The Taxation of foreign profits: a unified view

Michael P. Devereux, Clemens Fuest and Ben Lockwood

Oxford University Centre for Business Taxation
Saïd Business School, Park End Street,
Oxford, Ox1 1HP

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The Taxation of Foreign Profits: a Unified View *

Michael P.Devereux[†], Clemens Fuest[‡], and Ben Lockwood[§]

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Abstract

This paper synthesizes and extends the literature on the taxation of foreign source income in a framework that covers both greenfield and acquisition investment, and a general constraint linking investment at home and abroad for the multinational by introducing a cost of adjustment for the mobile factor. Unless the cost of adjustment is zero, the domestic tax on foreign-source income should always be set to ensure the optimal allocation of the mobile factor between domestic and foreign assets and should follow the classical rules in the literature; national optimality requires the deduction rule, and global optimality requires the credit rule. Only in the zero-cost case does exemption become optimal. Allowances can be set so as to ensure that domestic and foreign asset purchases are undistorted by the tax system: this requires a cash-flow tax on domestic investment in the greenfield case, and a cross-border cash flow tax on foreign investment in both cases. These basic results extend to various extensions of the model.

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[†]Centre for Business Taxation, Said Business School, University of Oxford, Park End Street, Oxford OX1 HP, UK. Email: michael.devereux@sbs.ox.ac.uk

[‡]Centre for European Economic Research (ZEW), Mannheim, Germany, and CBT. Email: fuest@zew.de

[§]CBT, CEPR and Department of Economics, University of Warwick, Coventry CV4 7AL, UK. Email: B.Lockwood@warwick.ac.uk

1. Introduction

A key result in the theory of international taxation states that countries should tax the foreign source income of multinational firms according to the foreign tax credit system to make sure that the allocation of capital in the world economy is undistorted (Richman, 1963). This result is based the idea that, under the foreign tax credit system, firms will ultimately pay the same tax, irrespective of the investment location, so that their location choices are not distorted if corporate tax rates differ across countries. The tax system leads to capital export neutrality (CEN). A second key result in the theory of international taxation states that, from a national perspective, it is optimal to tax foreign source income according to the full taxation after deduction principle (Feldstein and Hartman, 1979). However, the full taxation after deduction principle gives rise to double taxation and discriminates against border-crossing investment relative to purely national investment; this leads to a suboptimal outcome from a global point of view.

For many years tax policy in the US as well as the UK seemed to follow the logic of conventional international tax theory by taxing foreign source income according to the tax credit system (although both limited the size of the tax credit). Other countries like Germany and France, however, have chosen to exempt foreign source income fully or almost fully from domestic taxation. From the perspective of the standard theory, the exemption system is inefficient because it leads to a distortion of the international capital allocation, with overinvestment in low tax countries and underinvestment in high tax countries.

The view that the exemption system is inferior to the tax credit system has been challenged by Desai and Hines (2003, 2004), who argue that the US should adopt the exemption system. Their main argument is that a large part of international investment nowadays takes the form of mergers and acquisitions. This is a type of investment largely neglected by the standard theory of international taxation. The standard theory assumes that foreign investment implies a reallocation of physical capital across countries, with the effect that more economic activity takes place abroad and less at home. Desai and Hines (2003, 2004) emphasize the fact that this does not happen in the case of mergers and acquisitions investment.

Instead, this is a type of investment which implies a change in ownership, rather than the location of physical capital. But the ownership of assets is distorted if different potential owners, who are located in different countries, are taxed differently. Desai and Hines argue that capital ownership neutrality (CON) requires that all owners of an asset

face the same tax burden, irrespective of their country of residence.[1]

While the analysis in Desai and Hines (2003, 2004) is not based on a formal model, Becker and Fuest (2010) investigate the optimal taxation of foreign source income with acquisitions in a formal model. They find that the exemption system is optimal from a national as well as a global perspective if foreign acquisitions of multinational firms do not affect domestic activities. But they argue that in the opposite polar case, when the number of acquisitions abroad reduces the number at home one-for-one, neither the tax credit system nor the full taxation after deduction system can restore global or national optimality[2].

There is no doubt that the extension of models of foreign direct investment to include acquisitions has been fruitful. But existing papers are based on rather different assumptions regarding the corporate tax system under consideration, the impact of foreign investment on domestic economic activity and the type of foreign investment - greenfield versus acquisitions. This makes it difficult to draw systematic conclusions for purposes of tax policy. This paper attempts to reconcile and extend the different results and approaches in the literature by analyzing the optimality of taxes on foreign source income in a model which encompasses most of the models in the literature.

Our model extends the literature in several ways. Firstly, existing models usually take the tax base as given and focus on tax rates. We consider the design of tax rates and tax bases simultaneously, and we show that this is of key importance for understanding the optimal taxation of foreign source income. Secondly, we develop a model which includes both greenfield and acquisition investment as special cases. Thirdly, rather than assuming that foreign investment either reduces domestic investment one by one or does not affect domestic investment at all, our approach also includes intermediate cases, as will be explained further below.

In our model, foreign investment by a domestic multinational firm is in two steps. The first is the purchase of an immobile asset in the foreign country, initially owned by a foreign household, and can be understood as choosing the *location* of production. This asset may be interpreted as a piece of land or an existing firm. Following Desai and Hines (2003), Becker and Fuest (2010), we allow for the multinational to have an ownership

[1] The term capital ownership neutrality was introduced by Devereux (1990) in a slightly different context.

[2] Becker and Fuest (2010) show that national optimality can be achieved in this case by allowing the firm to deduct the cost of the acquisation against tax in the from period, and then applying the deduction rule to foreign-source income in the second period. This result is a special case of our Proposition 2 below.

advantage relative to the seller i.e. it can possibly produce more output from the asset.[3] Conceptually, the only difference between greenfield and acquisition investment is that the foreign corporate tax rate is capitalized into the price of the firm, but not into the greenfield asset. This brings out the central role of tax capitalization very clearly, in contrast to other models, where greenfield investment is often viewed as the allocation of capital to a production function.

The second step is to combine the immobile asset with a continuously variable, internationally mobile, factor of production, and can be understood as choosing the *scale* of production. The recent literature on the taxation of foreign profits has shown that it is of central importance whether foreign investment affects domestic economic activity, and we allow for this in a simple and empirically relevant way, by means of introducing a *cost of adjustment* for the mobile factor. Specifically, the multinational has an initial stock of the mobile factor, which it can allocate to assets at home or abroad. But, in addition, it can hire additional amounts of the mobile factor, at the cost of incurring a convex cost of adjustment in addition to the market price of the factor. In the limiting case where this cost of adjustment is zero, there is no link between domestic and foreign production (Becker and Fuest's "variable management capacity"). In the other limiting case where the adjustment cost becomes very large, there is a one-to-one trade-off between domestic and foreign projects (Becker and Fuest's "fixed management capacity").

We first consider the case where governments can choose the tax rate and the tax base, including the size of the initial allowance. This brings out the main features very clearly. In the general case where there is some positive cost of adjustment of the mobile factor, our main findings are as follows. The government has two kinds of instrument; first, the statutory tax on foreign-source income, and second, allowances on domestic and foreign asset purchase. It turns out that for both national and global optimality, there is a simple and robust assignment of instruments to targets. First, the domestic tax rate on foreign-source income should be set to ensure the optimal allocation of the mobile factor between domestic and foreign assets. The setting of the tax rate follows the classical rules in the literature; national optimality requires the deduction rule, and global optimality requires the credit rule. Second, the initial allowances should be set so as to ensure that domestic and foreign asset purchases are undistorted by the tax system. This requires a cash-flow tax on domestic investment[4], and a *cross-border cash flow tax* on foreign

[3] We follow these contributions in abstracting from residence based taxes on capital income at the personal level. In the context of taxing foreign source income the role of these taxes is discussed in Becker and Fuest (2011), Devereux (2000, 2004), Gordon (2011), Ruf (2009) and Wilson (2011).

[4] A qualification is that in the aquisitions case, no allowance should be granted as the aquisition price

investment. Generally, the cash-flow tax on domestic investment and the cross-border cash-flow tax will be at different rates[5].

Our analysis includes several extensions of the baseline model. Firstly, we show that our results also hold in a variant of our model where multiple acquirers compete for one target firm. Secondly, while our baseline model assumes that the interest rate in the capital market is given, we analyze how our results are affected if we close the model and endogenize the interest rate. Our results for global optimality do not change. In the case of national optimality, however, countries may have an incentive to change the interest rate, depending on whether they are capital exporters or capital importers, so that the nationally optimal tax policy may be distorted. Thirdly, we analyse the case where the tax base is the full income of the firm, after depreciation but before financing costs. This removes one instrument available to the government, and generally means that a first-best solution is no longer feasible.

The rest of the paper is set up as follows. Section 2 briefly discusses the previous literature. Section 3 presents the model. In section 4 we analyze the optimal taxation on foreign source income for the different variants of our model. Section 5 explores various extensions of the baseline model. Section 6 concludes.

2. Related Literature

We briefly discuss the related literature in more detail. We organize the discussion by first focussing on the polar case of unlimited management capacity. Desai and Hines (2003, p. 496) for the most part assume that domestic capital stock is unaffected by foreign acquisitions, corresponding to our special case of unlimited management capacity[6]. In this case, they have three claims. First, they claim that national optimality requires exemption: '*National welfare is maximized by exempting foreign income from taxation in cases in which additional foreign investment does not reduce domestic tax revenue raised from domestic economic activity.*' (Desai and Hines, 2003, p. 496). Second, they claim that exemption is also sufficient for global optimality, i.e. CON: *"CON is satisfied if all countries exempt foreign income from taxation"* (Desai and Hines, 2003, p. 494). Third, they say that exemption is not necessary for CON, as a tax credit system will also work:

is already adjusted by the corporate tax rate.

[5]The exception is where the investment is greenfield, and the welfare criterion is national optimality: in this case, a common rate equal to the domestic corporation tax rate is optimal.

[6]Specifically, they assume that "the total stock of physical capital in each country is unaffected by international tax rules" (p494).

"if all countries tax foreign income (possibly at different rates), while permitting taxpayers to claim foreign tax credits, ..(this meets).. the requirements for CON" (Desai and Hines, 2003, p. 494). Turning to Becker and Fuest (2010), in the case of unlimited management capacity, they find that the exemption system is optimal from a national as well as a global perspective if foreign acquisitions of multinational firms do not affect domestic activities (Proposition 3 in their paper). Our results for unlimited management capacity generalize and clarify these claims: we show that with a cash-flow tax, *any* tax on foreign-source income is optimal from a global perspective, *not just a tax of zero (exemption) or a tax equal to the difference between domestic and foreign corporate tax rates (credit).*

Desai and Hines have relatively little to say about nationally and globally optimal tax rules when national capital stocks respond to tax differences: in this case, they say that *"the welfare implications of CON are less decisive"* (Desai and Hines, 2003, p. 494). Becker and Fuest (2010) consider the polar case where foreign acquisitions reduce domestic investment one-for-one. They also consider a cross border cash flow system, as we do, and find that this system leads to national but not to global optimality. We find that a cross-border cash flow system also generates global optimality; the difference between the two results is explained by that fact that Becker and Fuest (2010) impose the condition that the tax rate of the cross border cash flow tax has to be the same as the domestic corporate income tax.

Our main contribution in this paper, relative to the literature, however, is to characterize optimal tax rules in the general case where management capacity is limited, but not fixed. In this case, we show that the optimality of the exemption rule is not robust; national and global optimality of exemption *only holds in the knife edge case where the impact of foreign investment on domestic activity is exactly zero.* As soon as there is a small but positive adjustment cost, deduction is nationally optimal, and credit is globally optimal.

Another related paper is Wilson (2011). In his model foreign acquisitions may increase or decrease the productivity of domestic activities of multinational firms. While his model differs from ours in various respects, one important difference is that foreign taxes are always deductible from taxable foreign source income. We do not make this assumption.[7] Given this, he asks whether domestic taxes should be positive. His main result is that exemption is usually not optimal.

Another insight generated by our analysis is that many results for the optimal taxation

[7] Gordon (2011) also analyses optimal taxes on foreign source income but focuses on income shifting between corporate profits and wages of employees.

of foreign profits in the presence of acquisitions investment that have been derived in the literature are driven by assumptions on the tax base, rather than underlying factors like differences between acquisitions and greenfield investment or the impact of foreign investment on domestic investment as such. In an extension of our baseline model, we show this by assuming that the tax base is as in a typical income tax system, where tax depreciation is equivalent to economic depreciation and no relief is given for the cost of finance. In general in this setting, it is not possible to achieve a first best, since the tax drives up the cost of capital leading to underinvestment. The optimal treatment of the mobile factor depends on whether the costs of using that factor are fully deductible from tax. If so, then the usual rules apply to the tax rate: national optimality requires a deduction system, and global optimality requires a credit system. If not, then these rules apply not to the tax rate, but to the rate of relief given, since this is what determines the international allocation of this factor.

3. The Model

3.1. Overview

There are two countries, home and foreign, and two periods. A single multinational (MN) is based in the home country. In the first period, the MN can purchase assets either in the home or foreign country. An asset can be either a greenfield site or an existing company, as explained in more detail below. Output can be produced by combining this asset with a factor of production, which we call management capacity, following Becker and Fuest (2010), but which could be interpreted as capital. This factor can be purchased on an international market at a fixed price w. Each asset requires one unit of management capacity, plus one unit of local labour, to produce output in the second period. The MN has a fixed initial stock of management capacity, M_0, which can be costlessly allocated between home and foreign activities. In addition, the MN can hire additional managers on the international market to work either at home or in the foreign country. Hiring, however, incurs quadratic costs of adjustment. The adjustment cost parameter α nests the two special cases that have so far been considered in the literature. Specifically, $\alpha = 0$ is the case of completely variable management capacity, and $\alpha \to \infty$ is the case of completely fixed management capacity.

3.2. Assets and Outputs

In the case of greenfield investment, we assume that there are number - technically, a continuum - of different possible domestic and foreign investment projects, indexed by Δ, Δ^* respectively, where Δ is the output from domestic project and Δ^* is the output from the foreign project.[8] The distribution of Δ, Δ^* given by G, G^* respectively. In the case of acquisition investment, we assume that the asset - a home or foreign firm - can produce v, v^* respectively using one unit of management. Following Becker and Fuest, we assume that the MN has some comparative advantage in management, so that when a national domestic (foreign) firm is acquired by the MN, its output is boosted by Δ (resp. Δ^*), where the distribution across national (foreign) firms is given again by G, G^*. So, when owned by the MN, revenues from the domestic and foreign firms are $v + \Delta$, $v^* + \Delta^*$ respectively.

3.3. Asset Prices

Generally, we denote the price of the domestic and foreign assets by P, P^* respectively; this is the price paid by the MN in the first period if the asset is bought. In the case of greenfield investment, we assume that the MN can acquire the asset (e.g. land) at its opportunity cost. This cost can be interpreted as what can be produced from the land in its alternative use e.g. farming, and we denote the costs as C, C^* in the home and foreign countries respectively. So, in this case,

$$P = C, \ P^* = C^*. \tag{3.1}$$

We make a similar assumption in the case of acquisition investment i.e. that the MN can acquire the foreign target at its private opportunity cost, which in this case is the after-tax profit which the target firm could have made, which is $(v - w)(1 - \tau)$ for the home target, and $(v^* - w)(1 - \tau^*)$ for the foreign target. This assumption is relaxed in Section 4.1 below. So, in this case,

$$P = (v - w)(1 - \tau)/(1 + r), \ P^* = (v^* - w)(1 - \tau^*)/(1 + r). \tag{3.2}$$

Note the key difference between greenfield and acquisition assets; in the latter, the corporate tax is capitalized into the price, whereas in the former, it is not. In our framework,

[8] An interesting question for tax purposes is whether profits generated by a foreign investment project are based on domestic assets of the multinational firm like particular know-how, for instance. If so one could argue that royalties should be paid to the parent company, to make sure that the income generated by domestic assets is also taxed domestically. In the following we abstract from this issue. Including it would require a broader discussion of international income shifting, which is not the focus of this paper.

this is the only substantive difference between greenfield and acquisition investment, and it is this that drives the differences in the results below. Finally, note that if the revenue or profit produced from land in its alternative use is subject to corporate tax, then $P = C(1-\tau),\ P^* = C^*(1-\tau)$, and there would be no substantive difference between greenfield and acquisition investment.

3.4. The Multinational

With either greenfield or acquisition investment, the MN will purchase a domestic asset if and only if the productivity of the asset is above some cutoff $\hat{\Delta}$. Similarly, the MN will purchase a foreign asset if and only if the productivity of the asset is above some cutoff $\hat{\Delta}^*$. The number of managers required to run domestic operations is therefore $1 - G(\hat{\Delta})$, and similarly, the number of managers required to run foreign operations is $1 - G^*(\hat{\Delta}^*)$. The number of new hires that the MN makes in its domestic and foreign operations is then

$$h = 1 - G(\hat{\Delta}) - (M_0 - M^*),\ h^* = 1 - G^*(\hat{\Delta}^*) - M^*$$

where M^* is the number of of its M_0 existing managers the MN costlessly allocates to its foreign subsidiary. Of course, h, h^* can negative, in which case they have the interpretation of reductions in the initial managerial workforce.[9]

Following a well-known literature in labour economics (Hamermesh and Pfann, 1996), we suppose that there are costs of adjusting the managerial workforce. For $h, h^* > 0$, these will be the costs of hiring and training. For $h, h^* < 0$, these will be the legal and organizational costs of reducing the existing workforce. For analytical simplicity, and following, for instance, Pfann and Verspagen (1989), we assume that these costs are quadratic in h, h^* i.e.

$$\frac{\alpha}{2}h^2,\ \frac{\alpha^*}{2}(h^*)^2$$

We also assume that along with wages, these costs are fully deductible from the tax base.

Given the above, second-period domestic and foreign cash-flows of the firm are

$$\begin{aligned} \Pi &= \int_{\hat{\Delta}} (v + \Delta - w) g(\Delta) d\Delta - \frac{\alpha}{2}h^2 \\ \Pi^* &= \int_{\hat{\Delta}^*} (v^* + \Delta^* - w) g^*(\Delta^*) d\Delta^* - \frac{\alpha^*}{2}(h^*)^2 \end{aligned} \tag{3.3}$$

where, in the case of greenfield investment, it is understood that $v = v^* = 0$.

[9] Another interpretation of this case would be that, in the case of a foreign acquisition, management capacity of the target firm would have to be reduced.

Second period cash-flow Π is taxed at rate τ by the home government. Second period cash-flow Π^* is taxed at rate τ^* by the foreign government and at rate τ^f by the home government.

We do not explicitly permit any deduction for the cost of finance. However, allowances could reflect both the cost of depreciation and the cost of finance. In particular, below we consider a cash flow tax in which the value of the allowance is equal to the tax rate. As is well known, this can be achieved by a cash flow tax which allows a deduction for the entire cost of asset purchases, but no deduction for the cost of finance. However, this could equally well be interpreted as relief for true economic depreciation as well as the cost of finance. For simplicity our discussion is based on the cash flow approach, where finance is raised from new equity, given by:

$$E = (1 - G(\hat{\Delta}))(1 - a)P + (1 - G(\hat{\Delta}^*))(1 - a^f - a^*)P^* \tag{3.4}$$

where a, a^f are the shares of the purchase prices P, P^* respectively that can be set against domestic corporate tax, and a^* is the share of the purchase priceP^* that can be set against foreign corporate tax.

The MN makes three choices; it chooses $\hat{\Delta}, \hat{\Delta}^*, M^*$.

3.5. Relationship to the Existing Literature

This set-up encompasses most existing contributions to the study of rules for taxation of foreign-source income. First, the original Feldstein-Hartman(1979) set-up can be thought of as a special case where (i) there are no asset purchase decisions i.e. the MN has already decided on the number of plants at home and abroad i.e. $\hat{\Delta}$, and $\hat{\Delta}^*$; (ii) the only decision is now to allocate a fixed stock of the factor of production (capital in their model) between the domestic and foreign plants. In turn, the case of a fixed stock of capital is a limiting case of this set-up where the cost of adjustments to the capital stock become infinite i.e. $\alpha, \alpha^* \to \infty$. The model of Becker and Fuest (2010) is also a special case of this one, where (i) investment can only be acquisition, not greenfield, and (ii) the variable factor of production (management capacity in their case) is either completely fixed or completely variable ($\alpha, \alpha^* \to \infty$ or $\alpha = \alpha^* = 0$).

There are many extensions of Feldstein-Hartman (1979) set-up, but most of these share common feature that they do not explicitly model asset acquisition across borders. Investment decisions are (implicitly) made by households, who rent or sell capital to domestic firms who are *already established* in each country: there are no multi-nationals. For example, Horst (1980) allows the supply of capital (assumed fixed in both countries

in Feldstein-Hartman (1979)) to be elastic. Keen and Piekkola (1997) extend the Horst framework to allow for a government budget constraint, and also allow home and foreign governments to set domestic distorting taxes and also lump-sum taxes. Slemrod et al.(1997) study an extension of Feldstein-Hartman (1979) where there is both inward and outward investment, and Devereux (2004) extends this to the case of simultaneous portfolio and direct investment flows. Some of the ground covered by these papers is dealt with in our extensions: for example, in Section 4.2, we study the case where the supply of both capital and managerial capacity is endogenous.

Other related literature includes recent contributions on the taxation of outward investment where multinationals are modelled, and which consider the choice between FDI and exports as modes of serving the foreign market. Devereux and Hubbard (2003), which studies an environment where the home firm competes in the foreign market with a competitor firm located in a third country. For the firm, there is no link between domestic production and either export or FDI, as in this paper ie. in the language of Becker and Fuest (2010), there is unlimited management capacity. Becker (2013) and Lockwood (2012) also study tax rules design where firms can choose between exports and FDI. In Lockwood (2012), as in Devereux and Hubbard (2003), to allow focus on the role of the export option as creating an opportunity cost of FDI. Our results would also apply (suitably modified) to these models.

4. Analysis

4.1. The Firm

The firm maximizes the value of second-period after-tax cash-flow minus new equity, i.e.

$$V = -E + \frac{(1-\tau)\Pi + (1-\tau^* - \tau^f)\Pi^*}{1+r} \tag{4.1}$$

where r is taken as exogenous e.g. determined on the world market (we relax this is Section 4.2 below). So, using (3.3),(3.4) and(4.1), the maximand of the firm can be written out explicitly as

$$\begin{aligned} V(1+r) \;=\; & -(1-G(\hat{\Delta}))(1+r)(1-a)P + (1-G(\hat{\Delta}^*))(1+r)(1-a^f-a^*)P^* \\ & +(1-\tau)\left[\int_{\hat{\Delta}}(v+\Delta-w)g(\Delta)d\Delta - \frac{\alpha}{2}\left(1-G(\hat{\Delta})-(M-M^*)\right)^2\right] \\ & +(1-\tau^*-\tau^f)\left[\int_{\hat{\Delta}^*}(v^*+\Delta^*-w)g^*(\Delta^*)d\Delta^* - \frac{\alpha^*}{2}(1-G^*(\hat{\Delta}^*)-M^*)^2\right] \end{aligned} \tag{4.2}$$

The firm's choice variables are $\hat{\Delta}, \hat{\Delta}^*$ and M^*. First, the firm's first-order condition with respect to $\hat{\Delta}, \hat{\Delta}^*$ characterize the acquisition decisions of the firm. These can be written as:

$$\frac{(v + \hat{\Delta} - w - \alpha h)}{P} = \frac{(1-a)}{(1-\tau)}(1+r) \tag{4.3}$$

$$\frac{(v^* + \hat{\Delta}^* - w - \alpha^* h^*)}{P^*} = \frac{(1-a^f-a^*)}{(1-\tau^*-\tau^f)}(1+r) \tag{4.4}$$

These can be interpreted as standard conditions for investment at home and abroad. The LHS of each expression is the marginal product of the investment. The RHS is a standard expression for the cost of capital. These are equalized at the optimal level of investment. The RHS of the condition for outbound investment reflects the tax due in both countries.

The firm's first-order condition with respect to M^* characterizes the decision of the firm about where to allocate initial management capacity, and is:

$$\alpha^* h^*(1-\tau^*-\tau^f) = \alpha h(1-\tau) \tag{4.5}$$

This says that the marginal cost of adjusting management numbers for the MN is the same in the domestic and foreign country.

4.2. National Optimality

4.2.1. Greenfield Investment

We begin with the greenfield case. We treat the interest rate r and the wage w are independent of both the MN's decisions and choice of tax system. National economic welfare can then be measured by just the value of the firm plus domestic tax revenue. An expression for this can be obtained from (4.2) by setting $\tau^f = \tau = a = a^f = 0$, (this adds in net tax revenue) and also specializing to the greenfield case by setting $v = v^* = 0$, $P = C$ and $P^* = C^*$. Doing this gives

$$\begin{aligned} W_{N,G} &= -(1-G(\Delta))(1+r)C + (1-G(\Delta^*))(1+r)C^*(1-a^*) \\ &\quad + \left[\int_{\hat{\Delta}} (\Delta - w)g(\Delta)d\Delta - \frac{\alpha}{2}h^2\right] \\ &\quad + (1-\tau^*)\left[\int_{\hat{\Delta}^*} (\Delta^* - w)g^*(\Delta^*)d\Delta^* - \frac{\alpha^*}{2}(h^*)^2\right] \end{aligned} \tag{4.6}$$

Note that from the perspective of national welfare the benefit of the foreign purchase is reduced by the tax τ^*, but at the same time, the cost of the foreign purchase is reduced

by the foreign tax allowances at rate a^*. The first-order condition for a maximum of (4.6) with respect to $\hat{\Delta}, \hat{\Delta}^*,\ M^*$ can be written as:

$$\frac{\hat{\Delta} - w - \alpha h}{C} = 1 + r \tag{4.7}$$

$$\frac{\hat{\Delta}^* - w - \alpha^* h^*}{C^*} = \frac{(1-a^*)}{(1-\tau^*)}(1+r) \tag{4.8}$$

$$\alpha^* h^*(1-\tau^*) = \alpha h \tag{4.9}$$

These compare to the firms' conditions (4.3),(4.4),(4.5). The tax system is said to be *nationally optimal* if the firm's choice of $\hat{\Delta}, \hat{\Delta}^*,\ M^*$ also maximizes $W_{N,G}$.

The conditions for this are as follows. First, comparing (4.5) and (4.9), we see that if $\alpha > 0$, for nationally optimal allocation of M^*, we need

$$(1-\tau^*) = \frac{(1-\tau^*-\tau^f)}{1-\tau} \Rightarrow \tau^f = \tau(1-\tau^*) \tag{4.10}$$

i.e. the deduction rule. On the other hand, if $\alpha = 0$, choice of M^* is undetermined, and so no restriction is as yet imposed on τ^f.

Second, consider investments. Comparing (4.3) and (4.7) for domestic investment with $v = 0$ and $P = C$ implies that national optimality requires

$$a = \tau \tag{4.11}$$

This is a standard result requiring a cash flow taxation or its equivalent for domestic investment, at any rate of tax for $0 \leq \tau \leq 1$. It is well known that such a tax leaves the cost of capital unaffected, and therefore neutral with respect to standard investment decisions. This result is independent of α. Comparing (4.4) and (4.8) for outbound investment, national optimality of investment requires

$$\frac{(1-a^f-a^*)}{(1-\tau^*-\tau^f)} = \frac{(1-a^*)}{(1-\tau^*)} \tag{4.12}$$

which implies

$$\tau^f = \theta(1-\tau^*),\ a^f = \theta(1-a^*),\ 0 \leq \theta \leq 1 \tag{4.13}$$

This implies that the home country should levy a cash flow tax at any rate θ on the net flows from the foreign country on the outbound investment. Note that since this cash flow tax is applied to net flows, then foreign tax payments are effectively deducted from the tax base; following the literature, we call such a tax a *cross-border cash-flow tax*. But, from (4.10), θ must be equal to τ for $\alpha > 0$. So, we have shown:

Proposition 1. *Assume greenfield investment. For national optimality, cash-flow taxes are required on domestic investment i.e.* $a = \tau$. *In addition, if there is limited managerial capacity,* $\alpha > 0$, *sufficient conditions for national optimal acquisition and managerial capacity decisions are: (i) the deduction rule i.e.* $\tau^f = \tau(1-\tau^*)$, *and (ii) allowances* $a^f = \tau(1-a^*)$. *These two are equivalent to a cross-border cash-flow tax at rate* $\theta = \tau$. *If* $\alpha = 0$, τ^f *is undetermined, and thus, exemption* ($\tau^f = 0$), *is one possible optimal rule.*

The intuition for this result is simply one of targets and instruments. There are three targets; efficient choice of M^*, and efficient domestic and foreign asset purchases. The efficient choice of M^* requires the deduction rule i.e. $\tau^f = \tau(1-\tau^*)$. Given this, the firm can be induced to make nationally efficient domestic asset purchases by setting a cash-flow tax at rate τ, and similarly, can be induced to make nationally efficient domestic asset purchases by setting a cross-border cash-flow tax, also at rate τ.

4.2.2. Acquisition Investment

Now we turn to the acquisition case. National economic welfare can again be measured by just the value of the firm plus domestic tax revenue, which using (4.2), is now:

$$\begin{aligned} W_{N,A} &= -(1-G(\Delta))(v-w) - (1-G(\Delta^*))(1+r)P^*(1-a^*) \\ &\quad + \int_{\hat{\Delta}} (v+\Delta-w)g(\Delta)d\Delta - \frac{\alpha}{2}h^2 \\ &\quad + (1-\tau^*)\left[\int_{\hat{\Delta}^*} (v^*+\Delta^*-w)g^*(\Delta^*)d\Delta^* - \frac{\alpha^*}{2}(h^*)^2\right] \end{aligned} \tag{4.14}$$

Again, the tax system is said to be *nationally optimal* if the firm's choice of $\hat{\Delta}, \hat{\Delta}^*$, M^* also maximizes $W_{N,A}$. The first-order conditions for the nationally optimal choice of $\hat{\Delta}, \hat{\Delta}^*$ are now:

$$\hat{\Delta} = \alpha h \tag{4.15}$$

$$\frac{(v^*+\hat{\Delta}^*-w-\alpha^* h^*)}{P^*} = \left(\frac{1-a^*}{1-\tau^*}\right)(1+r) \tag{4.16}$$

$$\alpha^* h^*(1-\tau^*) = \alpha h \tag{4.17}$$

Note that the managerial efficiency condition is identical to that in the greenfield case. The condition for foreign acquisitions is also identical, recalling that $P^* = C^*$ in the greenfield case.

So, our first conclusion from (4.17) is that the deduction rule i.e. $\tau^f = \tau(1-\tau^*)$ is also required, as in the greenfield case. Second, comparing (4.15),(4.3), and recalling that

$P = (v-w)(1-\tau)/(1+r)$ from (3.2), we see that $a = 0$ is required for nationally optimal domestic acquisitions. This differs from the greenfield case, where $a = \tau$, because the price of the target company, P, is already effectively multiplied by $1 - \tau$ because of the capitalization effect. That is, there is no need for an allowance as the tax is capitalized into the price.

Finally, comparing (4.16),(4.4), we see that again, any cross-border cash-flow tax at rate θ, *i.e.* where $\tau^f = \theta(1 - \tau^*)$ and $a^f = \theta(1 - a^*)$, $0 \leq \theta \leq 1$ will ensure nationally optimal foreign acquisitions. We can summarize these results as follows:

Proposition 2. *Assume acquisition investment. Then, the tax rules for nationally optimal acquisition and capacity decisions are identical to the greenfield case, with the exception that no relief on domestic investment i.e. $a = 0$ is now required. That is, as long as $\alpha > 0$, the deduction rule i.e. $\tau^f = \tau(1 - \tau^*)$, and allowance $a^f = \tau(1 - a^*)$ is required. Again, these are equivalent to a cross-border cash-flow tax at rate $\theta = \tau$ on foreign investment.*

This result is an extension of Proposition 1 of Becker and Fuest (2010) to the case where total management capacity is not fixed ($\alpha = \infty$), but variable at a cost ($\alpha > 0$). If $\alpha = 0$ i.e. fully variable management capacity, then from Proposition 2, the optimal choice of τ^f is undetermined, as in Proposition 3 of Becker and Fuest (2010). Moreover, comparing Propositions 1 and 2 makes it clear that there is no fundamental difference between greenfield and acquisition investment. The crucial issue is whether there is any cost of expanding managerial capacity ($\alpha > 0$) or not ($\alpha = 0$).

4.3. Global Optimality

4.3.1. Greenfield Investment

We begin again with the greenfield case. The difference between national and global welfare in our model is that foreign taxes are costs from a national perspective but not from a global perspective. So, modifying (4.6), global economic welfare is measured by:

$$\begin{aligned} W_{G,G} &= -(1 - G(\Delta))(1 + r)C - (1 - G(\Delta^*))(1 + r)C^* \\ &\quad + \int_{\hat{\Delta}} (\Delta - w)g(\Delta)d\Delta - \frac{\alpha}{2}h^2 \\ &\quad + \int_{\hat{\Delta}^*} (\Delta^* - w)g^*(\Delta^*)d\Delta^* - \frac{\alpha^*}{2}(h^*)^2 \end{aligned} \tag{4.18}$$

The first-order conditions for a maximum of (4.18) are

$$\frac{\hat{\Delta} - w - \alpha h}{C} = 1 + r \tag{4.19}$$

$$\frac{\hat{\Delta}^* - w - \alpha^* h^*}{C^*} = 1 + r \tag{4.20}$$

$$\alpha^* h^* = \alpha h \tag{4.21}$$

First, comparing (4.5) and (4.21), we see that if $\alpha > 0$, for globally optimal allocation of managerial capacity, M^*, we need

$$1 - \tau = 1 - \tau^* - \tau^f \Rightarrow \tau^f = \tau - \tau^*$$

This is the credit rule: the domestic country must give a full credit for foreign taxes paid, and then tax the foreign income at the domestic tax rate. This is because global optimality requires the marginal managerial unit to be taxed at the same rate at home and abroad. If $\alpha = 0$, of course, no constraint in placed on τ^f.

For domestic greenfield investment, comparing (4.3) and (4.19), with $v = 0$, global optimality implies the same condition as national optimality. Hence a cash flow tax with $a = \tau$ is optimal. This is because there is no difference in the expressions for national and global welfare with respect to domestic investment. Since we are considering global welfare, by symmetry, the foreign country should also implement a cash flow tax to ensure optimality of its own domestic investment, so that $a^* = \tau^*$.

Finally, $\tau^f = \tau - \tau^*$, $a^* = \tau^*$ is equivalent to a cross-border cash flow tax at rate $\theta = (\tau - \tau^*)/(1 - \tau^*)$. The key difference between the requirements for national and global optimality in the case of greenfield investment is therefore the tax rate applied to outbound investment; in the former case, it is $\theta = \tau$. We therefore have shown:

Proposition 3. *Assume greenfield investment. For global optimality, cash-flow taxes are required on domestic investment in each country i.e.* $a = \tau$, $a^* = \tau^*$. *In addition, if there is limited managerial capacity,* $\alpha > 0$, *necessary and sufficient conditions for globally optimal acquisition and managerial capacity decisions are: (i) the credit rule i.e.* $\tau^f = \tau - \tau^*$, *and (ii) allowance* $a^f = a - a^*$. *Conditions (i) and (ii) are equivalent to a cross-border cash-flow tax at rate* $\theta = (\tau - \tau^*)/(1 - \tau^*)$. *If there is unlimited management capacity,* $\alpha = 0$, τ^f *is undetermined, and thus, exemption* ($\tau^f = 0$) *is one possible optimal rule.*

4.3.2. Acquisition Investment

We now turn to acquisitions investment. At the global level, the opportunity cost of the asset to the multinational firm is not P^*, but forgone revenue $v^* - w$ in the second period. So, modifying (4.14), global economic welfare is measured by

$$\begin{aligned} W_{G,A} &= -(1-G(\Delta))(v-w) + (1-G(\Delta^*))(v^*-w) \\ &\quad + \int_{\hat{\Delta}} (v+\Delta-w)g(\Delta)d\Delta - \frac{\alpha}{2}h^2 \\ &\quad + \int_{\hat{\Delta}^*} (v+\Delta^*-w)g^*(\Delta^*)d\Delta^* - \frac{\alpha^*}{2}(h^*)^2 \end{aligned} \tag{4.22}$$

The first-order condition for a maximum of $W_{G,A}$ are:

$$\hat{\Delta} = \alpha h \tag{4.23}$$

$$\hat{\Delta}^* = \alpha^* h^* \tag{4.24}$$

$$\alpha^* h^* = \alpha h \tag{4.25}$$

The first of these - the condition for domestic investment - is the same as the case of national optimality. The second differs from the national optimality case because tax relief in the foreign country is now considered as a transfer with no welfare consequences; this term from (4.16) is not therefore present. The third condition, for allocation of managerial capacity, is the same as that required for global optimality of greenfield investment.

Not surprisingly, then the implications for taxes are similar. First, as (4.25) is the same as (4.21), the credit rule is still optimal $\tau^f = \tau - \tau^*$ as long as $\alpha > 0$. Second, comparing (4.3) to (4.23) and using the price formulae (3.2), we see that $a = 0$ again reflecting the fact that the tax is capitalized into the price of the target firm. By symmetry, then we also have $a^* = 0$. Combining (4.24) with (4.4) indicates that global optimality for outbound acquisitions requires

$$\frac{1-a^*-a^f}{1-\tau^*-\tau^f} = \frac{1}{1-\tau^*}$$

Conditional on $a^* = 0$, then the condition is similar to that for national optimality, in (4.12). That is, the condition is satisfied by a cross-border cash flow tax with rate $\theta(1-\tau^*)$ and allowance $a^f = \theta$, $0 \leq \theta \leq 1$. However, as already remarked, the condition (4.25) for globally optimal allocation of managerial capacity if $\alpha > 0$, is that $\tau^f = \tau - \tau^*$. Consistency between both conditions therefore requires $\theta = (\tau - \tau^*)/(1-\tau^*)$, exactly as for greenfield investment[10]. We have shown the following:

[10] However, with $a^* = 0$, in this case the cash flow tax cannot be applied to flows gross of foreign taxes (since $a^f \neq t^f$).

Proposition 4. *Assume acquisition investment. Then, the tax rules for globally optimal acquisition and capacity decisions are identical to the greenfield case, with the exception that no relief on domestic investment in each country i.e.* $a = 0,\ a^* = 0$, *is now required. That is, as long as* $\alpha > 0$, *the credit rule i.e.* $\tau^f = \tau - \tau^*$, *and an allowance* $a^f = (\tau - \tau^*)/(1 - \tau^*)$ *is required. Again, these are equivalent to a cross-border cash-flow tax at rate* $\theta = (\tau - \tau^*)/(1 - \tau^*)$ *on foreign investment. If there is unlimited management capacity,* $\alpha = 0$, τ^f *is undetermined, and thus, exemption* ($\tau^f = 0$) *is one possible optimal rule.*

Comparing Propositions 3 and 4 shows that the optimality rules for greenfield and acquisition investment are again very similar; the only difference is that in the acquisition case, no allowance is needed for purchase of domestic assets, as the allowance is already effectively capitalized into the price. In particular, a cross-border cash flow tax system can be found which leads to optimal foreign investment in both cases.

How are these results related to the literature? Becker and Fuest (2010) also consider a cross border cash flow system but they impose the restriction that the tax rate has to be equal to the domestic income tax rate and find that this tax system is nationally but not globally optimal. In our model this would imply $\theta = \tau$, which is also compatible with national optimality (see Proposition 2) but not with global optimality (see Proposition 4). Our results also shed light on the optimality properties of the exemption system discussed by Desai and Hines (2003)

4.4. Reflections on CEN and CON

Desai and Hines (2003) define capital export neutrality as the principle that "capital should be taxed at the same rate regardless of the location in which it is earned" (Desai and Hines, 2003, p.492). In our setting, the CEN principle applies to greenfield investment: one dollar spent on purchase of land should generate the same return at home and abroad. It is then easy to see that our conditions for global optimality include CEN: from (4.19),(4.20), we have that the returns to investment at home and abroad are satisfied:

$$\frac{\hat{\Delta} - w - \alpha h}{C} = \frac{\hat{\Delta}^* - w - \alpha^* h^*}{C^*} \tag{4.26}$$

Capital ownership neutrality, as defined by Desai and Hines (2003), is the principle that tax systems should not distort the pattern of ownership of assets: acquisitions should take place only if the buyer can use the asset more productively than the seller. It is then easy to see that our conditions for global optimality include CON: from (4.23),(4.24), we see that it is optimal for acquisitions at home and abroad to take place up to the point where

the net productive advantage of the acquirer is zero:

$$\hat{\Delta} - \alpha h = 0, \ \hat{\Delta}^* - \alpha^* h^* = 0 \tag{4.27}$$

Note here that the productive advantage is net, because the cost of additional hiring must be subtracted in each case. Thus, referring back to Propositions 3 and 4, we see that what is required for CEN is cash-flow taxation in each country, with the cash-flow tax being cross-border i.e. on the cross-border flows net of foreign taxes. What is required for CON is the same, except that no allowance should be given for the cost of domestic acquisitions.

This is rather different than the findings of the literature, where it is usually argued that CEN requires a tax credit system, where firms can credit any taxes paid abroad against their domestic tax liability (Desai and Hines (2003)). The reason for this difference is that the formal arguments underpinning the assertion that CEN requires a tax credit system are typically made using models where capital is a variation in the scale of production, and thus CEN is a statement about marginal rates of return. In contrast, in our model, the factor of production that can be adjusted at the margin is managerial capacity (which could be interpreted as capital as well), and we know from Propositions 3 and 4 that the condition for the tax system not to distort the allocation of capital across foreign and domestic plants is precisely the credit rule.

5. Extensions

5.1. Competition between Acquirers

So far, we have assumed that the home MN can extract all the surplus from the seller when making an acquisition. However, as stressed by Desai and Hines (2003), there may be several international investors competing for a single product. Assume now that there is a potential acquirer located in the foreign country (the foreign acquirer, FA) who can produce an additional amount $\gamma(\Delta^*)$ from the target Δ^* firm. (The FA could be located in a third country without changing the results, at the cost of additional notation). Now consider the equilibrium. First, the most that the MN and the FA are willing to pay for the target Δ^* firm are amounts

$$\begin{aligned} P^{MN}(\Delta^*) &= \frac{(v^* + \Delta^* - w - \alpha^* h^*)(1 - \tau^* - \tau^f)}{(1+r)(1 - a^* - a^f)} \\ P^{FA}(\Delta^*) &= \frac{(v^* + \gamma(\Delta^*) - w)(1 - \tau^*)}{(1+r)(1 - a^*)} \end{aligned}$$

Now, suppose that the price for the target is set competitively i.e. the firm with the largest reservation price buys it and pays the price that the other firm is willing to pay, if that exceeds the reservation price of the seller, $(v^* - w)/(1+r)$. This will be the outcome of any auction, for example (Dutch, English, first-price, second-price) conducted by the seller - see e.g. Krishna (2009). So, the price that the domestic MN now faces for purchase of a foreign firm is

$$P^* = \max\left\{\frac{(v^* - w)(1-\tau^*)}{(1+r)},\ \frac{(v^* + \gamma(\Delta^*) - w)(1-\tau^*)}{(1+r)(1-a^*)}\right\} \tag{5.1}$$

i.e. the price to the domestic MN may be higher because it has to compete with the FA.

The first point to note is that because the national government takes P^* as given, the conditions for national optimality are unaffected. Thus, Proposition 2 continues to hold. However, this is not true for global optimality. Note that now, the global real opportunity cost allowing the MN to own the firm located in the foreign country is $(v^* - w + \max\{\gamma(\Delta^*), 0\}$. So, the objective $W_{G,A}$ changes to

$$\begin{aligned} W_{G,A} \;=\; & -(1-G(\Delta))(v-w) - \int_{\hat{\Delta}} (v^* - w + \max\{\gamma(\Delta^*), 0\}) \\ & + \int_{\hat{\Delta}} (v + \Delta - w) g(\Delta) d\Delta - \frac{\alpha}{2} h^2 \\ & + \int_{\hat{\Delta}^*} (v + \Delta^* - w) g^*(\Delta^*) d\Delta^* - \frac{\alpha^*}{2} (h^*)^2 \end{aligned} \tag{5.2}$$

The first-order conditions for a maximum of $W_{G,A}$, assuming that $\gamma(\hat{\Delta}^*) > 0$ - the other case is uninteresting - are as before, except that (4.24) becomes:

$$\hat{\Delta}^* = \alpha^* h^* + \gamma(\hat{\Delta}^*) \tag{5.3}$$

We must now check that the firm's equilibrium condition (4.4) holds at $\hat{\Delta}^* = \alpha^* h^* + \gamma(\hat{\Delta}^*)$ as required by (5.3). First, assume $a^* = 0$ and $\gamma(\hat{\Delta}^*)$ in (5.1). Then, from (4.4), we see that $\hat{\Delta}^*$ is determined in equilibrium as

$$\frac{(v^* + \hat{\Delta}^* - w - \alpha^* h^*)}{P^*} = \frac{(1-a^f)}{(1-\tau^* - \tau^f)}(1+r),\ P^* = \frac{(v^* - w + \gamma(\hat{\Delta}^*))(1-\tau^*)}{(1+r)}$$

which reduces to

$$v^* + \hat{\Delta}^* - w - \alpha^* h^* = \frac{(1-a^f)(1-\tau^*)}{(1-\tau^* - \tau^f)}(v^* - w + \gamma(\hat{\Delta}^*))$$

But, again using the conditions in Proposition 4 that $a^f = (\tau - \tau^*)/(1-\tau^*), \tau^f = \tau^f - \tau^*$, this reduces to $\hat{\Delta}^* = \alpha^* h^* + \gamma(\hat{\Delta}^*)$ i.e. (5.3) as required. So, we have demonstrated that Proposition 4 extends to this case.

Summarizing the results of this section, we have:

Proposition 5. *In the case of acquisition investment, Propositions 2 and 4 continue to hold, even when there are multiple potential acquirers in different countries.*

This shows that our results are robust to the presence of several potential buyers for the asset. However, it is worth noting that if the seller can extract some of the surplus from the MN *when there is no other potential buyer*, a kind of "hold-up" problem is created; from a global point of view, the asset is too expensive for the MN buyer, and so acquisitions will be inefficiently low under cross-border cash-flow taxation. To see this, note that in the greenfield case, the price paid for the asset would be

$$P = C + \sigma(\Delta - C), P^* = C^* + \sigma^*(\Delta^* - C^*)$$

where $0 \leq \sigma, \sigma^* \leq 1$ parameterize the bargaining power of the seller of the asset. Then, it is easily checked that the equilibrium conditions become

$$\frac{(\hat{\Delta} - w - \alpha h)}{C + \sigma(\Delta - C)} = \frac{(1-a)}{(1-\tau)}(1+r) \tag{5.4}$$

$$\frac{(\hat{\Delta}^* - w - \alpha^* h^*)}{C^* + \sigma^*(\Delta^* - C^*)} = \frac{(1-a^f-a^*)}{(1-\tau^*-\tau^f)}(1+r) \tag{5.5}$$

So then, from (4.19) and (4.20), for global optimality, we require

$$\frac{(1-a)}{(1-\tau)} = \frac{C}{C + \sigma(\Delta - C)}, \frac{(1-a^f-a^*)}{(1-\tau^*-\tau^f)} = \frac{C^*}{C^* + \sigma^*(\Delta^* - C^*)} \tag{5.6}$$

Now, because the asset is overpriced, the allowance has to be more generous than the tax to adjust for this i.e. $a > \tau$, $a^* + a^f > \tau^* + \tau^f$, and so cash-flow taxation is no longer optimal. This point is also made in Section 3.3 of Becker and Fuest(2010). However, in this case, we are in a second-best world; the government does not have enough instruments to deal with the mispricing of the asset and maintain cash-flow taxation. One solution would be for the government to subsidize the asset prices directly at rates $\frac{\sigma(\Delta - C)}{C + \sigma(\Delta - C)}$, $\frac{\sigma^*(\Delta^* - C^*)}{C^* + \sigma^*(\Delta^* - C^*)}$ except that σ and σ^* are not observed.

5.2. Endogenous Interest Rate and Wage Rate

So far we have assumed that the interest rate r and the price of internationally mobile managers w are given exogenously. Assuming that prices of internationally mobile factors

are fixed is a standard assumption in the analysis of tax policy in small open economies. This assumption is appropriate for the analysis of national optimality but problematic when it comes to analyzing global optimality. In this section we 'close' the model by explicitly considering savings behavior and the determination of the interest rate in the international capital market, as well as the supply of management services and the determination of w endogenously. We assume that the utility function of the household residing in the home country is given by the quasi-linear utility function

$$U(C_1, C_2, L) = u(C_1) + C_2 - e(L)$$

where C_1 and C_2 are consumption in the first and the second period and L is the management service provided by the household in period 2. Utility from first period consumption $u(.)$ is strictly concave, with $u\prime > 0$, $u\prime\prime < 0$ and $e(L)$ is a convex function which represents the disutility of work, with $e\prime$, $e\prime\prime > 0$. This utility function implies that income effects on first period consumption and supply of management services are zero.[11] The utility function of the foreign representative household is denoted by

$$U^*(C_1^*, C_2^*, L^*) = u^*(C_1^*) + C_2^* - e^*(L^*).$$

The asterisk denotes the foreign country or location. In period 1, the domestic (foreign) household has a given endowment of E (E^*) units of the numeraire good. The domestic (foreign) household also owns all domestic (foreign) firms, and both households own shares in the multinational firm. Households may borrow or lend in the international capital market at the interest rate r. Denote the net lending of the two households by S and S^*, respectively. Given this, the first period budget constraints of the domestic and foreign households are given by

$$C_1 = E - S + R,\ C_1^* = E^* - S^* + R^*$$

where R, R^* is revenue from the sale of firms to the multinational company in the case where acquisitions take place. In the case of greenfield investment, we have R, $R^* = 0$. The return on savings which accrues to the domestic (foreign) household in period 2 is given by $(1 + r)S$ and $(1 + r)S^*$, respectively. The first order conditions for optimal savings can be expressed as:

$$u\prime(E - S + R) = 1 + r \tag{5.7}$$

$$u^*\prime(E^* - S^* + R^*) = 1 + r \tag{5.8}$$

[11] Becker and Fuest (2010) also assume quasilinear utility.

The others who are active in the international capital market are the multinational firm, which has to raise funds to finance investment, and the two governments, which may need money to finance investment allowances paid out in period 1. Overall borrowing from the multinational firm and the two governments in period 1, which we denote by B, is given by

$$B = (1 - G(\hat{\Delta}))P + (1 - G(\hat{\Delta}^*))P^* \tag{5.9}$$

Capital market equilibrium implies

$$S + S^* = B \tag{5.10}$$

How does investment affect the interest rate? This depends on whether investment takes the form of acquisitions or greenfield investment. Consider first the case of acquisitions. In this case we have

$$R = (1 - G(\hat{\Delta}))P, R^* = (1 - G(\hat{\Delta}^*))P^* \tag{5.11}$$

Total differentiation of (5.7)-(5.11) shows that a change in either domestic or foreign acquisitions investment leaves the interest rate r unaffected. The economic explanation is that, say, an increase in foreign acquisitions increases capital demand by the multinational firm but also increases the foreign household's revenue from selling firms in period 1 (R^*). The foreign household will reinvest these funds in the international capital market. Put differently, a change in acquisition investment changes the portfolio composition of households but does not affect the intertemporal resource allocation in the economy as a whole.

Consider next the labour market. The household's supply of management services equates the wage rate to the marginal disutility of work:.

$$e\prime(L^S) = w \tag{5.12}$$

$$e^*\prime(L^{S*}) = w \tag{5.13}$$

Equilibrium in the international market for management services implies

$$L^S + L^{S*} = L^D + L^{D*} \tag{5.14}$$

where L^D and L^{D*} are domestic and foreign demand for management services, which equals the number of active firms, since each firm needs one unit of management services. In the case of acquisitions investment, the number of firms does not change - only their ownership changes. This implies that the wage rate in the market for management services is unaffected by the level of acquisitions investment.

Given this, we may state:

Proposition 6. *In the case of acquisition investment, Proposition 4 continues to hold, even when the interest rate and the wage rate are determined endogenously.*

In the case of greenfield investment things are slightly different because a change in greenfield investment does affect the inter-temporal resource allocation in the economy as a whole, so that the interest rate changes. Greenfield investment also changes the number of active firms and, hence, demand for management services. In order to increase investment households have to reduce consumption in period 1. Capital market equilibrium is now given by

$$S + S^* = (1 - G(\hat{\Delta}))C + (1 - G(\hat{\Delta}^*))C^* \tag{5.15}$$

Equation (5.15) implicitly defines the equilibrium interest rate as a function $r = r(\hat{\Delta}, \hat{\Delta}^*)$. Along the same lines, equilibrium in the market for management services now implies

$$L^S + L^{S*} = (1 - G(\hat{\Delta})) + (1 - G(\hat{\Delta}^*)) \tag{5.16}$$

Assume that global welfare is given by the sum of utilities $U(C_1, C_2, L) + U^*(C_1^*, C_2^*, L^*)$. This is appropriate if we assume that all tax revenue is passed on to the two households in a lump sum manner in period 2. In this case global welfare can be expressed as

$$\begin{aligned} W^G &= u(E - S) + u^*(E^* - S^*) + (S + S^*)(1 + r) \\ &\quad -(1 - G(\Delta))(1 + r)C - (1 - G(\Delta^*))(1 + r)C^* - e(L) - e^*(L^*) \\ &\quad + \int_{\hat{\Delta}} \Delta g(\Delta) d\Delta - \frac{\alpha}{2} h^2 + \int_{\hat{\Delta}^*} \Delta^* g^*(\Delta^*) d\Delta^* - \frac{\alpha^*}{2} (h^*)^2 \end{aligned} \tag{5.17}$$

Maximizing (5.17) over $\hat{\Delta}$, $\hat{\Delta}^*$and M^* and using (5.12),(5.13), (5.15) and (5.16) yields first order conditions which are identical to equations (4.19)-(4.21). Given that the multinational firm takes the interest rate as given, its investment behavior will be as described by equations (4.3)-(4.5). This implies:

Proposition 7. *In the case of greenfield investment, Proposition 3 continues to hold, even when the interest rate and the wage rate are determined endogenously.*

While Propositions 6 and 7 thus show that our results for globally optimal tax rules also hold if we close our model by endogenizing interest rates and the price for management services, things are different in the case of national optimality if individual countries have a significant impact on these factor prices. In this case the optimal tax policy depends on whether countries are net importers or exporters of capital and management services. The fact that countries may be able to exploit market power in international markets has

been studied extensively in the literature[12], so that we do not discuss this issue further here.

5.3. Income Tax

We now consider the case in which each country levies a tax on the full income of the firm. We define this to be a tax on the total income of the firm after deducting costs other than financing costs. In effect, this fixes the rate of allowance. This leaves only the tax rates as instruments that can be set by each government.

We assume full relief is available for the cost of depreciation, but no relief is available for the cost, or opportunity cost, of finance. In the context of a two period model, the asset has no value at the end of period 2, and hence the rate of depreciation in that period is 100%. This generates tax relief in period 2 of τ in the home country and τ^* in the foreign country. Assume that the tax on outbound investment receives a depreciation allowance worth d^f. A full depreciation allowance would be $d^f = \tau^f$, but we do not impose that at this stage. Note that these depreciation allowances are equivalent to fixing the values of the initial allowance as $a = \tau/(1+r)$; $a^* = \tau^*/(1+r)$ and $a^f = d^f/(1+r)$.

5.3.1. Management costs fully deductible

We continue for now to assume that the expenses related to hiring management are fully deductible. We relax that assumption below. In this case the maximand of the firm can be written as:

$$\begin{aligned} V(1+r) \;=\; & -(1-G(\hat{\Delta}))[1+r-\tau]P \\ & +(1-G(\hat{\Delta}^*))[1+r-\tau^*-d^f]P^* \\ & +(1-\tau)\left[\int_{\hat{\Delta}}(v+\Delta-w)g(\Delta)d\Delta - \frac{\alpha}{2}\left(1-G(\hat{\Delta})-(M-M^*)\right)^2\right] \\ & +(1-\tau^*-\tau^f)\left[\int_{\hat{\Delta}^*}(v^*+\Delta^*-w)g^*(\Delta^*)d\Delta^* - \frac{\alpha^*}{2}(1-G^*(\hat{\Delta}^*)-M^*)^2\right] \end{aligned} \tag{5.18}$$

The firm's first order condition for the allocation of management capacity is unchanged because the costs associated remain fully deductible. Hence:

$$\alpha^* h^*(1-\tau^*-\tau^f) = \alpha h(1-\tau) \tag{5.19}$$

[12] For surveys of the literature on setting of source-based capital taxes with an endogenous interest rate, see Haufler (2001).

The firm's first-order condition with respect to $\hat{\Delta}, \hat{\Delta}^*$ are now given by:

$$\frac{v + \hat{\Delta} - w - \alpha h}{P} = \frac{1 + r - \tau}{1 - \tau} \tag{5.20}$$

$$\frac{v^* + \hat{\Delta}^* - w - \alpha^* h^*}{P^*} = \frac{1 + r - \tau^* - d^f}{1 - \tau^* - \tau^f} \tag{5.21}$$

The conditions for national and global optimality are unchanged and are given by equations (4.7) - (4.9) and (4.19)-(4.21) respectively for greenfield investment, and (4.15) - (4.17) and (4.23)-(4.25) respectively for acquisitions investment.

Note first that, because the firm's decision for allocating management capacity is independent of depreciation allowances or deductibility of financing costs, the optimal tax rates on foreign source income are the same as under a cash flow tax. This applies to both greenfield and acquisition investment. If $\alpha > 0$ national optimality requires $\tau^f = \tau(1 - \tau^*)$, and global optimality requires $\tau^f = \tau - \tau^*$.

Comparing (5.20) with the conditions for national and global optimality of domestic investment, it is clear that the cost of capital under an income tax (the RHS of (5.20)) exceeds the cost of capital under the optimality conditions. Consequently, for any positive tax rate, there will be under-investment.

Comparing (5.21) with the condition of global optimality also indicates that, for any positive tax rate in the foreign country, there will be under-investment relative to the global optimum. A sufficient condition for the national optimum is an exemption system: $d^f = \tau^f = 0$, but this is inconsistent with the optimal tax rate for the allocation of managerial capacity. Conditional on setting $\tau^f = \tau(1 - \tau^*)$, then for nationally optimal outbound investment the rate of depreciation allowance would need to be set at $d^f = \tau(1 + r - \tau^*)$; this is clearly not a standard income tax treatment. In general then it is clearly not possible to achieve a national or global first-best with an income tax.

5.3.2. Management costs not fully deductible

So far, we have allowed the costs of adjusting the management capacity to be fully deductible from tax. Now consider the case in which the value of the tax deduction is lower; specifically, at home it is β, $0 \leq \beta \leq \tau$ and abroad it is β^*, $0 \leq \beta^* \leq \tau^*$. Similarly the rate of relief for outbound investment is β^f. This is consistent with the alternative interpretation of this factor being capital expenditure, which is not immediately deductible under an income tax. More generally, it is consistent with any expenditure that is not fully allowed against tax. This only has an effect on the first order condition for the allocation of this factor, so that (5.19) becomes:

$$\alpha^* h^*(1-\beta^*-\beta^f) = \alpha h(1-\beta) \tag{5.22}$$

In this case, the condition for global optimality is unchanged, but the condition for national optimality becomes:

$$\alpha^* h^*(1-\beta^*) = \alpha h \tag{5.23}$$

The conditions for the optimal allocation of this factor are similar. For national optimality, we require the deduction rule, but applied to the value of the tax deduction:

$$(1-\beta^*) = \frac{(1-\beta^*-\beta^f)}{1-\beta} \rightarrow \beta^f = \beta(1-\beta^*) \tag{5.24}$$

and for global optimality, we require the credit rule, again applied to the value of the tax deduction:

$$1-\beta = 1-\beta^*-\beta^f \rightarrow \beta^f = \beta-\beta^* \tag{5.25}$$

This clarifies the role of the deduction or credit rule in this model. These solutions apply not to the tax rate applied to the income generated from investments, but to the rate of relief that the costs associated with the mobile factor receive in each country. Only when costs are fully deductible are these two equivalent.

In sum, we have:

Proposition 8. *A first-best solution across all three margins (domestic investment, outbound investment and allocation of the mobile factor eg. management capacity) is not feasible if countries use an income tax instead of a cash flow tax, since there will generally be underinvestment. The optimal treatment of the allocation of the mobile factor depends on its tax treatment. If the costs of using that factor are fully relieved against tax, then the usual rules apply to the tax rate on outbound investment: national optimality requires a deduction system and global optimality requires a credit system. However, if anything less than full relief is given, then these rules apply not to the tax rate, but to the value of relief given.*

6. Conclusions

This paper has analyzed the national and global optimality of taxes on foreign source income of multinational firms. We start from the observation that the recent literature on the taxation of foreign profits makes different assumptions regarding the corporate

tax system under consideration, the impact of foreign investment on domestic economic activity and the type of foreign investment - investment in immobile assets and investment in mobile capital. The main finding of the analysis is that the standard results regarding the optimal taxation of foreign source income - the national optimality of the full taxation after deduction system and the global optimality of the tax credit system - also hold in a model that combines investment in immobile assets and mobile capital, provided that two conditions hold. Firstly, the corporate tax is a cash flow tax, with full deductibility of all capital expenses. Secondly, more foreign investment reduces domestic investment.

If the second condition does not hold and domestic investment does not decline as a result of more foreign investment, the exemption system leads to optimality, but any other tax on foreign source income (provided it is not confiscatory) does so as well. If the first condition does not hold because either acquisition expenses or capital costs for greenfield investment are not fully deductible, the optimal tax on foreign source income changes. In some cases, none of the standard regimes lead to either national or global optimality.

Given that existing corporate income tax systems increasingly restrict the deductibility of capital expenses, our results suggest that implementing optimal taxes on foreign source income also becomes increasingly difficult. One should also bear in mind that although we integrate many aspects of existing models, our analysis abstracts from various relevant factors. This includes, for instance, the mobility of headquarters and the issue of international profit shifting. Taking this into account adds additional complications. This suggests that more research is needed to improve our understanding of the taxation of foreign source income.

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