 7 where $\omega_1 = (u_{a2} - u_{a1})P_1$ and $\omega_2 = (u_{a2} - u_h)P_2$. Shrinking the range of activities performed in affiliate 2 increases the MNE's total after-tax profit when u_{a2} exceeds u_h . Therefore, when u_h declines relative to u_{a2} , total after-tax profits increase if the range of activities performed by affiliate 1 increases, even though affiliate 1 does not “sell” its tasks to parent.

An interesting feature illustrated by this case is that the range of tasks performed by the affiliate in country 1 depends not only on its tax rate differential with country 2, where it “sells” its tasks, but also on the tax rate differential between country 2 and the home country. Thus the MNE's FDI in country 1 depends on the tax rate differentials between the other countries as the product moves up the value-added chain. This drives home the point that the FDI by an MNE in any country depends not only on that country's tax rate, but also on the tax rates imposed by all of the countries in MNE's global value chain.

Figure 7: Allocation of Tasks Among Two Foreign Affiliates and the Parent

$$u_{a2} > u_{a1} > u_h$$



Outsourcing, Offshoring, and the Capital Intensities of Tasks

The model to this point has also been limited by the assumption that all tasks require the same capital-labour ratios and that the MNE cannot outsource some of its tasks. In this section, we assume that tasks vary in their capital intensity and that foreign suppliers can perform some tasks for the MNE.¹⁶ Many complex issues affect the insource versus outsource decision including incomplete contracts, hold-up problems, searching for suitable suppliers, and protection of intellectual property.¹⁷ In contrast to the trade literature which focuses on limited contracts in establishing the insource vs. outsource boundary, we assume that a complete contract with foreign suppliers can be signed and enforced in order to emphasize the role that the international tax system can play in determining the tasks that are outsourced to foreign suppliers and those that are performed by a foreign affiliate operating in the same country as the foreign suppliers.

We now assume that each task requires one unit of labour. Let $\alpha_{Ka}(i)$ denote the amount of capital required to perform task i by the affiliate operating in country j . The tasks are ordered in terms of increasing capital intensity and therefore $\alpha'_{Ka}(i) > 0$. We also make the “strong” assumption that coordination costs are increasing in i , perhaps because the more complex tasks are the more capital intensive tasks. Hence the after-tax cost of task i performed by the affiliate in country j is:

$$c_{aj}(i) = ((1 - u_j)w_j + \alpha_{Ka}(i)\rho_{aj})bt(i) \quad (36)$$

where u_j is the CIT rate, w_j is the wage rate, and ρ_{aj} is the after-tax cost of capital of the affiliate operating in country j . The foreign suppliers of tasks in country j have the following after-tax costs of performing tasks:

¹⁶ We do not focus on the effects of taxes on the domestic outsourcing decision because an increase in the home or host country CIT rates should not affect the onshore outsourcing decision.

¹⁷ See Spencer (2005) for a survey of the trade literature on modelling outsourcing decisions.

$$c_{oj}(i) = ((1 - u_j)w_j + \alpha_{ko}(i)\rho_{oj})\beta t(i) \quad (37)$$

We assume that the foreign affiliate and the foreign suppliers face the same wage rate and CIT rate, and that coordination costs are the same, but that there are differences in their capital requirements and their after-tax costs of capital. Specifically, we assume:

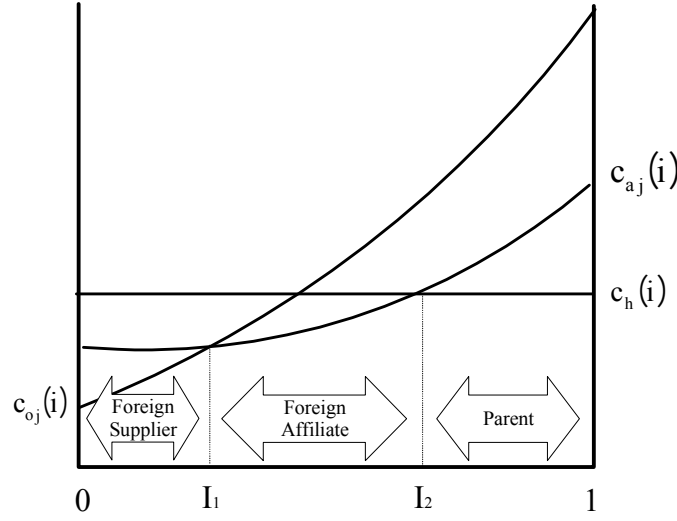
$$\alpha_{ko}(i) \leq \alpha_{ka}(i) \quad \text{for} \quad 0 < i \leq h \leq 1 \quad (38)$$

and that $\rho_{oj} > \rho_{aj}$ and $c_{oj}(0) < c_{aj}(0)$. That is, we assume that the foreign suppliers are more efficient at performing at least some range of tasks, but that they have a higher after-tax cost of capital than the foreign affiliate operating in their country. Note that the lower after-tax cost of capital is assumed to occur even when both sets of firms face the same host country CIT rate u_j . As demonstrated in OECD (2007b), Dahlby (2008), and Chen and Mintz (2008) foreign affiliates can have a lower after-tax cost of capital than a purely domestic firm through financial arrangements such as the use of hybrid securities that are treated as debt by the host country and as equity investment by the home country, or the channelling of investments through tax havens and other low tax countries in order to achieve a double deduction of interest on debt used to finance the investment in the affiliate—a so-called double dip. It is assumed that these types of financing schemes, which can significantly lower the cost of capital for FDI, are not available to the domestic firms that can perform tasks in country j .¹⁸ Consequently, the foreign suppliers may have a cost advantage in performing a range of tasks with low capital intensity, such as task 0, but we will assume that at some capital intensity, the foreign affiliate can perform tasks at a lower after-tax cost.

Figure 8 illustrates the division of tasks between the foreign suppliers in country j , the foreign affiliate operating in that country, and the parent operating in the home country, if the $u_j = u_h$. Our assumptions lead to the not unexpected result that the MNE imports labour intensive tasks from foreign suppliers (offshore outsourcing) and relies on a foreign affiliate for more capital intensive tasks. In our example, the most capital intensive tasks are still performed by the parent in the home country because of very high coordination costs. This model is consistent with the evidence presented by Antràs (2003, p.1376) that US MNEs “...tend to import capital-intensive goods, such as chemical products, within the boundaries of their firms, while they tend to import labor-intensive goods, such as textile products, from unaffiliated parties.” In his model, the problem of incomplete contracting gives rise to this pattern of trade. We have shown that this trade pattern is also consistent with foreign affiliates having a lower cost of capital than foreign suppliers because they are often able to take advantage of tax deductions for interest payments on debt in both the home and host countries.

¹⁸ For example, Chen and Mintz (2008, Table 5b, p.19) shows that the effective marginal tax rate on investment by a Canadian multinational investing in the U.K. using a Barbados conduit entity was 7.9 percent in 2008 while U.K. firm investing in its domestic market would have faced a marginal effective tax rate of 21.8 percent. Conversely, a U.K. firm using a Swiss conduit entity to invest in Canada would have faced an 11.4 percent effective tax rate compared to 24.4 percent effective rate on an investment in Canada by a domestic Canadian firm.

Figure 8: Foreign Outsourcing Versus Insourcing



How is outsourcing affected by the CIT rate differentials between the home and host country? We assume that the foreign suppliers are perfectly competitive firms that earn zero after-tax profits. The MNE can purchase tasks from 0 to I_1 from the foreign suppliers at a price which covers their pre-tax costs of production:

$$P_{oj} = \frac{1}{I_1} \frac{MC_{oj}(I_1)}{1 - u_j} \quad (39)$$

It is also assumed that the final product is sold in the home country by the parent, and it pays a transfer price of P_{aj} for the tasks I_1 to I_2 performed by the foreign affiliate operating in country j . It can be shown that the optimal value for I_1 , the boundary between offshore outsourcing and offshore insourcing, is determined by the following condition:

$$c_{oj}(I_1) - c_{aj}(I_1) = \frac{(1 - u_j)(u_j - u_h)}{1 - u_h} \frac{P_{aj}}{\beta t(I_1)} \quad (40)$$

Since the left-hand side of (40) is not affected by u_h (subject to a caveat to be discussed below), while the right-hand side is decreasing in u_h given that $u_j < 1$, a reduction in the home country CIT rate should increase offshore outsourcing compared to production by the MNE's foreign affiliates operating in the same country. This prediction assumes that p_{aj} does not decline when u_h declines. This seems reasonable given that a reduction in u_h will make borrowing by the parent to finance the foreign affiliate less attractive.

2.6 What Can We Learn From This Model?

In this section we discuss some of the insights concerning the effects of taxes on FDI that can be gleaned from the trading in tasks framework. While many of these insights are not unique to the trading in tasks model, its emphasis on the linkages between parents and foreign subsidiaries provides a more detailed description of the factors that influence FDI and how the tax system influences these decisions than the standard models of FDI used by public finance economists.

Predictions Regarding Inbound FDI

- FDI can be very sensitive to the host country CIT rate. The shore effect, which is highlighted in this model, generally can have a larger than the impact on the volume of FDI than changes in total output. Of course, our simulation results in Tables 4 and 5 are hypothetical and may not reflect all of the empirically relevant factors that affect FDI decisions. Still, compared to the conventional model of taxation and FDI, the trading in tasks framework suggests that FDI can be very sensitive to the host country tax rate because FDI is affected by the range of tasks that are performed by the foreign subsidiaries of MNEs.
- If the growth of FDI and the intra-firm trade in intermediate inputs is driven by reductions in communication and coordination costs, FDI may become less responsive to increases in the host country's CIT rate. This is illustrated in Tables 4 and 5 where simulations with lower values for β and higher initial values for FDI generate lower semi-elasticities for FDI with respect to the CIT rate. Again, it should be stressed that these are predictions based on particular sets of parameter values and a specific functional form for coordination costs and should not be taken as general predictions. Still, these simulation results serve as a counter example to the widely expressed belief that lower coordination and communication costs over time have made FDI more tax sensitive.
- FDI seems to be more sensitive to the host country's CIT rate when the sales of the final product are attributed to the affiliate, rather than the parent, and the MNE uses constrained profit-maximizing transfer prices.
- An increase in the host country's CIT rate has a more deleterious effect on FDI in a capital intensive sector than in a labour intensive sector because an increase in the CIT rate increases the user cost of capital because the return on equity investment is not deductible. The cost of performing tasks in the subsidiary will increase by a greater amount the more capital intensive they are, thereby having a more deleterious effect on FDI.
- A switch to transfer prices that maximize after-tax profits has an ambiguous effect on the sensitivity of FDI to the host country's CIT rate.
- FDI by vertically integrated MNEs may be more sensitive to the host country CIT rate than FDI by horizontal MNEs because the shore effect is a potentially important determinant of the tax sensitivity of FDI for a vertically integrated MNE, and it is (virtually) absent in a horizontal MNE.
- As shown by the profit-maximizing conditions in (34) and (35) and illustrated in Figure 7, FDI in any country depends not only on the host country's CIT rate, but also on the tax rates imposed by all of the countries in MNE's global value chain.

Predictions Regarding Outbound FDI

- Contrary to the predictions of the conventional tax competition model, in the trading in tasks framework a higher home country CIT rate may lead to lower outbound FDI. However, this negative effect was only observed in a few simulation results, suggesting that it may only emerge under fairly restrictive conditions. As we will see in the following section, empirical studies have found mix results concerning the effects of home country CIT rates on outbound FDI, a pattern of results which nonetheless seems more consistent with the trading in tasks framework than with the conventional model.
- Outbound FDI seems to be more sensitive to the home country's CIT rate when sales of the final product are attributed to the parent rather than the affiliate and the MNE uses constrained profit-maximizing transfer prices.
- A switch to transfer prices that maximize after-tax profits has an ambiguous effect on the sensitivity of FDI to the home country's CIT rate.

Predictions Regarding Offshore Outsourcing

- Offshore outsourcing of tasks becomes more advantageous, relative to production by foreign affiliates, when the home country's CIT rate declines, holding the host country's CIT rate constant.

In the next section we review the empirical literature from the perspective of the trading in tasks model, and in the final section we discuss some of the policy implications of this model.

3.0 Empirical Studies of FDI, Profit-Shifting, and Taxation

Many non-tax factors affect the size and location of FDI such as the size and growth rate of foreign markets, unit labour costs, legal systems and regulatory regimes, and “distance” from the home country, including language and cultural differences. While all of these factors may be important, in this survey we focus on the impact of taxation on FDI.

Over the last 30 years, a substantial body of empirical research on the effects of taxes on FDI has emerged. This literature has received wide-spread attention and has been the subject of a number of excellent surveys including Hines (1999), Gresik (2001), Gordon and Hines (2002), and OECD (2007, Chapter 2). Rather than cover the same ground as those previous surveys by providing a detailed review of the main body of literature, we will begin by summarizing the main findings of two recent literature surveys—de Mooij and Ederveen (2006) and Devereux (2007). Although these are fairly recent surveys of the empirical literature, there has recently been a veritable explosion of empirical studies of international taxation in the past 3 or 4 years which these surveys did not cover. Therefore in Section 3.2, we will review the findings of the most recent literature on taxation and FDI. Since the theoretical model developed in Section 2 has highlighted the potentially important impact that transfer pricing may have on the location of the links in the global value chain, in Section 3.3 we focus on the recent empirical literature on profit-shifting through transfer pricing and the location of MNEs' activities.

Before beginning these reviews, we should note that just as trade economists have not incorporated taxation in their models of the global value chain, so public finance economists have not based their studies of the impact of taxes on FDI on models of trade

in intermediate products. The empirical literature on taxation and FDI therefore provides little direct evidence of the effect of taxation on the global value chain.

3.1 Overviews of the Empirical Literature on Taxation and FDI

A Decision Tree Framework for FDI

Devereux (2007) contains a comprehensive review of the empirical literature on taxation and FDI. He began his survey by noting that most of the empirical research is based on a model where capital is allocated across countries to equalize its after-tax returns, and that “this model seems more suitable for describing flows of portfolio capital rather than the location and investment decision of multinational companies, which by contrast are characterised by the presence of imperfect competition and economic rent.” (p.4) Devereux has argued that a better framework for thinking about how taxation influences FDI is the following decision tree that a firm faces:

1. *Whether to serve only the domestic market or to sell its product in foreign markets, and if so, whether to export a product or produce it abroad?* If the firm decides to produce abroad, this gives rise to horizontal FDI. Although not specifically considered by Devereux, we can also consider at the first stage of a decision tree, whether a firm will purchase inputs from domestic suppliers or from a foreign country and if the latter, whether to outsource offshore or to insource offshore. That latter choice gives rise to vertical FDI. The decision to serve foreign markets will be affected by both the foreign and domestic average effective tax rates, and as we have seen in Section 2, the export versus production abroad decision will be influenced by tariffs and the tax treatment of foreign source income.¹⁹

2. *Which foreign country or countries to produce in, given that the firm has decided to serve a foreign market by producing abroad or to produce inputs abroad?* Devereux argues that this decision will be influenced by the average effective tax rates on profits from the firm’s operations in any of the foreign countries where it might operate.²⁰

3. *What scale of the production to undertake in the foreign countries where production will take place?* The neo-classical model of investment predicts that the marginal effective tax rate on investment will affect the amount of capital invested.

4. *Where to realize or record profits, given the allocation of production activities in foreign countries?* Devereux points out that the realization of profits, through such means as transfer pricing of intermediate products, royalty payments for the use of assets such as patents and trademarks, and intra-corporate financing, will largely be driven by the foreign and domestic countries’ statutory corporate tax rates. Recording higher profits in a country with a low tax rate will almost always involve some level of FDI, if only to establish an office in a tax haven. However, as the model in the earlier section indicated, shifting profits to affiliates in countries with low corporate tax rates may be less susceptible to detection by foreign and domestic tax officials if the target country has many legitimate transactions with affiliates in other countries. Thus research facilities, back offices, and even plants may be located in a low statutory tax rate country in order to promote profit-shifting activities. With regard to the empirical literature, Devereux (2007, p.13) notes that

¹⁹ See Kemsley (1998) on the effect of US tax treatment of foreign source income on exports by US MNEs.

²⁰ The average effective tax rate (EATR) is defined as the ratio of the present value of the taxes to the present value of the income generated by a project that earns a given amount of economic rent. The EATR is a weighted average of the statutory rate and the EMTR. See the OECD (2007b) on the computation of the EATR and EMTR in the context of international taxation.

while “some papers do consider flows of capital and profit...none has attempted to create and use a measure of effective taxation of capital taking into account the possibility of profit shifting.”

In Devereux's framework, the location and volume of FDI is a multi-stage decision, and the different measures of the tax rate on corporate profits—the average effective tax rate, the marginal effective tax rate, and the statutory tax rate—can all affect the final outcome. Note also that in the first and fourth stages of the decision process, both the home and host country tax rates will affect the volume and location of FDI.

A Meta Analysis of Research on FDI and Taxation

De Mooij and Ederveen (2006) provides a meta analysis of 31 econometric studies of corporate taxation and FDI published between 1984 and 2005.²¹ They performed statistical analyses of the 427 estimates of the semi-elasticity of FDI with respect to corporate income tax rates from these studies to investigate common patterns in these parameter estimates.²² (The semi-elasticity is the percentage change in the volume of FDI from a one percentage point increase in the host country's corporate income tax rate. Various measures of corporate income tax rates were used in different studies.) In broad terms, they found that the majority of semi-elasticities were between 0 to -5, with a mean semi-elasticity of -3.72 and a median of -2.91. Only slightly more than 50 percent of the 427 estimated semi-elasticities were considered statistically significant in the original studies. This indicates that the literature contains a wide range of estimates of the tax sensitivity of FDI.

Beyond summarizing previous results, de Mooij and Ederveen investigated how different aspects of the econometric studies, such as the sample period and the type of data used in the regressions, affected the parameter estimates. They did this by estimating regression equations where the dependent variable was the semi-elasticity and the explanatory variables were the characteristics of the data used in the 31 studies.

Their key findings are summarized below:

- *The home country's tax treatment of foreign source income.*²³ If the home country uses a foreign tax credit system in taxing foreign source income, FDI may be less responsive to a host country's CIT rate than it is under an exemption system (where no home country tax is levied on active business income from foreign sources) because the higher host country tax rate may be offset by a larger tax credit by the home country for firms that are in a deficit tax credit position, i.e. the host country tax rate is less than the home country tax rate.²⁴ However, the ability to defer the repatriation of foreign investment income may greatly reduce or eliminate the additional home country tax that may be levied under a tax credit system, effectively converting it into the equivalent of an exemption system. De Mooij and Ederveen found that there were no statistical significant differences in the semi-elasticities obtained from data based on exemption and credit countries. Also, there were no significant differences

²¹ This is an extension and updating of an earlier meta analysis in de Mooij and Ederveen (2003).

²² Recall that the semi-elasticity is the percentage change in the volume of FDI from a one percentage point increase in the host country corporate income tax rate.

²³ See Barrios et al. (2008, pp.7-10) for a description of the credit, exemption and deduction systems to relieve double taxation.

²⁴ Higher host country taxes under a credit system may increase FDI through merger and acquisitions because local owners are worse off while foreign owners may be shielded from the tax increase by higher home country tax credits.

in the semi-elasticities for investment funded by retained earning or transfers of funds.

- *Periphery versus core countries.* Models which incorporate agglomeration effects, such as Baldwin and Krugman (2004), predict that investment in “core regions” may be less sensitive to capital tax rates than in the “periphery” because the advantages of locating in the core, such as proximity to customers or access to thick markets for key inputs, may more than offset the impact of higher taxes on after-tax profits.²⁵ De Mooji and Ederveen found that the estimated semi-elasticities were higher in periphery countries, such as Canada, Australia, and the Scandinavian countries, but the differences were not statistically significant.²⁶
- *Type of data.* Larger semi-elasticities were found in studies that used cross-section data compared to those based on time series or panel data. Studies that employed discrete choice data (0 or 1 for the location of FDI) had lower semi-elasticities. De Mooji and Ederveen (2006, p. 20) interpreted this to mean that “the amount of capital invested is more responsive to taxes than the location decisions themselves.” They also found that FDI in new plant and equipment had higher semi-elasticities, while FDI through mergers and acquisitions had lower semi-elasticities.
- *Definitions of tax rates:* Different semi-elasticities of investment are to be expected for the different definitions of the tax rates because, as Devereux’s decision tree framework indicates, the statutory tax rate, average effective tax rate, and marginal effective tax rate affect different aspects of the investment decision, such as the location, scale, or type of investment. Studies which used average or marginal effective tax rates on FDI yielded larger semi-elasticities than those that used statutory tax rates. Average effective tax rates produced the largest semi-elasticities.
- *Sample period.* Larger semi-elasticities were found in studies that used more recent data (measured by mean sample year), but the differences were not statistically significant.²⁷ Interestingly, they found that the semi-elasticities were higher when the studies used pre-1980 or post-1990 data. (The lower semi-elasticities that were obtained by the studies that used data from the 1980s may reflect a disruption in investment flows following the US tax reform in the mid 1980s which significantly lowered US tax rates and, with a lag, to tax cuts by many other countries.) Zodrow (2008, p.400) summarizes his assessment of the issue of whether the tax sensitivity of FDI has increased over time by noting that “there is some evidence that this sensitivity is increasing over time as globalization increases, especially in the form of international competition for highly mobile capital. However, other research suggests that the increase in the tax sensitivity of investment may be tempered by the increased availability of tax-avoidance devices that reduce the need to reallocate real investment in order to reduce tax liability in relatively high-tax countries.” The question of whether the tax sensitivity of FDI has increased in recent years is discussed in more detail in Section 4.

²⁵ In this literature, core regions have the location advantages noted above, while the periphery refers to smaller economies where output and input markets lack these characteristics.

²⁶ In this section, a higher or lower semi-elasticity refers to the absolute value of the semi-elasticity.

²⁷ Evidence of an increase in the tax sensitivity of FDI was found by Altshuler, Grubert and Newlon (2001) who examined the FDI in manufacturing by US multinationals in 1984 and 1992.

While meta analysis has its limitations—all observations from all studies are given equal weight in the regressions, even though there may be obvious differences in the “quality” of research—it provides a useful perspective on the empirical literature. While there are clearly a wide range of estimates of the tax sensitivity of FDI, some of the factors that produce these variations have been identified. The overall conclusion regarding the empirical literature is also fairly robust—a higher host country tax rate reduces FDI.

3.2 Recent Empirical Studies of Taxation and FDI

Devereux (2007, p. 42) has noted that the “advent of microeconomic data is important in allowing researchers to study the decisions of multinational companies in more detail, and in giving them the opportunity to exploit, or control for, the many observed and unobserved differences across economic agents, and across countries.” Many of the recent studies of taxation and FDI have utilized large microeconomic data sets on MNEs’ activities in Europe, and we will now provide an overview of recent empirical studies of FDI and taxation.

Host Country Tax Rates and FDI

Bénassy-Quéré, Fontagné, and Lahrière-Révil (2005) estimated a model based on FDI flows between 11 OECD countries over the period 1984-2000. The responsiveness of FDI (which excluded reinvested earnings) was estimated with respect to four measures of corporate income tax rates: statutory rates, average and marginal effective tax rates (METRs), and average rates based on corporate tax revenue and earnings data. In the baseline version of their model, all four versions of the tax variable were negative and statistically significant, with the average tax rate having the largest semi-elasticity of -9.40 and the METR having the smallest, -2.89. Countries with larger markets tend to attract more FDI, and they found that “a host country suffering from a 10% disadvantage in terms of market potential (compared to other host countries) can offset this handicap by a 5 percentage-point lower statutory tax rate.” (p.588) Higher public investment in the host country was also associated with higher FDI. A higher distance-weight average tax rate for all other countries raised FDI in a given host country, consistent with the notion that differences in average tax rates affects the location of FDI.

They also explored non-linearities in the effects of tax rate differentials on FDI. They found that “a higher tax rate in the host country is more harmful to inward FDI than a lower tax rate is attractive for foreign capital” and that “increasing FDI inflows through tax cuts could prove more efficient in high-tax countries than in low-tax ones.” (p.594) As expected, these non-linearities in the response of FDI to taxes occurred when home countries used a foreign tax credit regime; the responses were linear when countries used an exemption system.

Buettner and Ruf (2007) investigated the sensitivity of FDI to host country tax rates using a large micro data set from the Bundesbank on outbound FDI by German multinationals in 18 countries over the period 1996 to 2003. They found that the location of German MNEs’ FDI is affected by the host country’s statutory and average effective tax rates, but not by its marginal effective tax rate, a result which is consistent with Devereux’s decision tree framework for FDI. Buettner and Ruf found that if a foreign country’s tax rate increases by 10 percentage points, the probability that an investment occurs declines by 12.5 percentage points if previously there was a 50 percent chance that it would occur. They also found that the statutory tax rate has greater predictive power than the average effective tax rate which is somewhat inconsistent with Devereux’s framework and previous empirical work in Devereux and Griffith (1998). Overall, they

found that the location of FDI by German MNEs is less tax sensitive than the Devereux and Griffith (1998) study of the location of FDI in Europe by US multinationals indicated.

While most studies have focussed on the host country's CIT rate, a study by Desai, Foley and Hines (DFH) (2004), based on using firm level data for 1982, 1989, and 1994, found that the host country's "indirect taxes" also affect the level of investment and production by US multinationals. These effects are quite large—a 10 percent higher host country indirect sales tax rate is associated with a 7.1 percent reduction in the affiliate's assets, an impact that is similar to an equivalent income tax rate increase. Their finding is especially significant when FDI is viewed from a global value chain perspective because FDI is linked to trade in intermediate goods. Devereux (2007, p.28) considers the findings somewhat puzzling as most OECD countries with value-added taxes (VAT) provide credits for the sales taxes that are levied on purchases of intermediate inputs and provide VAT rebates on products that are exported. However, not all countries levy value-added taxes. Retail sales taxes that fall on business inputs and excise taxes on motive fuels may raise the cost of doing business in countries with such taxes. The findings by DFH suggest that the recent adoption of harmonized sales taxes (which provide input tax credits) by Ontario and British Columbia might make Canada a more attractive location for FDI.

Home Country Tax Rates and FDI

While most of the empirical literature has focussed on the tax sensitivity of FDI to the host country's CIT rate, the home country's tax system will also affect the level of FDI. Barrios et al. (2008) focused on the effect of home country taxation on the location decisions of multinationals. In particular, they examined whether multinationals tend to have the parent firm located in a country with a relatively low rate of taxation of foreign-source income. Their study used the AMADEUS database containing data on multinational firms operating in 33 European countries over the years 1999 to 2003. Their sample consisted of 906 parent companies and 3,094 foreign subsidiaries. Parent corporations located in France, Spain, and the United Kingdom had the most foreign affiliates, while Denmark, Spain, and the United Kingdom were the host countries with the most foreign affiliates operating in them.

Barrios et al. computed the taxes levied by home and host countries on foreign affiliates' dividend payments to their parents. The mean value of the overall effective tax was 35.3 percent, consisting of a mean host country tax of 30.2 percent and a mean international tax of 5.1 percent. The international tax reflects the withholding taxes levied by host countries and any additional tax levied by the home country. They found that both home and host country tax rates reduced the likelihood of FDI in a particular country, and the magnitudes of these impacts were about the same, while the effect of withholding taxes was statistically insignificant. In addition, they found that taxes affect where a multi-national firm chooses to locate its parent corporation, with a low residual home country tax increasing the probability that a parent of a foreign subsidiary will be located in a particular country. Barrios et al. (2008, p.4) concluded that "corporate taxation of foreign-source income is important in shaping the organizational structure of multinational firms."

Becker and Riedel (2008) also focussed on the effects of home country taxation on FDI. They hypothesize that higher home country corporate taxation not only reduces domestic capital investment, but it also reduces investment in the foreign affiliates of its multinationals. They posited three reasons why this might occur. First, this effect could arise if the parent and foreign affiliates use common inputs (such as patents from R&D) and higher domestic taxes reduce the common input, reducing the ability of the firm to

compete in foreign markets. Second, if the MNE is credit constrained and has to finance investment out of retained earnings, higher home country taxes would reduce the ability of the MNE to invest both at home and abroad. Third, if the ability to use transfer pricing to shift profits is related to the size of the MNE's capital stock, higher home country taxes by reducing domestic investment would also reduce its ability to reduce foreign and domestic taxes and earn a higher rate of return on FDI.

Becker and Reidel (2008) also used the AMADEUS database where both the parent and subsidiary firms operate in 25 EU countries from 1995 to 2006. In their baseline regressions, the semi-elasticity of the foreign subsidiary's capital stock with respect to the host country statutory tax rate varied between -1.42 and -1.67, depending on the specification of the regression, while the semi-elasticity with respect to the home country statutory rate varied between -0.56 and -0.71. Thus a ten percentage point increase in the home country's CIT rate is associated with a 5.6 to 7.1 percent decrease in the affiliate's capital stock. The tax sensitivity of FDI to the home country tax rate was even higher for manufacturing firms and for parents with intangible assets such as patents and trademarks. They also found that a higher home country tax rate had no effect on the capital stocks of foreign affiliates of high profit parents, while there was a strong negative effect on the foreign subsidiaries of low profit parents. This result is in line with the hypothesis that higher taxes that reduce the retain earnings of parents reduces foreign investment of firms that face capital market constraints. Finally, they found evidence of profit-shifting, as affiliates' profits were negatively related to the tax rate differential between the host and home countries, with a semi-elasticity ranging from -0.71 to -0.84. Other research studies indicating tax motivated profit-shifting will be reviewed in Section 3.3.

Bilateral Tax Rates and FDI

Egger et al. (2007) focussed on the impact of bilateral tax rates, which reflect the provisions of the double taxation treaties signed between countries, on FDI. These treaties describe the method of double taxation relief (credit, exemption, or in rare cases deduction of foreign taxes) by the home country, and the withholding tax rates that the host country applies to dividend, interest payments, and royalties. The authors computed the bilateral tax rates between the home and host countries and also what they called the unilateral tax rates, which are the average and marginal effective tax rates that apply to domestic firms in the home and host country. They argued that all three types of tax rates will influence the level of FDI because, holding the bilateral tax rate constant, a higher home country tax rate makes producing the product abroad more attractive than exporting, and a higher unilateral country tax rate gives foreign investors an advantage compared to domestic firms in the host country's market.

They computed unilateral and bilateral tax rates between 22 home and 26 host countries (all OECD members). They found that the median bilateral average effective tax rate exceeded the rate for the host country's domestic firms by 6 percentage points, although they noted that this differential declined over the period. The higher tax rate faced by foreign investors compared to domestic investors was largely due to the withholding taxes that are levied by host countries on the repatriated earnings of foreign-owned firms.

Their finding that the foreign affiliates of multinational firms faced higher tax rates than domestic firms in the host country was based on the assumed method of financing the foreign affiliate. Their computations do not reflect the possibility that foreign investment may be financed through a conduit entity situated in a low tax country which could result in significant reductions in taxes on FDI through the double deductions of

interest payments on debt and the use of hybrid securities. See OECD (2007b), Dahlby (2008), and Chen and Mintz (2008) on how these financing schemes measures can reduce the average and marginal effective tax rates on FDI.

They estimated their model on 2,361 observations on aggregate bilateral FDI stocks between 1991 and 2002, and found, as they predicted, that higher home and host country unilateral tax rates were associated with higher levels of FDI, while a higher bilateral tax rate reduced FDI.²⁸ They argued that previous research that did not take into account both unilateral and bilateral tax rates likely produced downward biased estimates of the effects of taxes on FDI.

Egger et al. (2009) extended these authors' previous research on taxation and FDI by expanding their sample to include 52 home and 45 host countries over the period 1991 to 2004. They estimated a model with home and host country statutory tax rates and depreciation allowances for tax purposes and the withholding tax rate applied by the host country as explanatory variables. For the sample of home countries that use the exemption system, they found that a higher host country statutory CIT rate or a higher withholding tax rate on repatriated profits reduced FDI, in line with expectations. However, a higher home country statutory CIT rate reduced FDI, contrary to expectations and the results in their previous study which had indicated that a higher home average effective tax rate increases FDI. In addition, they found that higher home and host country depreciation allowances reduced FDI, with the latter result inconsistent with the prediction that higher depreciation allowances in the host country, by lowering the average and marginal effective tax rates on investment, would increase FDI. However, a higher depreciation allowance in the host country benefits domestic firms as well as foreign affiliates, and it is possible that the net effect is to reduce the competitiveness of foreign firms and the volume of FDI.

One conclusion that they reached is that "different combinations of corporate profit tax instruments may lead to an identical level or change of the effective tax rate for the average MNE, yet the resulting impact on FDI or other modes of MNE activity may differ due to heterogeneous indirect effects on other firms." (p.34) As a result, they argued that it may be better to focus on instrument-specific parameter estimates, such as the effect of depreciation allowances on FDI, rather than ones based on aggregate effective tax rates.

Tax Sensitivity of Different Types of Investment

Stöwhase (2005) examined FDI outflows from Germany, the Netherlands, and the UK to eight other EU countries in 1995, 1996, 1998, and 1999 in the primary, secondary and tertiary sectors. The primary sector, which consisted on agriculture, fishing, mining and quarrying, had only one tenth of the FDI flows in the secondary sector (manufacturing) and the tertiary sector (transportation, communications and financial intermediation). He found that the average effective tax rate was not a statistically significant determinant of FDI in the primary sector and that FDI in the tertiary sector was much more sensitive to the differential between the host and home countries' average effective tax rates than the secondary sector.

²⁸ The other independent variables in the regression as in most of the regression models estimated in this literature reflect the size of the home and host country markets and the distance between the home and host country.

Karkinsky and Riedel (2009) investigated the tax sensitivity of the location of MNEs' patent applications using data from the European Patent Office and the AMADEUS database on MNEs from 18 European countries from 1995 to 2003. The data set consists of 85,330 observations on patent applications by 11,828 subsidiaries of multinational enterprises. Their data show that the Netherlands and Switzerland have a large number of subsidiaries holding patent applications because these countries offer favourable tax treatment of royalty income.²⁹ They computed tax rates on royalty income by a subsidiary located in each country based on its statutory CIT rate and a simple average of the withholding tax rates applied by the other countries where its affiliates are located. The average withholding tax rate was only 1.1 percent (although it ranged as high as 30 percent) so that in most cases the most important tax consideration in the location of the patent application from a tax perspective is the CIT rate on the subsidiary's profits. Their econometric results indicate that a subsidiary's corporate tax rate, and its tax rate differential with other firms in the corporate group, have a negative effect on the number of patent applications that it makes, with a semi-elasticity of the volume of patent applications with respect to the tax rate of -2.3.

MacDonald (2009) also investigated the impact of taxes on the location of patenting activity by multinational enterprises. Her database was obtained from the US Patent and Trademark Office and contained firm-level information on the patenting activity of US multinationals in 20 OECD countries from 1986 to 2000. These data indicate that US multinationals engaged in substantial R&D investment in the foreign affiliates--\$18 US billion in 1999--and the royalty payments by foreign affiliates to their US parents for the use of technology was also large--\$25 US billion in 1999. The data also indicate that the foreign patenting activities of US multinational was concentrated in five of the 20 countries in her study--18.1 percent in Great Britain, 13 percent in Germany, 12.3 percent in Canada, 12.3 percent in Japan, and 10.3 percent in France.

She developed a theoretical model of an MNE which maximizes its total after-tax profits through its allocation of R&D activities in the US or in a foreign subsidiary. Her model predicts that an MNE with excess foreign tax credits (i.e. firms which face a higher average foreign tax rate than their US rate) will reduce its R&D investments in its foreign subsidiaries when the foreign tax rate increases. In contrast, an MNE in a deficit foreign tax credit position will not alter its foreign R&D investments when the foreign tax rate increases because the effective tax rate on its income is the US rate. (Note however this ignores the potential for reducing the present value of the residual tax through deferral.) Her model also predicts that MNEs should increase their R&D activities in foreign subsidiaries if the tax incentives for R&D become more generous in the foreign country.

She found, in line with her prediction, that firms in an excess credit position decreased the level of foreign patenting activity when the firm's average foreign tax rate increased. However, country specific statutory tax rates were not significantly related to the degree of foreign patenting activity by US multinationals. Foreign patenting activity also increased with the foreign tax incentives for R&D. Contrary to expectations, she also found that foreign patenting activity increased as foreign tax rates increase for US MNEs in a deficit credit position.

²⁹ See also Weichenrieder and Mintz (2007) on the tax treatment of holding companies in the Netherlands and Switzerland.

3.3 Empirical Studies of Taxation and Profit-Shifting

Tax Base Shifting Through Transfer Pricing and Debt Placement

A number of previous studies, such as Bernard and Weiner (1990), Grubert and Mutti (1991), Harris et al. (1993), Hines and Rice (1994), Collins et al. (1998), Hoffman (2001), Bernard et al. (2006) and Overesch (2006) have provided evidence of profit-shifting by multinationals through transfer pricing.³⁰ Some of the strongest direct evidence is contained in Clausing (2003). She used monthly data from the US Bureau of Labor Statistics on the prices of exported and import goods into the United States for three years, 1997 to 1999, from 54 countries. The data set allowed her to distinguish between intrafirm and non-intrafirm prices on 22,000 items. Her regression analysis indicates that a one percent reduction in a host country statutory tax rate results in 1.8 percent lower prices on exports from the US and 2.0 percent higher prices for imports to the US on intrafirm trade compared to non-intrafirm traded goods.

Huizinga and Laeven (2008) developed a theoretical model of profit-shifting by an MNE which predicts that the amount of taxable income shifted into country j is:³¹

- proportional to the “true” level of profits earned in country j because it is less costly to conceal additional profits in a highly profitable subsidiary,
- decreasing in the statutory tax rate of country j ,
- decreasing in the marginal cost of shifting profits through transfer pricing and debt placement, and
- directly related to a weighted average of the differentials between the other countries’ statutory tax rates and country j ’s statutory tax rate, where the weights are increasing in the other countries’ true taxable incomes.

Their model thus predicts that the tax sensitivity of a country’s corporate tax base depends on its tax rates relative to the tax rates in all other European countries in which its MNEs operate, and it also depends on the level of investment in that country compared to other countries.

They then used the AMADEUS database to examine the degree of corporate tax base shifting in Europe in response to tax rate differentials. Overall, they found that a one percentage point increase a country’s top statutory CIT rate reduced the reported taxable income of its MNE-linked firms by an average of 1.3 percent. However, there were substantial variations in the tax sensitivity of the tax bases, with the semi-elasticity of the tax base with respect to the country’s CIT rate ranging from -0.28 for Germany to -2.92 for the Netherlands. The cost of profit-shifting was estimated to be 0.6 percent of the tax base.

Huizinga and Laeven’s analysis indicated in 1999 there was substantial profit shifting in Europe at Germany’s expense because it had the highest tax rate, at 53.76 percent, compared to the European average of 34.44. Approximately 13.6 percent of its “true”

³⁰ For many intra-firm transactions, there may be no well-defined arm’s length prices because the inputs transacted are unique to the firm. This can give the firm considerable leeway in setting its transfer prices. Lowering its total tax liability may be one of the factors that it considers in setting those prices. Profit-shifting can also occur through the location of debt financing. See Dahlby (2008) for a survey of the empirical literature on profit-shifting by MNEs through the location and magnitude of debt used to finance FDI and Clausing (2009) for the estimates of tax motivated profit-shifting by U.S. multinationals.

³¹ This section on the Huizinga and Laeven model draws on the literature survey in Dahlby (2008).

taxable income was shifted from Germany. Italy, Portugal and the Slovak Republic also suffered outward profit-shifting. Hungary and the Czech Republic had profits shifted to them equal to 22.4 and 26.3 percent of their true profits respectively. While Hungary, with a tax rate of 18 percent in 1999, was an obvious target for tax base shifting, the high degree of shifting to the Czech Republic indicates that a country can benefit from tax base shifting, even if its tax rates are close to the average, if the firms operating in its territories are linked with firms in higher taxed countries (such as German), and if large “real” profits are generated from extensive business linkages with the high tax countries.³²

Maffini and Mokkas (2008) investigated whether transfer prices used by MNEs for inter-affiliate trade have affected the measured productivity of the affiliates. In particular, they tried to determine whether the productivity of affiliates in low tax countries is overstated because the MNEs have an incentive to overstate the value of the goods they produce and understate the value of the inputs they use through intra-group transactions.³³ Base on the ORBIS database of approximately 16,000 firms in 10 European between 1998 and 2004, they found that a 10 percentage point cut in the statutory CIT rate corporate tax rate increases an affiliate’s measured total factor productivity by about 10 percent relative to domestic firms. Conversely input costs are shifted to high tax countries. They interpreted this as evidence of profit-shifting by MNEs through transfer price manipulation.

Dischinger and Riedel (2009) found evidence that MNEs systematically shift profits from foreign subsidiaries to the parent company. Using the AMADEUS database on firms from 27 European countries over the period 1999-2006, they found that the return on investment is on average 30 percent higher at headquarters than in the foreign subsidiaries. They argued this profit gap occurs in order to overcome agency costs that arise when the managers of foreign affiliates are geographically separated from headquarters management and might have the ability to “misuse” any free cash flow. They also found that over the last decade, as communications and travel costs have declined, the profitability gap between the parents and foreign subsidiaries has declined for vertical FDI but not for horizontal FDI.³⁴ Tax motivated profit-shifting was significant for vertical FDI, but not for horizontal FDI. Because parent corporations paid 61% higher taxes on their corporate activity than their subsidiaries, Dischinger and Riedel concluded that profit-shifting to control agency problems provides a rationale for governments to promote multinational firms headquartered in their country—create national champions—rather than try to attract foreign subsidiaries.

Grubert (2009) used data from US Treasury tax files to compare the foreign and domestic profits of 754 large non-financial US multinationals in 1996 and 2004. He found that the share of total world-wide pre-tax profits earned abroad increased from 37.1 percent in 1996 to 51.1 percent in 2004. During this period, foreign tax rates generally declined relative to US tax rates, creating greater incentives for US based multinationals to shift income abroad. He also noted that shifting income within a US multinational has

³² Overesch (2009) found that FDI in Germany is increasing in the difference between the German statutory tax rate and that of the home country of the subsidiary’s direct owner. Thus, a reduction in the home country tax rate increases outbound FDI, an effect that he attributed to a reduction in the MNE’s cost of capital due to profit-shifting.

³³ See Bartelsmann and Betelsmann (2003) for earlier previous study of the effect of transfer pricing on measured productivity especially with respect to in Ireland.

³⁴ An MNE may also want to shift profits out of a subsidiary in a politically unstable foreign country, especially if there is a danger that the subsidiary might be expropriated by the foreign government.

became easier with “check the box” provisions in the US tax code which allows interest payments from a foreign subsidiary to escape US taxes because it is considered part of the consolidated domestic company.

Grubert found that 6 of the 14 percentage point increase in the share of foreign profits in total world-wide profits can be attributed to increases in losses sustained by US parents. Lower foreign tax rates over the 1996 to 2004 period lead to faster growth in the foreign activities of US multinationals and increases in the share of profits in earned abroad. He found that lower foreign tax rates are associated with higher US domestic losses, and he attributed 0.5 to 2.0 percentage points of the 6 percent shift due to higher losses by parent firms to foreign tax rate reductions. He also found that a 10 percentage point lower foreign tax rate lowers the US parent’s domestic profit margin by 14 percent and increases the foreign share of worldwide income by more than 4 percentage points. Overall, of the 14 percentage point increase in the share of foreign profits, he attributed 5.5 to 8.0 percentage points to reductions in foreign tax rates.

The Quality and Quantity of FDI

Tax motivated profit-shifting also figured prominently in Becker, Fuest, and Riedel (2009). They set out to measure the quantitative and qualitative effects of higher host country tax rates, where quantity is the size of the affiliate’s capital stock and quality is the rate of return on capital earned by the affiliate. Essentially, high quality capital contributes more to a country’s tax base than does low quality capital. They argued that in the standard model of tax competition, a country with a higher tax rate will have a higher quality of capital, because the pre-tax return on the marginal unit of capital has to be higher in order to earn the same after-tax return as capital in lower tax jurisdictions. However, they used the framework of the GRH task trading model to argue that a country with a lower tax rate will attract those tasks where the corporate tax base per unit of capital is higher. In their model, a lower host country CIT rate should be associated with a higher physical capital stock and a higher profit rate per unit of capital because firms shift high profit tasks to low tax countries to maximize total after-tax profits. The Becker, Fuest, and Riedel paper is therefore notable in being the first econometric study to use the task trading framework to generate predictions about the effects of taxes on FDI.

Becker, Fuest, and Riedel also used the AMADEUS database for 29 European countries, containing 49,236 observations from 11,813 subsidiaries for the years 1995 to 2005. They found that a one percentage point increase in the host country’s statutory CIT rate reduces the affiliate’s capital stock by 3.36 and the profit-rate earned by the affiliate by 2.08 percent. Thus a one percentage point increase in the CIT rate reduces the host country’s corporate tax base by 5.34 percent. They argued that because of the quantity and quality effects of taxes on a government’s tax base are almost the same, attention should be paid not only to the volume of FDI, but also the corporate tax revenues that it will generate.

The Use of Holding Companies and Conduit Entities

Weichenrieder and Mintz (2007) have studied how the ownership structure of FDI may be influenced by international tax considerations. They worked with a special database established by the Bundesbank for the years 1989 to 2002 on the use of holding companies and conduit entities for German inbound and outbound FDI. They noted that some countries have established special tax regimes that make the establishment of holding companies of multinationals especially attractive. The Netherlands, from 1997 to 2010, reduced the rate of tax on interest income from foreign subsidiaries from 35 percent

to 7 percent, and holding companies in Switzerland only face an 8 percent tax rate. Not surprisingly, these countries are popular locations for holding companies with investments in third countries.

The Bundesbank data reveal that in 2001, 11 percent of German affiliates, representing 6 percent of total outbound FDI, were held through third countries, whereas 25 percent of the inbound FDI (13 percent by value of assets) was held through entities in third countries. Weichenrieder and Mintz found that the Netherlands and Switzerland are the two most frequently used conduit countries for German outbound FDI, followed by the Austria, US, the UK, and France. They also found that tax havens, such as Bermuda, Barbados, the Cayman Islands, and the Bahamas, were not widely used as conduit countries for German outbound FDI in 2001 because Germany did not have tax treaties with them. (Tax treaties reduce the tax on dividend income from foreign subsidiaries located in the treaty countries.) They noted that subsequent changes in German tax treatment of dividends, which extends exemption treatment to non-treaty countries, may have made the establishment of conduit entities in these tax havens more attractive. Luxembourg was the most important conduit country for inbound German FDI, with most of this investment ultimately owned by UK firms.

Of the 105 German investments in Canada that were owned through conduit entities in third countries, 68 were located in the US, 12 were located in both the Netherlands and Switzerland, 8 were located in the UK, and 5 were located in France. By value of assets, 94 percent were owned through entities located in the United States and 5 percent through entities locate in the Netherlands.³⁵ Of the 13 Canadian firms with investments in Germany held through entities in third countries, 9 were located in the Netherland and 4 were located in the UK. The Netherland-based entities held 91 percent of these assets.

4.0 Summary and Implications

Key Aspects of the Trading in Tasks Framework

Recently, trade economists have developed models which analyze some of the forces shaping the global value chain, but these models have ignored the role that taxation may be playing. On the other hand, public finance economists have generally ignored the trade economists' models in formulating and interpreting their empirical models of the effects of taxes on FDI. This chapter has taken up the challenge of linking the two fields—a linkage that cannot be fully achieved at this time because of the divergent approaches and interests of economists in the two fields. However, in our view, linking the two fields is a potentially fruitful research program because intra-firm trade is an important aspect of world trade and is intimately connected with FDI. Public finance economists need the richer framework offered by the trading in tasks framework in order to capture key aspects of FDI decisions.

One of the main goals of this paper was to include taxes in a modified version of the trade in tasks framework developed by Grossman and Rossi-Hansberg (2008), which has been singled out by trade economists as a major advance in understanding the implications of international trade in intermediate inputs. In this modified GRH model, the effect of host and home country corporate income taxes on FDI can be decomposed into a *shore* and a *scale* effect. The shore effect refers to changes in FDI due to changes in the range of tasks undertaken in the affiliate or the parent, while the scale effect refers to changes in FDI due to changes in the volume of production caused by changes in the cost of the

³⁵ Weichenrieder and Mintz (2007, Tables 5 and 6, pages 14 and 15).

labour and capital in both countries. The model indicates that corporate income tax rates in both the host and home countries will affect the level of FDI and intra-firm trade in intermediate inputs in complex ways. Our analysis indicates CIT rate increases often have ambiguous, or offsetting, shore and scale effects on FDI.

The GRH task trading model, by making the range of tasks that can be performed in the affiliate or the parent an important economic decision highlights the important role that transfer prices play in determining the responsiveness of FDI. The model indicates that tax rate differentials between host and home countries can influence the allocation of tasks between the parent and foreign affiliates through their effects on the after-tax costs of labour and capital in the home and host countries and through the transfer prices that are used to value the tasks that are performed by each unit.

A few special insights from the modified GRH model should be highlighted.

First, the modified GRH model may be useful in determining the conditions under which tariff reductions on final products and intermediate inputs either promote or inhibit FDI. That is, it may help us to understand under what conditions FDI and trade are complements or substitutes.

Second, the GRH model indicates that an increase in the home country tax rate under certain conditions may inhibit FDI because of adverse shore or scale effects. This prediction is at variance with the conventional tax competition model which predicts that capital will flow out of the home country in response to a CIT rate increase. It is interesting to note that several of the recent empirical studies, which are referred to in more detail below, have found that higher CIT rates are associated with lower outbound FDI.

Third, the modified GRH model indicates that the division of tasks between any two foreign affiliates operating in different countries depends on all of the tax rates imposed in the countries in which the MNE has operations, something that is not highlighted in conventional models of the effects of taxation on FDI. This of course poses special challenges for estimating econometric models of FDI if the volume of investment in any host country depends not only on the home and host country tax rates, but also on tax rates in third countries where the MNE has affiliates that are part of its global value chain.

Fourth, foreign affiliates can have a lower after-tax cost of capital than a purely domestic firm through financial arrangements such as the use of hybrid securities or ownership structures that lead to “double dip” interest deductions. The model therefore predicts that foreign affiliates will tend to perform capital intensive tasks, while outsourcing offshore labour intensive tasks, in the same foreign country. It also suggests that when the home country’s tax rate declines, we might expect to see an increase in the capital intensity of the intermediate inputs that are outsourced offshore because the cost of capital advantage of the foreign affiliate may decline when the home country’s tax rate declines. It also implies that in any country, foreign-owned firms should be more capital intensive than purely domestic firms, and this difference in capital intensity should be increasing in the home country’s tax rate.

Fifth, a reduction in the home country’s CIT rate is predicted to increase offshore outsourcing compared to production by the MNE’s foreign affiliates operating in the same country. One testable prediction of the model is that the ratio of outbound FDI to imports of intermediate inputs from any foreign country should decline as the home country’s CIT rate decreases.

Finally, compared to the conventional model of taxation and FDI, the trading in tasks framework suggests that FDI can be very sensitive to the host country tax rate because

FDI is affected by the range of tasks that are performed by the foreign subsidiaries of MNEs.

While it is too early to claim that the trading in tasks framework provides a better framework than the conventional model for analyzing the effects of taxes on FDI, the fact remains that several recent empirical studies have found that FDI declines when home country tax rates increase, a result that is at variance with the predictions of the conventional model, and some empirical studies indicate that FDI may occur to facilitate profit-shifting through transfer pricing, an aspect MNE behaviour that is highlighted in the trading in tasks framework.

Summary of the Empirical Studies of Taxation and FDI

An important implication of Devereux's decision tree framework is that the average effective tax rates, the marginal effective tax rates, and the statutory tax rates of both the home and host affect the location and volume of FDI. Thus, empirical studies need to use a variety of tax rate measures for the home and host countries in order to capture the full impact of taxation on FDI decisions. While all three measures of CIT rates have been used in studies, average and marginal effective tax rates have yielded larger semi-elasticities with respect to FDI than statutory tax rates. Also recent research suggests that more disaggregated or refined measures of tax rates, such as depreciation allowances or bilateral tax rates including withholding tax rates, may improve the predictive powers of the econometric models. Furthermore, there may be non-linearities in the response of FDI to tax rates. Higher CIT rates may cause a greater reduction in FDI than the increase in FDI from an equivalent CIT rate reduction, and there may be decreasing return to increasing FDI through CIT rate cuts. There are also some indications that other taxes beside the CIT rates are important in determining the level of FDI. The results obtained by Foley, Desai and Hines (2004), which indicated that indirect taxes affect the level of FDI, are intriguing and warrant further study.

While most of the empirical literature has focussed on the effects of host country tax rates on inbound FDI, several recent empirical studies have found that higher home country CIT rates are associated with lower outbound FDI. Barrios et al. (2008) found that parents of MNE tend to be located in low tax countries. In that sense, higher home country rates are associated with lower FDI, not higher FDI as in the conventional model. Egger et al. (2009) and Becker and Reidel (2008) also found that higher home country CIT rate reduced outbound FDI with some indication in the latter study that reduced retained earnings, a source of financing for FDI, may be responsible for the negative effect.

The recent literature also indicates that some types of FDI are more tax sensitive than others. Investment in the primary sector seems to be relatively insensitive, whereas investment in the tertiary sector (services) is more tax sensitive. In particular, the studies indicate that the location of patents (which may reflect to some degree the location of R&D activity by multinationals) responds to CIT rate differentials and tax incentives for R&D. These results are consistent with the growing body of evidence that tax differentials lead to profit-shifting by multinationals through transfer pricing, financial arrangements, and their organizational structures.

Implications of Global Value Chains for Tax Policy

The growing importance of international trade in intermediate inputs has provoked heated debates, especially in the United States, over its impact on labour markets.³⁶ Trade

³⁶ See Mankiw and Swagel (2006) and Blinder (2009).

economists have been at the forefront of this debate, and they have focussed on the labour market policy issues arising from the expansion of global value chains. In this section, we will review the broad policy issues identified by two prominent trade economists—Dan Trefler and Robert Baldwin—but our focus will be on the implications for tax policy, an issue which have not received much attention from trade economists.

Trefler (2006) presents a wide ranging survey of the potential impacts of offshoring for the Canadian economy. Although the growth of trade in intermediate inputs is a relatively new phenomenon, Trefler (2006, p.5) has argued that:

Offshoring creates only a few new policy issues. First, it forces Canadian firms to be part of a global market and hence to compete globally. It thus makes framework policies that encourage investment and competitiveness all the more important. Second, it creates more churning among firms and workers, thus destroying human capital that is specific to worker-firm matches. We must think of policies that encourage these investments without at the same time creating the kinds of labour market inflexibilities that are the source of Euro-sclerosis. Third, it is important politically to find ways of helping workers displaced by service offshoring.

Trefler's main point is that offshoring creates greater pressure for countries, such as Canada, to become more globally competitive through investment in human capital, physical capital, and new technology. Dealing with the pressures to promote international competitiveness has been the one of the factors shaping tax policy in Canada and other OECD countries for the last 10 to 20 years. (Of course, promoting investment and employment in purely domestic activities has also been an important motivation for reducing CIT rates.) Marginal effective tax rates have been reduced to promote investment, and statutory CIT rates have been lowered to reduce profit-shifting. Promoting investment in human capital involves both personal and corporate tax policy. The personal income tax treatment of tuition fees and other expenses associated with general education, and the progressivity of the personal income tax system, will affect individuals' incentives to acquire training and education. The corporate tax system affects the after-tax cost of employer-provided on-the-job training. Promoting innovation through generous tax treatment of R&D investment has been a constant aim of Canadian corporate tax policy. Whether more could, or should, be done through the Canadian tax system to promote R&D (which is already very generous by international standards) is a controversial topic. With increasing emphasis on global value chains, new technology developed in Canada may simply be transferred abroad to be used by foreign affiliates or third parties, raising further questions about the effectiveness of generous R&D tax credits in promoting the well-being of Canadians generally.

Robert Baldwin (2006, 2009) has argued that the fragmentation of the global value chain has important features which will shape policy responses. In his view, future changes in competitiveness will be sudden and unpredictable and felt primarily at the level of the individual worker as opposed to having firm-wide, or sector-wide, effects. Sudden and unpredictable changes in competitiveness will arise because it is difficult to forecast the types of activities where the costs of coordination, transportation, and communication will decline because of technological innovations. These changes will affect individual workers or occupational groups. Otherwise identical workers (in terms of education or skills) in the same firm or industry may either find their productivity enhanced, because they are able to work with lower cost complementary inputs, or their wage rates and employment opportunities undermined, because of outsourcing. In other words, it will become increasingly difficult to predict "winners and losers", and these groups will be subsets of

workers in the same firms and industries. There will be no sunset or sunrise industries, only sunset or sunrise occupations or skill sets that apply across a range of sectors.

If Baldwin is correct, the implication for corporate tax policy is that governments should continue to aim to achieve a low statutory rate on a broad base. Governments should refrain from setting lower rates in certain sectors, such as manufacturing, because of the competitive pressures from offshoring, or trying to promote certain sector through tax incentives, because the pressures and the opportunities will occur at a finer division than at the industry level. In any event, the unpredictable nature of future technological changes, which Baldwin stresses, makes picking winner or protecting losers an even more dubious strategy than it has been in the past.

Perhaps the most important issue for tax policy arising out of the increasing international fragmentation of production is whether FDI is becoming more sensitive to corporate income tax rate differentials, and therefore putting even greater pressure on countries to lower their corporate income tax rates. At one level, the fragmentation of production likely makes investment more tax sensitive because at the margin the decision is now where to place a particular task, instead of where to locate a particular plant. The greater range of options for locating tasks, as opposed to plants that are large lumpy investments, would tend to make FDI more sensitive variations in average and marginal effective tax rates across countries. Also, the tax sensitivity of FDI will have increased if technological innovations have now reduced the cost of offshoring capital intensive and highly skilled tasks, whereas previously coordination cost reductions mainly allowed offshoring of labour intensive tasks. (Recall that Tables 4 and 5 show that FDI is more tax sensitive when the firm's activities are more capital intensive.) However, the increased use of sophisticated international financing arrangements and transfer pricing, which allows firms to shift taxable profits across international boundaries, may be an offsetting force that may make FDI less responsive to tax rate differentials across country. For example, Hong and Smart (2007, p. 17) have developed a model of international investment which indicates that while "income shifting to tax havens may reduce revenues of high-tax jurisdictions and increase tax base elasticities, it tends to make the location of real investment *less* responsive to tax rate differentials." [Emphasis in the original.]

Given that there are a number of potentially offsetting factors which may be influencing the tax sensitivity of FDI over time, this issue can really only be resolved by econometric studies. The strongest evidence for an increase in the tax sensitivity of FDI is a study by Altshuler, Grubert, and Newlon (2001) who found that the semi-elasticity of US outbound FDI in manufacturing increased from -1.5 in 1984 to -2.8 in 1992. Also, as previously noted, in their meta analysis of studies of the tax sensitivity of FDI, de Mooij and Ederveen (2006) found that studies that used more recent data produced larger semi-elasticities. (However, the differences were not statistically significant.) Given this slender body of evidence, it would be rash to draw a general conclusion, and we have to await further empirical research, which specifically addresses this issue, before making any strong claims about the effects of international fragmentation of production on the tax sensitivity of foreign direct investment.

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