Taxation of Foreign Profits with Heterogeneous Multinational Firms

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Abstract

Recent empirical studies find that foreign direct investment (FDI) by a multinational firm is not associated with a reduction of the firm's domestic activities. As it is often argued, this finding may imply that a country should not tax the firm's foreign profit income since this reduces foreign investment without benefitting the domestic economy. The paper analyzes this argument using a model with heterogeneous multinational firms which serve a foreign market through exports or FDI. If a firm switches from exporting to FDI, domestic activity and tax payments may decrease, stay constant or even rise due to intra-firm trade. It turns out that, in all three cases, the optimal tax system implies full taxation after deduction of foreign tax payments. If the country accounts for the effects of its policy on the foreign price level, the case for taxing foreign income becomes even stronger. From a global point of view, the nationally optimal tax rate on repatriated foreign profits is inefficiently high. In contrast to the standard literature, the globally optimal tax system requires a lower tax rate than under the tax credit system which, under certain circumstances, may imply exempting foreign income from tax.

JEL-Code: H25, F23.

Keywords: corporate taxation, foreign profits, multinational firms.

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1 Introduction

In 2008, the worldwide income from outward foreign direct investment reached an all-time high of US$ 1,283 billion, of which the United States alone had US$ 350 billion and the United Kingdom around US$ 130 billion.[1] This income is generally taxed at source, i.e. in the country where the investment has been made. However, when transferred back to the firm's headquarter, it can additionally be taxed by the country where the headquarter of the multinational firm resides. In this case, the OECD recommends choosing among two standard systems of taxing repatriated business income: the tax credit system where foreign income is taxed at the domestic corporate tax rate and foreign taxes are credited against the domestic tax liability, and the exemption system where foreign income is exempt from domestic taxation. Given the scarcity of public funds, one would expect that governments in residence countries around the world grasp this opportunity and exercise their right to tax. However, the opposite can be observed: Several countries including the United Kingdom[2] and the United States[3] have recently switched from the tax credit system to exemption or are considering such a move.

These reform initiatives receive intellectual support from the academic realm which may seem surprising because, for a long time, scholars used to favor the tax credit system for effiency reasons. However, as proponents of the exemption system argue, empirical findings have altered the view on international capital flows and, thus, the foundation for optimal taxation reasoning. According to these authors, the new view on multinational investment implies the optimality of the tax exemption system. For instance, Mihir Desai (2009) states that "*modern welfare norms that capture the nature of multinational firm activity recommend a move toward not taxing the foreign activities of American firms, rather than taxing them more heavily*". In this paper, I examine whether the case for switching to an exemption system is theoretically well-founded.

The superiority of the credit system builds on the classical work by Peggy Musgrave (née Richman, 1963) who describes a world in which a multinational firm al-

[1] See www.unctad.org (World Investment Report), www.bea.gov and www.statistics.gov.uk (number for UK from 2007: GBP 89,855 (exchange rate from 31/12/2008).

[2] See e.g. HM Treasury and HM Revenue and Customs, 2007.

[3] See e.g. United States Department of the Treasury, Office of Tax Policy, 2007.

locates its investment projects across locations. At the margin, it chooses between investing the last dollar at home or abroad. In such a situation, full taxation of foreign income after deduction of foreign taxes paid is the optimal tax policy from a national point of view, whereas crediting foreign taxes against domestic taxes leads to global optimality. Musgrave's work (Richman, 1963, Musgrave, 1969) and the following contributions like Hamada (1966) and Feldstein & Hartman (1979) were highly influential in shaping international taxation agreements like e.g. the OECD convention on double taxation treaties.[4]

This view has recently been challenged. The main point of criticism focusses on the multinational's investment behaviour. In the Musgrave model, one dollar of investment abroad crowds out one dollar of investment at home. Proponents of the new view on international taxation argue that this has been proven wrong by empirical evidence.[5] Instead, a dollar invested abroad can be shown to effectively increase domestic investment within the firm or, at least, to leave it unaffected.[6] Then, the proponents argue, there is no rationale anymore for taxing foreign income for efficiency reasons. Optimality implies exemption of foreign profits.

In the following, I will restate the proponents' arguments in a formal model which captures the important features of the "*nature of multinational firm activity*": imperfect competition, firm-specific advantages and heterogeneous consumer tastes. Firms may choose between foreign direct investment, exporting or not servicing the foreign market at all. Firm heterogeneity allows endogenously determining these decisions (as well as those on quantity and prices) as a function of factor productivity, like in Helpman et al. (2004). If the firm chooses investment abroad, part of the production remains at the domestic headquarter and is supplied to the foreign affiliate via intra-firm trade, like in Grossman & Rossi-Hansberg (2008). As a consequence, foreign investment may actually be associated with increased domestic activity and tax payments. In this case, according to the authors favoring the exemption system, a tax on foreign profits unnecessarily reduces the multinational's firm activity without benefitting (or even by harming) the domestic economy. The model presented in this paper allows asking whether

[4] Other standard references are Bond & Samuelson (1989) and Bucovetsky & Wilson (1991).

[5] See e.g. Desai & Hines (2003, 2004), Hines (2008), Desai (2009).

[6] See e.g. Egger & Pfaffermayr (2003), Simpson (2008), Desai, Foley & Hines (2009) and Kleinert & Toubal (forthcoming).

this view is correct and how the choice of the optimal tax rate on foreign profits looks like in such a setting.

As the main result, the model shows that, even if foreign investment increases domestic activity and tax payments, a tax on foreign income is optimal for efficiency purposes. It turns out that the standard result proves to be robust in this setting: The nationally optimal tax system implies full taxation after deduction of foreign tax payments. The reason is that firms themselves take into account that domestic profits increase in response to foreign investment. Without a full tax on foreign income, social and private interests diverge. Moreover, I find that, if the home country is able to manipulate the foreign price level, the incentive to levy a tax on foreign profits may even increase.[7] From a global point of view (i.e. accounting for the welfare of the foreign country's household), the tax rate on foreign profits is inefficiently high. In contrast to the standard literature, the globally optimal tax system may imply exemption of foreign income.

In order to set the contribution of this paper in a wider context, it is useful to consider how the literature on optimal foreign profit taxation evolved after the seminal achievement by Peggy Musgrave (1963). Essentially, the literature has dealt with a number of extensions concerning the assumption of a fixed capital stock (Horst, 1980, Keen & Piekkola, 1997), the implementation of double taxation agreements in a strategic multi-country setting (e.g., Janeba, 1995, Mintz & Tulkens, 1996, and Davies, 2003), the role of deferral (Dharmapala, Foley & Forbes, 2009) and headquarter mobility (Voget, 2009). Moreover, the implications of alternative forms of investment like r&d spending (Grubert & Mutti, 1995) and mergers and acquisitions (Desai & Hines, 2003, 2004, Becker & Fuest, forthcoming) have been considered. For the purpose of this paper, extensions regarding the multinational firm's investment behaviour and the introduction of a world capital market are most important. If a country is small relative to the world capital market, capital is virtually infinitely available at a fixed interest rate. Then, investment abroad need not be associated with reduced investment at home, as both investment levels are effectively determined by the world market interest

[7] Accounting for tax effects on the foreign price level may capture the case in which foreign and domestic investment are complementary within the firm (as in Desai, Foley & Hines, 2005) but are substitutes in aggregate (as demonstrated by Feldstein, 1995) because foreign investment by one firm crowds out activity by other firms.

rate. In this setting, there is no need to tax foreign income for efficiency reasons (see Grubert & Mutti, 1995, Mintz & Tulkens, 1996, and Devereux, 2004, for a discussion).[8] However, these studies (implicitly) assume perfect competition and, thus, miss some features of multinational firm activity which have been stressed by recent empirical studies.

Given the literature with its broad range of assumption sets and modelling choices, the question arises which model to choose in order to answer the research question brought up by the recent debate on switching to the exemption system. I have two answers to this question. Firstly, the model should capture all the stylized facts which the exemption proponents have indicated to be crucial for their argument and which the recent empirical studies have proven to be robust. These are firm heterogeneity, imperfect competition and the simultaneous existence of exporting and FDI. The model should yield that domestic activity may react positively to foreign investment within the firm (Desai, Foley & Hines, 2005), and negatively in aggregate (Feldstein, 1995). Secondly, the proponents of the exemption system themselves recommend a model framework in the tradition of Melitz (2003) for deriving optimal tax rates on foreign income: "*This new evidence (...) suggests that further explorations of the application of these models to the question of taxing foreign profits would be highly profitable*" (Desai, 2009, p. 11/12). It turns out, though, that a Melitz (2003) framework with FDI, as in Helpman et al. (2004) cannot replicate the stylized fact that domestic activity increases in response to foreign investment. Therefore, I adopt model features from Grossman & Rossi-Hansberg (2008) where the multinational firm is allowed to allocate different production "tasks" across locations within the firm. This gives rise to intra-firm trade and links the two activity levels at home and abroad with each other.

The remainder of the paper is organized as follows. In the next section, I present the model and the results for nationally and globally optimal tax policy. Section 3 discusses potential extensions and limitations of the analysis. Section 4 concludes.

[8] This is true, as long as the domestic tax rate is assumed to be given and no revenue requirement is binding. If the domestic tax rate is endogenized, the government faces a Ramsey style problem of optimization where optimal tax rates on domestic and foreign income reflect the locational elasticities.

2 The model

As indicated above, the model used in this paper has two building blocks, the first adopted from Melitz (2003) and Helpman et al. (2004), the second from from Grossman & Rossi-Hansberg (2008). The integration of these two model types becomes necessary because of the tax focus in this paper which will be clarified later on.

Consider a world with two countries labelled home (h) and foreign (f). In each of these two countries, there are a representative household and many heterogeneous firms.

2.1 Households

The representative consumers in the home and the foreign country derive utility U_h and U_f, respectively, from a numéraire good y and a variety of differentiated goods X. The differentiated goods are either produced in the home country, then denoted as x_h with index i, or in the foreign country, denoted as x_f with index j. To keep things simple, I assume that the household preferences in both countries are equal. Therefore, location indices for representative consumers are omitted until misunderstandings may arise.

The utility function is given by

$$U = y + \frac{1}{\gamma}\left(\int_0^{N_h} x_h(i)^{\frac{\sigma-1}{\sigma}}\,di + \int_0^{N_f} x_f(j)^{\frac{\sigma-1}{\sigma}}\,dj\right)^{\frac{\sigma}{\sigma-1}\gamma} \tag{1}$$

where γ and σ are preference parameter, N_h and N_f are the numbers of home and foreign produced varieties, respectively, and $\sigma > 1$. I further assume that $\frac{\sigma-1}{\sigma} > \gamma$ which ensures that each first derivative of (1) with respect to $x_h(i)$ and $x_f(j)$ describe a utility maximum (see Chor, 2009, for a similar modelling strategy).

The budget constraint is given by

$$I = y + \int_0^{N_h} p_h x_h(i)\,di + \int_0^{N_f} p_f x_f(j)\,dj \tag{2}$$

where I denotes the household's after-tax income which is the sum of wage income, after-tax profits of firms and lump-sum transfers from the government. Prices are given by p_h, p_f and unity for the numéraire good y. I assume that all home firms belong to the home country's representative household and all foreign firms to the foreign household.

Substituting the budget constraint into the utility function yields

$$\begin{aligned} U &= I + \frac{1}{\gamma}\left(\int_0^{N_h} x_h(i)^{\frac{\sigma-1}{\sigma}}\,di + \int_0^{N_f} x_f(j)^{\frac{\sigma-1}{\sigma}}\,dj\right)^{\frac{\sigma}{\sigma-1}\gamma} \\ &\quad - \int_0^{N_h} p_h x_h(i)\,di - \int_0^{N_f} p_f x_f(j)\,dj \end{aligned} \tag{3}$$

The profit-maximizing quantities of $x_h(i)$ and $x(j)$ can be written as

$$x_h(i) = p_h(i)^{-\sigma} P^{\sigma-\frac{1}{1-\gamma}} \quad \text{and } x_f(j) = p_f(j)^{-\sigma} P^{\sigma-\frac{1}{1-\gamma}} \tag{4}$$

where $P = \left(\int_0^{N_h} p_h(i)^{1-\sigma}\,di + \int_0^{N_f} p_f(j)^{1-\sigma}\,dj\right)^{\frac{1}{1-\sigma}}$ is the price index.[9] It can be shown that the representative household's utility can be expressed as

$$U = I + \frac{1-\gamma}{\gamma}P^{-\frac{\gamma}{1-\gamma}} = W + \Pi + T + \frac{1-\gamma}{\gamma}P^{-\frac{\gamma}{1-\gamma}} \tag{5}$$

where W is the household's wage income, Π is dividend income from firms belonging to the household and T is a lump-sum transfer from the government financed by source-based business taxes.

2.2 Firms

The numéraire good y is produced by firms in both countries with constant returns to scale technology under perfect competition. Labor productivity in this sector is identical in both countries. The numéraire good y can be freely traded across borders which effectively equalizes wages in both countries.

Upon entering the market, each home firm draws a productivity level, given

[9] Note that, due to the quasi-linearity of the utility function, the utility-maximizing quantities do not depend on the income level. Of course, this is different in a world without a numéraire good, which will be discussed in section 3.

by $1/a(i)$, where $a(i)$ is the amount of labor the firm i needs to produce a unit of $x(i)$ (cf. Helpman et al., 2004). Firms differ in $a(i)$. For simplicity, assume that a is uniformly distributed over the intervall $[a^-, a^+]$ and that a increases in the index i. Similarly, each foreign firm draws a productivity level $a(j)$. For simplicity, I assume that the distributions of $a(i)$ and $a(j)$ are independent of each other and that $\partial a(i)/\partial i = 1$ and $\partial a(j)/\partial j = 1$.

In principle, all firms in the differentiated goods sector are allowed to serve both markets. Since both markets are perfectly separated and the paper's focus is on optimal repatriation taxation by the home country government, I will focus on the foreign market in what follows.

Home country firms either export their goods to the foreign market (export regime, denoted by subscript E) or invest in own production facilities in the foreign country (FDI regime, denoted by subscript I). In the export regime, the goods are produced in the home country and sold in the foreign country. Production requires a fixed cost of F_E units of labor input. Variable costs are the wage rate w (the index of which has been omitted since wage rates are identical in both locations) grossed up by the transport cost $\tau > 1$. After-tax profits are then given by

$$\pi_E(i) = [(p(i) - a(i)\tau w)\, x(i) - wF_E](1 - t_h) \tag{6}$$

where t_h is the corporate tax rate in the home country.

The individual firm chooses $x(i)$ given the choices of all other firms in the economy. It also assumes that its choice has no impact on the price index P_f. Then, profit-maximizing production choices under the export regime yield a price of

$$p_E(i) = \frac{\sigma}{\sigma - 1} a(i)\tau w \tag{7}$$

If the firm decides to invest in foreign production facilities, production is shifted to the foreign country. However, a fraction $\theta_I \in [0, 1]$ of production remains at the headquarter (think of management or technology services; Grossman & Rossi-Hansberg, 2008, use the term "tasks" that can be allocated across locations within the firm). For accounting and tax purposes, the foreign affiliate has to purchase the part of the goods produced in the home country from the home country headquarter at a price of δ. Shifting production abroad may lower the variable pro-

duction cost, since there is a transport cost related to exporting. However, foreign direct investment involves a higher fixed cost of production, $F_I > F_E$. After-tax profits are given by

$$\begin{aligned}\pi_I(i) &= \theta_I a(i)(\delta - \tau w)x(i)(1-t_h) \\ &\quad + [(p(i) - a(i)[(1-\theta_I)w + \theta_I\delta])x(i) - wF_I](1-t_e) \end{aligned} \tag{8}$$

where t_e is the effective tax rate on foreign income equal to $t_e = t_f + t_r(1-t_f)$ and t_r is the statutory tax rate on repatriated foreign profits. The profit maximizing price under the FDI regime is given by

$$p_I(i) = \frac{\sigma}{\sigma-1}a(i)\left[(1-\theta_I)w + \theta_I\tau w + \theta_I(\delta - \tau w)\frac{t_h - t_e}{1-t_e}\right] \tag{9}$$

If the transfer price exactly reflects the cost of the headquarter input, $\delta = \tau w$, the price p_I does not depend on tax rate differentials between t_h and t_e.[10] The reason is that, at $\delta = \tau w$, there is no taxable profit at the headquarter location. Since variable costs are deductible at the foreign affiliate and marginal profits are zero, the effective tax on foreign profits, t_e, does not play a role either. However, if $\delta > \tau w$, part of the foreign profit is shifted to the home country headquarter via intra-firm trade. If the effective tax on headquarter income is higher than on affiliate income, $t_h > t_e$, this drives up the variable cost and, thus, the profit-maximizing price. Put differently, an increase in the repatriation tax t_r reduces the price: $\frac{\partial p_I(i)}{\partial t_r} = -\frac{\sigma}{\sigma-1}a(i)\theta_I(\delta - \tau w)\frac{1-t_h}{(1-t_f)(1-t_r)^2}$. In the following, I will allow for cases in which $\delta \neq \tau w$ and consider $\delta = \tau w$ as a special case.

Finally, foreign firms have an after-tax profit of

$$\pi_f(j) = (1-t_f)[(p_f(j) - a(j)w)x_f(j) - wF_f] \tag{10}$$

and charge profit maximizing prices of

$$p_f(j) = \frac{\sigma}{\sigma-1}a(j)w \tag{11}$$

[10] Of course, the same is true if $\theta_I = 0$, i.e. all production takes place at the foreign affiliate and no intra-firm trade occurs.

2.3 Equilibrium

The focus of this paper is on the welfare and efficiency properties of repatriation taxation. I therefore take the tax rates t_h and t_f as given.[11] Consider the following three decision stages. In the first stage, the home country sets the tax rate t_r on repatriated foreign income. In the second stage, all firms choose whether or not to produce and the home country firms choose between the export and the FDI regime. In the third stage, all producing firms and the representative households choose their quantities.

The decisions in the third stage are implicitly determined by equations (7), (9) and (11). The second stage decisions are characterized by three equations which define different margins. At the first two margins, the marginal home and foreign firms make zero profits. Firms with a labor productivity below $1/a_f^c$ and $1/a_h^c$, respectively, do not have an incentive to enter the market, where a_h^c and a_f^c are defined by $\pi_h(N_h) = 0$ and $\pi_f(N_f) = 0$ and N_h and N_f denote the indices of the marginal home country and foreign firms, respectively. At the third margin, the marginal firm is indifferent between exporting and FDI. The threshold level a_I^c is defined by $\pi_E(n^c) = \pi_I(n^c)$ where n^c is the index of the marginal firm and

$$\pi_E(n^c) = (1-t_h)\left(\frac{1}{\sigma}p_E(n^c)^{1-\sigma}P_f^{\sigma-\frac{1}{1-\gamma}} - wF_E\right) \tag{12}$$

$$\pi_I(n^c) = (1-t_e)\left(\frac{1}{\sigma}p_I(n^c)^{1-\sigma}P_f^{\sigma-\frac{1}{1-\gamma}} - wF_I\right) \tag{13}$$

Before I analyze the welfare implications of home country tax policy in the next subsection, it is worth briefly discussing some specific features of the model outlined above. Firstly, only the more productive firms, i.e. firms with a labor productivity above $1/a_I^c$ choose the FDI regime if $p_I(n^c) < \left(\frac{1-t_e}{1-t_h}\right)^{\frac{1}{\sigma-1}} p_E(n^c)$ which is demonstrated in the appendix. I only consider cases in which this condition

[11] This assumption is in line with the standard literature. However, as demonstrated in Devereux (2000), it is of crucial importance. If tax revenue from foreign income can be used to reduce domestic taxes (or increase public goods provision), levying taxes on repatriated dividends may yield efficiency gains. In this setting, the government faces a Ramsey style problem of optimal taxation where optimal tax rates reflect locational elasticities. It should be noted, though, that apart from extreme situations exemption of foreign income is not a likely outcome if domestic taxes are endogenized.

holds. The price level on the foreign market is then given by $P_f = (\int_0^{n^c} p_I(i)^{1-\sigma} di + \int_{n^c}^{N_h} p_E(i)^{1-\sigma} di + \int_0^{N_f} p_f(j)^{1-\sigma} dj)^{\frac{1}{1-\sigma}}$. Secondly, FDI increases output as long as $p_I(i) < p_E(i)$. Thirdly, FDI may cause domestic activity to rise. Here, domestic activity - measured in labor input - does not decline if $\theta_I a_I^c x_I(n^c) \geq a_I^c x_E(n^c) + F_E$. Note that, without intra-firm trade ($\theta_I = 0$), domestic activity would always decline in response to foreign investment which is why the model part adopted from Grossman & Rossi-Hansberg (2008) is needed.

All these features are backed by empirical evidence. As indicated in the introduction, some authors presume that this changes the conditions for optimal tax policy substantially. This is to be examined in the next section.

2.4 Welfare

In line with the literature, I assume that the home country government maximizes the representative consumer's utility U_h which is the sum of wage income, firm profits, tax revenue and consumer surplus in the differentiated goods sector. This implies that the government has two kinds of incentive to levy a tax, i.e. to redistribute funds from the private to the public sector. Firstly, it may want to change the firms' or households' decisions for allocative efficiency reasons. Secondly, it may want to extract rents from foreigners. Since the focus of this paper is on the optimal choice of the repatriation tax levied by the home country which only concerns home country firms, it is possible to abstract from the second incentive to levy taxes by assuming that tax rates t_h and t_f are given (which is also in line with the literature, see Richman, 1963, and the subsequent contributions cited above).[12]

Due to the quasi-linearity of the utility function, the household's wage income and consumer surplus in the home country are not affected by variations in t_r.[13]

[12] Another option would be to assume that the households have a preference for a publicly provided good. However, such an analysis would also require to endogenize the tax rates t_h and t_r.

[13] Actually, Desai (2009) claims that a tax on foreign profits reduces competition in the home country market ("*Overall welfare is reduced at home given the lowered competition amongst firms*", p. 11). This may be true if foreign investment lowers variable cost associated with home country production, e.g. due to higher r&d activity. These effects would require another model, though, and are therefore neglected in the following.

Firm profits can be expressed as

$$\begin{aligned}\Pi_h &= (1-t_e)\int_0^{n^c}\left[\frac{1}{\sigma}p_I(i)^{1-\sigma}P_f^{\sigma-\frac{1}{1-\gamma}}-wF_I\right]di \\ &\quad +(1-t_h)\int_{n^c}^{N}\left[\frac{1}{\sigma}p_E(i)^{1-\sigma}P_f^{\sigma-\frac{1}{1-\gamma}}-wF_E\right]di \end{aligned} \tag{14}$$

and tax revenue as

$$\begin{aligned}T_h &= t_r(1-t_f)\int_0^{n^c}\left[\frac{1}{\sigma}P_f^{\sigma-\frac{1}{1-\gamma}}p_I(i)^{1-\sigma}-wF_I\right]di \\ &\quad +\theta_I(\delta-\tau w_h)\frac{t_h-t_r}{1-t_r}\int_0^{n^c}a(i)\,p_I(i)^{-\sigma}P_f^{\sigma-\frac{1}{1-\gamma}}di \\ &\quad +t_h\int_{n^c}^{N}\left[\frac{1}{\sigma}P_f^{\sigma-\frac{1}{1-\gamma}}p_E(i)^{1-\sigma}-wF_E\right]di \end{aligned} \tag{15}$$

To start I assume that the home country government takes the foreign price level as given. This assumption will be relaxed in subsection 2.6. The tax rate on foreign profits, t_r, is optimally chosen if $\frac{\partial U_h}{\partial t_r}=0$ with

$$\begin{aligned}\frac{\partial U_h}{\partial t_r} &= -\sigma\theta_I(\delta-\tau w_h)\frac{t_h-t_r}{1-t_r}P_f^{\sigma-\frac{1}{1-\gamma}}\int_0^{n^c}a(i)\,p_I(i)^{-\sigma-1}\frac{\partial p_I(i)}{\partial t_r}di \\ &\quad +\left[\frac{t_r}{1-t_r}\pi_I(n^c)-\frac{t_h}{1-t_h}\pi_E(n^c)+\theta_I(\delta-\tau w_h)\frac{t_h-t_r}{1-t_r}a_I^c p_I(n^c)^{-\sigma}P_f^{\sigma-\frac{1}{1-\gamma}}\right]\frac{\partial n^c}{\partial t_r}\end{aligned} \tag{16}$$

which equals zero at $t_r=t_h$. It can be shown that $\frac{\partial^2 U_h}{\partial t_r^2}<0$.[14] Thus, the optimal tax system implies full taxation of foreign profits after deducting foreign tax payments. This is the standard results firstly derived by Peggy Musgrave in 1963. The novel result here is that even though the foreign investment generates income and tax revenue in the home country, the home country government has an incentive to fully tax foreign income after deducting foreign tax payments. Note that this is even true if the home country tax revenue of the marginal firm is larger under the FDI regime than under the export regime. Higher domestic tax revenue

[14] A formal derivation is available upon request.

(at $t_r = 0$) implies that the foreign part of the firm's tax base is negative.[15] Using $\pi_E(n^c) = \pi_I(n^c)$, the above equation can be expressed as

$$\begin{aligned}\frac{\partial U_h}{\partial t_r} &= -\sigma\theta_I(\delta - \tau w_h)\frac{t_h - t_r}{1 - t_r}P_f^{\sigma-\frac{1}{1-\gamma}}\int_0^{n^c} a(i)\, p_I(i)^{-\sigma-1}\frac{\partial p_I(i)}{\partial t_r}di \\ &\quad -\frac{t_h - t_r}{(1-t_r)(1-t_h)}\left[\pi_I(n^c) - (1-t_h)\theta_I(\delta - \tau w_h)a_I^c x_I(n^c)\right]\frac{\partial n^c}{\partial t_r} \quad (17)\end{aligned}$$

where the term in square brackets is the foreign part of the tax base. If it is negative, the appendix shows that $\frac{\partial n^c}{\partial t_r} > 0$. Thus, at $t_r = 0$, $\frac{\partial U_h}{\partial t_r} > 0$.

I can therefore state

Proposition 1 *If the home country government does not take into account the effects of its tax policy on the price level, the optimal tax on foreign profits is $t_r = t_h$ (full taxation after deduction).*

What is the intuition behind the above proposition? If, at $t_r = 0$, tax revenue in the home country are lower if the firm chooses FDI (as in the Musgrave model), the government has an incentive to increase t_r to force the marginal firm back into the export regime. In contrast, if tax revenue is larger than under the export regime (as suggested by recent empirical evidence), the government has an incentive to subsidize FDI which can be achieved by increasing t_r (recall that the foreign part of the tax base is then negative). Finally, if tax revenues from the marginal firm are equal under both regimes, the foreign part of the tax base is zero. Any tax rate is optimal and increasing t_r does not harm the firm or the economy. Thus, in all these cases the government has an incentive to increase t_r until $t_r = t_h$. Then, private and social interests are aligned.

The result in Proposition 1 is diametrically opposed to the views expressed by the exemption proponents. From my point of view, there are two potential sources of misunderstanding, i.e. reasons which have led to the mistaken presumption that exemption is the optimal answer to a situation in which domestic activity by heterogeneous firms increases in response to foreign investment. The first concerns

[15] To be precise, the tax base under the FDI regime is larger if $\theta_I a_I^c(\delta - \tau w)\, p_I(n^c)^{-\sigma} P^{\sigma-\frac{1}{1-\gamma}} > \frac{1}{\sigma} p_E(n^c)^{1-\sigma} P^{\sigma-\frac{1}{1-\gamma}} - wF_E$. With $\pi_E(n^c) = \pi_I(n^c)$ it follows that the foreign part of the firm's tax base has to be negative for the above condition to be satisfied.

the investment behaviour by firms. It seems that some of the commentators treat the domestic income increase as an external effect of foreign investment which the firm does not account for in its investment decision. However, as long as there no grave principal-agent issues within the firm, the firm will account for it and invest until the sum of the returns in both locations equals the cost of production. The second source of misunderstanding might be identified in the differentiation of marginal from intra-marginal firms. Seemingly, some commentators have firms in mind which generate positive income abroad *and* at home. However, such a firm is not at the margin, i.e. will not react to small changes in the tax environment. The model shows that marginal firms have either positive income at home or abroad, but not both.

2.5 Optimal repatriation taxes when exporting is prohibitively expensive

In the model outlined above, the tax on foreign profits mainly affects the margin where firms choose between exporting and FDI. There may be cases, however, in which exporting is no option for servicing the foreign market. For instance, if transport costs are very high, exporting may be prohibitively expensive. In this case, firms either invest in foreign production facilities or do not supply at all. In fact, one might argue that this is the case in which the arguments in favor of exemption (presented in the introduction) actually apply.

In equilibrium, there are two types of firms, home country firms under the FDI regime and foreign firms, which charge prices of (9) and (11), respectively. Furthermore, the equilibrium is characterized by two margins defined by $\pi_I(n^c) = 0$ and $\pi(N_f) = 0$.

The sum of firm profits and tax revenue is then given by

$$\begin{aligned} \Pi_h + T_h &= (1-t_f)\int_0^{n^c}\left[\frac{1}{\sigma}p_I(i)^{1-\sigma}P_f^{\sigma-\frac{1}{1-\gamma}} - wF_I\right]di \\ &\quad +\theta_I(\delta-\tau w_h)\frac{t_h-t_r}{1-t_r}\int_0^{n^c} ap_I(i)^{-\sigma}P_f^{\sigma-\frac{1}{1-\gamma}}di \end{aligned} \tag{18}$$

Again, home country wage income and consumer surplus are not affected. The

effect of a marginal increase in t_r on the sum of Π and T is given by

$$\begin{aligned}\frac{\partial U_h}{\partial t_r} &= -\sigma\theta_I(\delta-\tau w)\frac{t_h-t_r}{1-t_r}P_f^{\sigma-\frac{1}{1-\gamma}}\int_0^{n^c}a(i)\,p_I(i)^{-\sigma-1}\frac{\partial p_I(i)}{\partial t_r}di \\ &\quad +t_r(1-t_f)\left[\frac{1}{\sigma}p_I(n^c)^{1-\sigma}P_f^{\sigma-\frac{1}{1-\gamma}}-wF_I\right]\frac{\partial n^c}{\partial t_r} \\ &\quad +\theta_I(\delta-\tau w)\frac{t_h-t_r}{1-t_r}a_I^c p_I(n^c)^{-\sigma}P_f^{\sigma-\frac{1}{1-\gamma}}\frac{\partial n^c}{\partial t_r}=0 \qquad (19)\end{aligned}$$

With $\pi_I(n^c)=0$, the above expression becomes zero if, again, $t_r=t_h$. It can be shown that $\frac{\partial^2 U_h}{\partial t_r^2}<0$. I may thus state

Proposition 2 *If exporting is prohibitively expensive and the only way to serve the foreign market is under the FDI regime, the optimal tax system is full taxation after deduction of foreign tax payments ($t_r=t_h$).*

What is the intuition behind this result? Since $\pi_I(n^c)=0$, a positive home country tax base requires a negative foreign part of the firm's tax base. Therefore, an increase in t_r increases FDI. The fiscal cost of subsidizing FDI equals the return, i.e. higher home country tax revenue, if $t_r=t_h$. If there is no positive tax revenue in the home country, e.g. because $\delta=\tau w$, the tax on foreign income is irrelevant because the foreign tax base is zero as well. A tax rate $t_r>0$ reduces the income of the intra-marginal firms, but this has no welfare effect because the firms are owned by the representative household who also receives the tax revenue as a lump-sum transfer.

2.6 Optimal repatriation taxes when home country taxes affect the foreign price level

So far I assumed that the home country government neglects that its tax policy affects the consumer price level in the foreign country. However, the government may take into account that an increase in FDI and a resulting drop in the foreign price level deteriorates the profits of other firms supplying in this market. This introduces a strategic aspect into the analysis which has, in the context of the model, two dimensions. Firstly, since an increase in home country firms' quantities

reduces the market shares of foreign firms, tax policy might be used to extract rents from foreign monopolists, like in Brander & Spencer (1985) and Eaton & Grossman (1986). Secondly, accounting for the price level widens the perspective to the aggregate level. As mentioned above, empirical analysis finds that, whereas foreign investment is associated with increased domestic investment within the firm (Desai, Foley & Hines, 2005), on the aggregate level, an increase in foreign investment crowds out domestic investment nearly dollar for dollar (Feldstein, 1995). Policy-makers might have the incentive to account for this effect on other domestic firms when deciding on tax policy strategies.

How does optimal tax policy look like when the government takes into account price level effects of its tax revenue? The effect of a small increase in t_r on the price level in the foreign country is given by

$$\begin{aligned}\frac{dP_f}{dt_r} &= P_f^{\sigma}\int_0^{n^c} p_I(i)^{-\sigma}\frac{\partial p_I(i)}{\partial t_r}di + \frac{P_f^{\sigma}}{1-\sigma}\left(p_I(n^c)^{1-\sigma} - p_E(n^c)^{1-\sigma}\right)\frac{dn^c}{dt_r} \\ &\quad + \frac{P_f^{\sigma}}{1-\sigma}p_E(N_h)^{1-\sigma}\frac{dN_h}{dt_r} + \frac{P_f^{\sigma}}{1-\sigma}p_f(N_f)^{1-\sigma}\frac{dN_f}{dt_r} \qquad (20)\end{aligned}$$

The first term on the right hand side captures the direct effect of t_r on prices $p_I(i)$. The second term represents the price level effect of a tax induced change at the export-FDI-margin. The third and fourth terms are the changes at the market entry margin of home and foreign firms, respectively.

The appendix demonstrates that $\frac{dP_f}{dt_r}$ is ambiguous. This is because two countervailing effects are at work. Given that an increase in t_r reduces FDI and $p_E(n^c) > p_I(n^c)$, this has - *ceteris paribus* - a positive effect on the price level. However, an increase in t_r also reduces the prices of all intra-marginal firms under the FDI regime (as long as $\delta > \tau w$). This has - *ceteris paribus* - a negative effect on the price level. It can be shown that for small δ approaching the headquarter variable cost τw, the effect of a tax increase is positive: $\frac{dP_f}{dt_r} > 0$.

Accounting for price level effects of taxation, the first-order condition in (16)

reads

$$\begin{aligned}\frac{\partial U_h}{\partial t_r} &= -\sigma\theta_I\left(\delta-\tau w_h\right)\frac{t_h-t_r}{1-t_r}P_f^{\sigma-\frac{1}{1-\gamma}}\int_0^{n^c}a\left(i\right)p_I\left(i\right)^{-\sigma-1}\frac{\partial p_I\left(i\right)}{\partial t_r}di \\ &+\left[\frac{t_r}{1-t_r}\pi_I\left(n^c\right)-\frac{t_h}{1-t_h}\pi_E\left(n^c\right)+\theta_I\left(\delta-\tau w_h\right)\frac{t_h-t_r}{1-t_r}a_I^c p_I\left(n^c\right)^{-\sigma}P_f^{\sigma-\frac{1}{1-\gamma}}\right]\frac{\partial n^c}{\partial t_r} \\ &+\frac{\partial\left(\Pi+T\right)}{\partial P_f}\frac{\partial P_f}{\partial t_r} \qquad (21)\end{aligned}$$

With $\frac{\partial(\Pi+T)}{\partial P_f}>0$, it follows that, for $t_r=t_h$, an increase in t_r still increases welfare if $\frac{\partial P_f}{\partial t_r}>0$ and vice versa. I can therefore state

Proposition 3 *If an increase in t_r increases the price level P_f, $\frac{\partial P_f}{\partial t_r}>0$, the optimal tax rate on foreign profits t_r exceeds the tax rate under full taxation after deduction, i.e. $t_r>t_h$.*

What is the intuition behind this effect? An increase in t_r reduces the number of firms under the FDI regime. The marginal firm is just indifferent between FDI and exporting. However, all firms profit from an increase in the price level. As a consequence, the sum of firm profits and tax revenue increases. Seen from a different perspective, the tax internalizes an external effect which the firm investing in FDI does not take into account. By having lower variable cost, the price level is reduced which then translates into lower profits for all other firms. Forcing the firm back into exporting thus corrects for this (from a national perspective) inefficiently high level of FDI.

The results for the case in which exporting is prohibitively expensive are similar. An increase in t_r reduces all prices and therefore decreases the price level. The effects on the marginal firm are therefore ambiguous: its own profits under FDI are increased for a given price level, but the price level itself is larger and, therefore, profits are - ceteris paribus - lower. An important difference is, though, that if $\delta=\tau w$ the tax rate t_r does not affect neither n^c nor P_f. The reason is that $\pi\left(n^c\right)=0$ and $\partial p_I\left(i\right)/\partial t_r=0$ in this case.

2.7 Global optimality

By assumption, the nationally optimal tax policy by the home country does not take into account the foreign household's utility U_f. Again, it is worthwhile to recall that, in the Musgrave model, the nationally optimal tax policy (full taxation after deduction) implies inefficiently high tax rates from a global point of view. The reason is that the home government considers foreign taxes as costs although, from a global viewpoint, taxes are just funds redistributed from the private to the public sector. What are the efficiency features of nationally optimal tax policy in our model?

Global welfare is simply the sum of home country and foreign welfare. The latter is given by $U_f = W_f + \Pi_f + T_f + \frac{1-\gamma}{\gamma} P_f^{-\frac{\gamma}{1-\gamma}}$ where $\frac{1-\gamma}{\gamma} P_f^{-\frac{\gamma}{1-\gamma}}$ is consumer surplus. Foreign profits Π_f are given by

$$\Pi_f = (1-t_f) \int_0^{N_f} \left[\frac{1}{\sigma} p_f(j)^{1-\sigma} P_f^{\sigma-\frac{1}{1-\gamma}} - wF_f \right] dj \tag{22}$$

and foreign tax revenue by

$$\begin{aligned} T_f &= t_f \int_0^{n^c} \left(\frac{1}{\sigma} P_f^{\sigma-\frac{1}{1-\gamma}} p(i)^{1-\sigma} - wF_I \right) di + t_f \int_0^{N_f} \left(\frac{1}{\sigma} P_f^{\sigma-\frac{1}{1-\gamma}} p_f(j)^{1-\sigma} - wF_f \right) dj \\ &\quad -\theta_I (\delta - \tau w_h) t_f \frac{1-t_h}{1-t_e} P_f^{\sigma-\frac{1}{1-\gamma}} \int_0^{n^c} a(i) p_I(i)^{-\sigma} di \end{aligned} \tag{23}$$

The question arises how t_r affects the foreign household's utility. Global welfare W_g can be expressed as

$$\begin{aligned} W_g &= \left(\frac{1}{\sigma} + \frac{1-\gamma}{\gamma} \right) P_f^{-\frac{\gamma}{1-\gamma}} - \int_0^{n^c} wF_I di - \int_{n^c}^{N_h} wF_E di - \int_0^{N_f} wF_f dj \\ &\quad +\theta_I (\delta - \tau w_h) \left(\frac{t_h - t_e}{1-t_e} \right) \int_0^{n^c} a(i) p_I(i)^{-\sigma} P_f^{\sigma-\frac{1}{1-\gamma}} di \end{aligned} \tag{24}$$

I can state

Proposition 4 *If $\frac{\partial P_f}{\partial t_r} > 0$, a reduction of t_r starting from $t_r = t_h$ unambiguously increases global welfare. The optimal tax system implies $t_e < t_h$.*

Proof. See appendix. ■

The intuition behind this proposition is the following. An increase in t_r if optimally chosen by the home country government does not affect home country welfare. From the viewpoint of the foreign country, it increases the price level, reduces the number of home country firms in the foreign country and increases entry of foreign firms into the market. It can be shown that, firstly, an increasing price level reduces consumer surplus more than it increases firm profits and tax revenue and, secondly, that the loss in welfare due to a reduction of home country firms' FDI dominates the welfare gain due to increased market entry.

The above proposition has three important implications. Firstly, the tax credit system is not a globally optimal tax policy choice. Secondly, it cannot be excluded that the exemption system is globally optimal. At $t_e = t_h$, (credit system), it is still desirable to reduce the tax in order to increase consumer surplus. Thirdly, since the tax credit system replicates the allocation, prices and quantities in the absence of taxes, the above proposition implies that a globally optimal tax system with $t_e < t_h$ attains a higher global welfare level than in the absence of taxation. The reason is that the market is characterized by imperfect competition. There is too little FDI in the absence of taxation since firms do not account for the resulting decrease in consumer prices.

3 Extensions and discussion

In this section, I discuss some crucial issues related to the model presented above and compare the model results to those in the standard literature. Crucial modelling issues concern the transfer price δ (3.1), implications for the labor market (3.2) and modelling choices with respect to taxation (3.3). Linkages to the existing literature are discussed in section 3.4.

The choice of the transfer price δ: So far, the transfer price δ has been treated as an exogenous variable. This may be questioned for two reasons. Firstly, it is often assumed in the literature that firms have some discretion in manipulating transfer prices for tax saving purposes. Firms would have an incentive to charge the lowest possible transfer prices as long as $t_e < t_h$. A natural lower bound of transfer prices might be the variable headquarter cost τw_h. However, at $t_e > t_h$,

this behaviour is reversed. While endogenizing the transfer price is clearly beyond the scope of this paper, it should be noted that the results do not crucially depend on the actual level of δ. Secondly, in bilateral tax agreements, national governments often agree on some system of transfer price rules that effectively split the tax base according to some notion of fairness. It is an interesting question how transfer pricing rules can be used to align the incentives for the two national governments involved given the investment behaviour of multinational firms. This is, however, beyond the scope of this paper.

Labor market effects: In the model presented above, it is possible to abstract from labor market effects of tax policy choices due to the assumptions of a quasi-linear utility function and the existence of a numéraire good. Assuming quasi-linearity of the utility function greatly simplifies the analysis but, of course, also restricts the model results in their generality. Without a numéraire good which enters linearly into the utility function, wages would adjust to tax rate changes. Similarly, the labor market would play an important role if labor was not mobile across the x and the y sector, if unions increase the wage in the x sector or if labor is taxed differently across sectors. While the precise welfare effects of labor market adjustments due to taxation crucially depends on how the labor market and its frictions are modelled, it is nevertheless possible to give an intuition what the effects look like.

Consider therefore the tax effects on labor demand in the home country. Let L_{Xh} denote the labor input in the differentiated goods sector in the home country given by

$$L_{Xh} = \int_0^{n^c} \theta_I x_I(i)\, di + \int_{n^c}^{N_h} x_E(i)\, di \tag{25}$$

A small increase in t_r has the following effect on labor input

$$\frac{\partial L_{Xh}}{\partial t_r} = \int_0^{n^c} \theta_I \frac{\partial x_I(i)}{\partial t_r} di + \int_{n^c}^{N} \frac{\partial x_E(i)}{\partial t_r} di + (\theta_I x_I(n^c) - x_E(n^c)) \frac{\partial n^c}{\partial t_r} + x_E(N_h) \frac{\partial N_h}{\partial t_r} \tag{26}$$

It follows from (4) and $x_E(N_h) = 0$ that $\frac{\partial x_I(i)}{\partial t_r}, \frac{\partial x_E(i)}{\partial t_r}, \frac{\partial N_h}{\partial t_r}$ depend on $\frac{\partial P_f}{\partial t_r} \lesseqgtr 0$. Furthermore, it is a priori possible that the marginal firm extends its home country activity in response to foreign investment: $\theta_I x_I(n^c) > x_E(n^c)$. Thus, the overall

effect of an increase in t_r on labor demand is ambiguous. Endogenous wages might therefore serve as an argument in favor of and against levying positive taxes on foreign profits. However, it seems that the arguments against taxing foreign income are not based on subtle general equilibrium wage effects which suggests sticking to the simpler model version with a numéraire good.

Modelling taxes: A third issue worth discussing is the choice of how to model taxes in a trade model with heterogeneous firms and monopolistic competition and the question of deductibility. In line with the literature on heterogeneous multinational firms, see e.g. Melitz (2003), I assumed that variable costs are labor costs and thus deductible. With certain transfer prices, $\delta = \tau w$, corporate taxes do not distort the profit-maximizing quantity choices. They only distort the choice between the export and the FDI regime. This would be different, if it was assumed that (part of) the variable cost is capital expenditures. Then, an increase in the repatriation tax t_r would - ceteris paribus - increase the variable cost of all intra-marginal firms which would give rise to new complexities. For instance, market entry of marginal exporting firms would have a positive welfare effect.

It is therefore important to note that the above derived results refers to repatriation taxes on foreign profits and not on foreign production inputs. I leave the integration of input taxes and the resulting complexities to further research.

Links to the literature: The results derived above show that some of the classical results in the tradition of Peggy Musgrave remain robust against the introduction of firm heterogeneity, imperfect competition and intra-firm trade. They are not a trivial replication of the standard theory, though. It is worth discussing what the framework presented here has in common with the classical one and where are the crucial differences.

The most important difference concerns the question how domestic and foreign activity are related. In the Musgrave framework, savings are distributed across locations. A dollar invested abroad cannot be invested at home - investment projects in both locations are therefore substitutes. In contrast, in the above presented framework an increase in activity abroad (FDI) does not necessarily reduce activity at home. One of the main insights of this paper is, that the

desirability of taxing foreign income does not depend on the effects of foreign activity on domestic activity (e.g. measured by tax revenue).

Moreover, capital productivity in the Musgrave framework entirely depends on the location. A dollar of additional investment reduces the marginal productivity of capital in a given location and vice versa. In the framework presented here productivity is firm-specific. Furthermore, the Musgrave model assumes homogeneous firms whereas the framework considered here explicitly allows for firm heterogenity. This allows determining endogenously which firms produce, which ones export and which ones invest in foreign production facilities. Finally, this paper explicitly allows for imperfect competition. This difference to the classical framework is important because a tax on foreign profits is sometimes interpreted in the context of strategic trade policy since, under imperfect competition, national firms may extract rents from foreign markets and thus hurt their competitors.[16] As this paper demonstrates, a tax on foreign profits is nevertheless optimal. Imperfect competition is also the reason that the global optimality of the tax credit system does not hold anymore. As it is shown above, proponents of the exemption system should argue more with the notion of global optimality than with the national interest.

4 Conclusion

One of the recently promoted arguments in favor of the exemption system goes as follows: If foreign investment does not affect or even fosters domestic activity, taxing foreign income is no longer desirable. In this paper, I build a model with heterogeneous firms and intra-firm trade and derive the choice of the optimal tax rate on foreign profits. It turns out that, even though foreign investment may be associated with increased domestic investment and higher domestic tax revenues, the optimal tax system implies full taxation of foreign income after deducting foreign tax payments. Thus, exemption is not an optimal choice from the national point of view. The standard view on foreign profit taxation prevails. However, the globally optimal tax rate is lower than the one chosen under a tax credit system (which has been considered globally optimal in the standard model). This may

[16] In the context of monopolistic competition, negative external effects of increasing quantities on other firms' profit levels occur because the price level is affected.

imply, under certain circumstances, that exemption is optimal from a global point of view.

Of course, the model results should be seen in the light of the many restrictions due to the specificity of the model assumption. As the literature cited in the introduction shows, a change in assumption is likely to translate into a change in the recommendation for optimal tax policy. In fact, policy-makers are aware of this conditionality; for instance, a US Treasury report states that "*[n]one of the proposed standards [of international taxation] fits all cases and tax policy cannot feasibly be calibrated to have different rules for different cases*" (United States Department of the Treasury, Office of Tax Policy, 2007).[17] It should therefore be recalled that the purpose of this paper is to analyze specific arguments based on the empirical finding that foreign investment need not be associated with reduced domestic activity. The paper's aim is to check whether tax exemption is an optimal tax policy response in this economic environment. It turns out that in such a situation exempting foreign income from tax is not an optimal strategy although there may be other good arguments in favor of doing so.

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Appendix

Appendix 1: Productive firms choose FDI

This appendix derives the conditions under which the more productive firms choose the FDI regime and the less productive firms prefer exporting. A firm is indifferent between exporting and FDI at $\pi_E(n^c) - \pi_I(n^c) = 0$. With $\frac{\partial p_E(i)}{\partial a(i)} = \frac{p_E(i)}{a(i)}$ and $\frac{\partial p_I(i)}{\partial a(i)} = \frac{p_I(i)}{a(i)}$, an increase in n^c has the following impact

$$\frac{\partial\left[\pi_E(n^c) - \pi_I(n^c)\right]}{\partial n^c} = \frac{\sigma-1}{\sigma} P_f^{\sigma-\frac{1}{1-\gamma}} \frac{1}{a_I^c}\left[(1-t_e)\, p_I(n^c)^{1-\sigma} - (1-t_h)\, p_E(n^c)^{1-\sigma}\right]$$

It follows that the above expression is positive, i.e. the more productive firms choose FDI, if

$$p_I(n^c) < \left(\frac{1-t_h}{1-t_e}\right)^{\frac{1}{1-\sigma}} p_E(n^c)$$

What is the effect of a small increase in t_r on the export-FDI-margin, i.e. on n^c? Differentiating $\pi_E(n^c) - \pi_I(n^c) = 0$ with respect to n^c and t_r, gives $dn^c/dt_r = -\frac{\partial[\pi_E(n^c)-\pi_I(n^c)]}{\partial t_r} / \frac{\partial[\pi_E(n^c)-\pi_I(n^c)]}{\partial n^c}$ where $\frac{\partial[\pi_E(n^c)-\pi_I(n^c)]}{\partial n^c} > 0$ is derived above. $\frac{\partial[\pi_E(n^c)-\pi_I(n^c)]}{\partial(1-t_r)}$ is given by

$$\frac{\partial\left[\pi_E(n^c) - \pi_I(n^c)\right]}{\partial t_r} = \frac{\pi_I(n^c)}{1-t_r} + (1-t_e)\frac{\sigma-1}{\sigma} P_f^{\sigma-\frac{1}{1-\gamma}} p_I(n^c)^{-\sigma} \frac{\partial p_I(i)}{\partial t_r}$$

It follows that $\frac{dn^c}{dt_r} = -\frac{\partial[\pi_E(n^c)-\pi_I(n^c)]}{\partial t_r} / \frac{\partial[\pi_E(n^c)-\pi_I(n^c)]}{\partial n^c}$ is negative if $\frac{\partial[\pi_E(n^c)-\pi_I(n^c)]}{\partial t_r} > 0$ which is the case if

$$\begin{aligned}\frac{\partial\left[\pi_E(n^c) - \pi_I(n^c)\right]}{\partial t_r} &= (1-t_f)\left[\frac{1}{\sigma} P_f^{\sigma-\frac{1}{1-\gamma}} p_I(n^c)^{1-\sigma} - wF_I\right] \\ &\quad -a_I^c\theta_I(\delta - \tau w)\frac{1-t_h}{1-t_r} P_f^{\sigma-\frac{1}{1-\gamma}} p_I(n^c)^{-\sigma}\end{aligned}$$

This equation can be expressed as

$$\frac{\partial\left[\pi_E(n^c) - \pi_I(n^c)\right]}{\partial t_r} = \left[\left(p(n^c) - a_I^c\left[(1-\theta_I)w + \theta_I\delta\right]\right)x(n^c) - wF_I\right](1-t_f)$$

It follows that $\frac{\partial[\pi_E(n^c)-\pi_I(n^c)]}{\partial t_r} > 0$ as long as the foreign part of the firm's tax base is positive.

Appendix 2: Accounting for changes in the price level

In this appendix, I derive the effect of a small increase in t_r on the endogenous variables that characterize the equilibrium accounting for effects on the foreign price level P_f. The export-FDI-margin is characterized by $\pi_E(n^c) = \pi_I(n^c)$, the entry margin for home country firms by $\pi_E(N_h) = 0$, the entry margin for foreign

firms by $\pi_f(N_f) = 0$ and the price level is given by

$$P_f = \left(\int_0^{n^c} p_I(i)^{1-\sigma} di + \int_{n^c}^{N_h} p_E(i)^{1-\sigma} di + \int_0^{N_f} p_f(j)^{1-\sigma} dj \right)^{\frac{1}{1-\sigma}}$$

These four equations define the endogenous variables n^c, N_h, N_f and P_f. The total differential is given by

$$\begin{aligned}
n^c \quad &: \quad \frac{\partial(\pi_E(n^c) - \pi_I(n^c))}{\partial P_f} dP_f + \frac{\partial(\pi_E(n^c) - \pi_I(n^c))}{\partial n^c} dn^c + \frac{\partial(\pi_E(n^c) - \pi_I(n^c))}{\partial t_r} dt_r = 0 \\
N_h \quad &: \quad \frac{\partial \pi_E(N_h)}{\partial N_h} dN_h + \frac{\partial \pi_E(N_h)}{\partial P_f} dP_f = 0 \\
N_f \quad &: \quad \frac{\partial \pi_f(N_f)}{\partial N_f} dN_f + \frac{\partial \pi_f(N_f)}{\partial P_f} dP_f = 0 \\
P_f \quad &: \quad dP_f = \frac{P_f^\sigma}{1-\sigma} \left(p_I(n^c)^{1-\sigma} - p_E(n^c)^{1-\sigma} \right) dn^c + \frac{P_f^\sigma}{1-\sigma} p_E(N_h)^{1-\sigma} dN_h \\
&\quad + \frac{P_f^\sigma}{1-\sigma} p_f(N_f)^{1-\sigma} dN_f + \left(P_f^\sigma \int_0^{n^c} p_I(i)^{-\sigma} \frac{\partial p_I(i)}{\partial t_r} di \right) dt_r
\end{aligned}$$

Solving for dn^c and dt_r yields

$$\frac{dn^c}{dt_r} = -\frac{\frac{\partial(\pi_E(n^c)-\pi_I(n^c))}{\partial t_r} + \frac{\frac{\partial(\pi_E(n^c)-\pi_I(n^c))}{\partial P_f} \frac{\partial \pi_f(N_f)}{\partial N_f} \frac{\partial \pi_E(N_h)}{\partial N_h} P_f^\sigma \int_0^{n^c} p_I(i)^{-\sigma} \frac{\partial p_I(i)}{\partial t_r} di}{\frac{\partial \pi_E(N_h)}{\partial N_h} \left(\frac{\partial \pi_f(N_f)}{\partial N_f} + \frac{\partial \pi_f(N_f)}{\partial P_f} \frac{P_f^\sigma}{1-\sigma} p_f(N_f)^{1-\sigma} \right) + \frac{P_f^\sigma}{1-\sigma} p_E(N_h)^{1-\sigma} \frac{\partial \pi_E(N_h)}{\partial P_f} \frac{\partial \pi_f(N_f)}{\partial N_f}}}{\frac{\partial(\pi_E(n^c)-\pi_I(n^c))}{\partial n^c} + \frac{\frac{\partial(\pi_E(n^c)-\pi_I(n^c))}{\partial P_f} \frac{P_f^\sigma}{1-\sigma} \left(p_I(n^c)^{1-\sigma} - p_E(n^c)^{1-\sigma} \right) \frac{\partial \pi_f(N_f)}{\partial N_f} \frac{\partial \pi_E(N_h)}{\partial N_h}}{\frac{\partial \pi_E(N_h)}{\partial N_h} \left(\frac{\partial \pi_f(N_f)}{\partial N_f} + \frac{\partial \pi_f(N_f)}{\partial P_f} \frac{P_f^\sigma}{1-\sigma} p_f(N_f)^{1-\sigma} \right) + \frac{P_f^\sigma}{1-\sigma} p_E(N_h)^{1-\sigma} \frac{\partial \pi_E(N_h)}{\partial P_f} \frac{\partial \pi_f(N_f)}{\partial N_f}}}$$

Solving for dN_h yields

$$\begin{aligned}
\frac{dN_h}{dt_r} \quad = \quad & -\frac{\frac{\partial \pi_E(N_h)}{\partial P_f} \frac{P_f^\sigma}{1-\sigma} \left(p_I(n^c)^{1-\sigma} - p_E(n^c)^{1-\sigma} \right) \frac{\partial \pi_f(N_f)}{\partial N_f}}{\frac{\partial \pi_E(N_h)}{\partial N_h} \left(\frac{\partial \pi_f(N_f)}{\partial N_f} + \frac{\partial \pi_f(N_f)}{\partial P_f} \frac{P_f^\sigma}{1-\sigma} p_f(N_f)^{1-\sigma} \right) + \frac{P_f^\sigma}{1-\sigma} p_E(N_h)^{1-\sigma} \frac{\partial \pi_E(N_h)}{\partial P} \frac{\partial \pi_f(N_f)}{\partial N_f}} \frac{dn^c}{dt_r} \\
& -\frac{\frac{\partial \pi_E(N_h)}{\partial P} \frac{\partial \pi_f(N_f)}{\partial N_f} P^\sigma \int_0^{n^c} p_I(i)^{-\sigma} \frac{\partial p_I(i)}{\partial t_r} di}{\frac{\partial \pi_E(N_h)}{\partial N_h} \left(\frac{\partial \pi_f(N_f)}{\partial N_f} + \frac{\partial \pi_f(N_f)}{\partial P_f} \frac{P_f^\sigma}{1-\sigma} p_f(N_f)^{1-\sigma} \right) + \frac{P_f^\sigma}{1-\sigma} p_E(N_h)^{1-\sigma} \frac{\partial \pi_E(N_h)}{\partial P_f} \frac{\partial \pi_f(N_f)}{\partial N_f}}
\end{aligned}$$

Solve for dN_f:

$$\frac{dN_f}{dt_r} = -\frac{\frac{\partial \pi_f\left(N_f\right)}{\partial P_f}\frac{P_f^{\sigma}}{1-\sigma}\left(p_I\left(n^c\right)^{1-\sigma}-p_E\left(n^c\right)^{1-\sigma}\right)\frac{\partial \pi_E(N_h)}{\partial N_h}}{\frac{\partial \pi_E(N_h)}{\partial N_h}\left(\frac{\partial \pi_f\left(N_f\right)}{\partial N_f}+\frac{\partial \pi_f\left(N_f\right)}{\partial P_f}\frac{P_f^{\sigma}}{1-\sigma}p_f\left(N_f\right)^{1-\sigma}\right)+\frac{P_f^{\sigma}}{1-\sigma}p_E\left(N_h\right)^{1-\sigma}\frac{\partial \pi_E(N_h)}{\partial P_f}\frac{\partial \pi_f\left(N_f\right)}{\partial N_f}}\frac{dn^c}{dt_r}$$
$$-\frac{\frac{\partial \pi_E(N_h)}{\partial N_h}\frac{\partial \pi_f\left(N_f\right)}{\partial P_f}P_f^{\sigma}\int_0^{n^c}p_I\left(i\right)^{-\sigma}\frac{\partial p_I(i)}{\partial t_r}di}{\frac{\partial \pi_E(N_h)}{\partial N_h}\left(\frac{\partial \pi_f\left(N_f\right)}{\partial N_f}+\frac{\partial \pi_f\left(N_f\right)}{\partial P_f}\frac{P_f^{\sigma}}{1-\sigma}p_f\left(N_f\right)^{1-\sigma}\right)+\frac{P_f^{\sigma}}{1-\sigma}p_E\left(N_h\right)^{1-\sigma}\frac{\partial \pi_E(N_h)}{\partial P_f}\frac{\partial \pi_f\left(N_f\right)}{\partial N_f}}$$

It can be shown that, if $\delta = w_h$, $\frac{dn^c}{dt_r} < 0$ and $\frac{dN_h}{dt_r}, \frac{dN_f}{dt_r} > 0$.

Now, the change in the price level can be calculated. Replacing $\frac{dn^c}{dt_r}$, $\frac{dN_h}{dt_r}$ and $\frac{dN_f}{dt_r}$ in the total differential expression given above this expression reads

$$\frac{dP_f}{dt_r} = \frac{\left(\frac{P_f^{\sigma}}{1-\sigma}\left(p_I\left(n^c\right)^{1-\sigma}-p_E\left(n^c\right)^{1-\sigma}\right)\frac{dn^c}{dt_r}+P_f^{\sigma}\int_0^{n^c}p_I\left(i\right)^{-\sigma}\frac{\partial p_I(i)}{\partial t_r}di\right)\frac{\partial \pi_E(N_h)}{\partial N_h}\frac{\partial \pi_f\left(N_f\right)}{\partial N_f}}{\frac{\partial \pi_E(N_h)}{\partial N_h}\left(\frac{\partial \pi_f\left(N_f\right)}{\partial N_f}+\frac{\partial \pi_f\left(N_f\right)}{\partial P_f}\frac{P_f^{\sigma}}{1-\sigma}p_f\left(N_f\right)^{1-\sigma}\right)+\frac{P_f^{\sigma}}{1-\sigma}p_E\left(N_h\right)^{1-\sigma}\frac{\partial \pi_E(N_h)}{\partial P}\frac{\partial \pi_f\left(N_f\right)}{\partial N_f}}$$

Appendix 3: Global optimality

In this appendix, I derive the first-order condition of t_r for global welfare. Adding home country profits in (14), home country tax revenue in (15), foreign profits in (22), foreign tax revenue in (23), and foreign consumer surplus given by $\frac{1-\gamma}{\gamma}P_f^{-\frac{\gamma}{1-\gamma}}$ gives

$$\begin{aligned}
W_g &= \Pi_h + T_h + \Pi_f + T_f + \frac{1-\gamma}{\gamma}P_f^{-\frac{\gamma}{1-\gamma}} \\
&= \frac{1-\gamma}{\gamma}P_f^{-\frac{\gamma}{1-\gamma}} + \int_0^{N_f}\left[\frac{1}{\sigma}p_f\left(j\right)^{1-\sigma}P_f^{\sigma-\frac{1}{1-\gamma}} - wF_f\right]dj \\
&\quad + \int_0^{n^c}\left[\frac{1}{\sigma}p_I\left(i\right)^{1-\sigma}P_f^{\sigma-\frac{1}{1-\gamma}} - wF_I\right]di + \int_{n^c}^{N}\left[\frac{1}{\sigma}p_E\left(i\right)^{1-\sigma}P_f^{\sigma-\frac{1}{1-\gamma}} - wF_E\right]di \\
&\quad + \theta_I\left(\delta - \tau w_h\right)\left(\frac{t_h - t_e}{1-t_e}\right)\int_0^{n^c}a\left(i\right)p_I\left(i\right)^{-\sigma}P_f^{\sigma-\frac{1}{1-\gamma}}di
\end{aligned}$$

The first-order condition with respect to t_r reads

$$\begin{aligned}
\frac{\partial W_g}{\partial t_r} &= -P_f^{-\frac{\gamma}{1-\gamma}-1}\frac{\partial P_f}{\partial t_r}+\left(\frac{\pi_I\left(n^c\right)}{1-t_e}-\frac{\pi_E\left(n^c\right)}{1-t_h}\right)\frac{\partial n^c}{\partial t_r} \\
&+\theta_I\left(\delta-\tau w_h\right)\left(\frac{t_h-t_e}{1-t_e}\right)a_I^c p_I\left(n^c\right)^{-\sigma}P_f^{\sigma-\frac{1}{1-\gamma}}\frac{\partial n^c}{\partial t_r} \\
&+\left(\sigma-\frac{1}{1-\gamma}\right)P_f^{\sigma-\frac{1}{1-\gamma}-1}\frac{1}{\sigma}\left[\begin{array}{c}\int_0^{N_f}p_f\left(j\right)^{1-\sigma}dj+\int_0^{n^c}p_I\left(i\right)^{1-\sigma}di \\ +\int_{n^c}^{N}p_E\left(i\right)^{1-\sigma}di\end{array}\right]\frac{\partial P_f}{\partial t_r} \\
&+\int_0^{n^c}P_f^{\sigma-\frac{1}{1-\gamma}}\frac{\partial p_I\left(i\right)}{\partial t_r}\left[\frac{1-\sigma}{\sigma}p_I\left(i\right)-\sigma\theta_I\left(\delta-\tau w_h\right)\frac{t_h-t_e}{1-t_e}a\left(i\right)\right]p_I\left(i\right)^{-\sigma-1}di \\
&-\theta_I\left(\delta-\tau w_h\right)\frac{1-t_h}{\left(1-t_f\right)\left(1-t_r\right)^2}\int_0^{n^c}a\left(i\right)p_I\left(i\right)^{-\sigma}P_f^{\sigma-\frac{1}{1-\gamma}}di
\end{aligned}$$

which can be simplified, using $\frac{\partial p_I(i)}{\partial t_r}=-\frac{\sigma}{\sigma-1}a\left(i\right)\theta_I\left(\delta-\tau w\right)\frac{1-t_h}{\left(1-t_f\right)\left(1-t_r\right)^2}$, to

$$\begin{aligned}
\frac{\partial W_g}{\partial t_r} &= -\frac{1}{\left(1-\gamma\right)\sigma}P_f^{-\frac{1}{1-\gamma}}\frac{\partial P_f}{\partial t_r} \\
&+\frac{t_h-t_e}{1-t_e}\left[\begin{array}{c}-\frac{1}{\left(1-t_h\right)}\left[\pi_I\left(n^c\right)-\left(1-t_h\right)\theta_I\left(\delta-\tau w_h\right)a_I^c p_I\left(n^c\right)^{-\sigma}P_f^{\sigma-\frac{1}{1-\gamma}}\right]\frac{\partial n^c}{\partial t_r} \\ -\int_0^{n^c}P_f^{\sigma-\frac{1}{1-\gamma}}\left[\sigma\theta_I\left(\delta-\tau w_h\right)a\left(i\right)p_I\left(i\right)^{-\sigma-1}\frac{\partial p_I(i)}{\partial t_r}\right]di\end{array}\right]
\end{aligned}$$

Provided that $\frac{\partial P_f}{\partial t_r}>0$, the consumer surplus decreases more than firm profits are increased (first term). The first term in square brackets which captures the effect of the marginal firm's regime switch on global tax revenue is unambiguously positive. The second term in square brackets depicts the effect of the intra-marginal firms' price changes on global tax revenue which is positive, too. Thus, the sign of the whole term depends on the sign of t_h-t_e.

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