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# The Tax Treatment of Interest Expenditures of Multinational Enterprises

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**Abstract**

This paper analyses the national tax treatment of interest expenditures of multinational enterprises in a non-cooperative world. It is shown that the international tax system generally leads to distortions in the capital decisions of multinational firms. In contrast to the existing literature on the tax treatment of the expenditures of multinationals, it is found that the form and size of distortions can differ per country depending on the stake a country has in the multinational. Furthermore, internationalisation of the firm's operations and ownership is demonstrated to lead to less generous interest deduction rules of individual countries and in the limit may result in no deduction allowance at all.

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Key words: International Investment, Multinational Firms, Optimal Taxation, Interest Expenditures, R&D Expenditures

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## 1. Introduction

The deduction of interest expenditures when calculating taxable income is generally permitted across countries. Multinational corporations can exploit the deduction possibility in order to minimise the world-wide income tax payable, by shifting their liabilities to those countries with the highest tax rates and most favourable interest deduction rules. Countries, in their turn, are able to reduce the possibilities for debt shifting, usually by requiring the apportionment of overall interest expenditures to home and foreign income according to some rule. Altshuler and Mintz (1994) and Froot and Hines (1994) have empirically examined the effect of stricter interest allocation rules aimed at preventing the debt shifting, on the behaviour of multinationals. They found that the stricter interest allocation rules of the 1986 Tax Reform Act in the USA induced the multinationals to alter the location of their debt, but also to scale back the scope of their operations. Thus, when deciding about the tax treatment of interest expenditures of multinationals, national states are likely to face a trade-off between allowing for the erosion of the corporate tax revenue base due to debt-shifting and negatively affecting the production at home and world-wide. Such a trade-off may be a possible explanation for the fact that the apportionment approach, although correcting for distortions introduced by debt shifting, has hitherto been used by relatively few countries.

Currently, no common rule exists as to how individual countries should attribute interest expenditures of multinationals to geographical sources of taxable income. The interest deduction rules diverge widely across countries. First, a large number of countries use the tracing approach (the use of borrowed funds is traced based on all the facts and circumstances; if money is shown to be used to earn income from a particular qualifying source, interest is deductible, otherwise it is not). Second, some countries apply the apportionment approach involving allocation of borrowed funds to the taxpayer's sources of income according to some formulae; these formulae usually describe the way to determine the fraction of world-wide interest expenditures which is allowed for deduction. Furthermore, the apportionment formulae used differ significantly per country and may be based on the value of the taxpayer's income-earning assets in the country (as in the US), but also on other criteria such as gross revenue or taxable income in the country. Thus, the treatment of the interest expenditures by the world tax systems may be characterised by the extensive use of the tracing approach, which is generally known to provide stronger incentives for debt shifting across countries, together with the lack of uniformity with respect to apportionment rules. This suggests that countries under certain conditions might have reasons to stay lax in terms of capturing the income tax base, in order to avoid distortions in capital and production decisions which can be created when eliminating debt-shifting.

This paper analyses the national tax treatment of the multinational's interest expenditures under the apportionment approach, and the distortions this approach can introduce with respect to capital decisions of a multinational[1]. A general feature of permitting the deduction of a fraction of world-wide interest expenditures is that a more generous allowance in a single country leads to an increase in debt and production not only in this country, but also world-wide. In a non-cooperative world countries determine their policies with respect to the interest deduction rules independently, and rules of one tax jurisdiction where the multinational operates do not have to be recognised by another tax jurisdiction. This means that the deduction parameters world-wide do not necessarily sum to unity, that is it might be the case that the multinational cannot include in the production costs all the interest expenditures incurred, what leads to distortions in capital decisions of the company. Furthermore, given that capital decisions are taken by the multinational for each country separately, the world-wide tax system can result in different degrees of distortion per country.

In the current analysis we specifically address how the character and size of the distortions countries face are influenced by both the increasing internationalisation of the firm in terms of operations, and the stake countries have in the firm's equity. The model of the paper is to some degree analogous to that used by Huizinga (1992) who examined optimal national tax policies with respect to R&D. Indeed, countries' policies concerning the tax treatment of interest expenditures of multinationals and of their R&D expenditures are to a certain extent similar. However, as the current model shows, the optimal tax treatment of interest expenditures as well as the effects of this treatment on the multinational's behaviour may differ to some degree from the R&D case. The main reason is the different nature of the assets the expenditures are related to (capital assets are pure private goods, while R&D assets are, at least, to some degree, public goods[2]). In terms of the model this implies that in case of interest expenditures, production in a country depends on the amount of capital employed in this country, while in the case of R&D it depends on the world-wide amount of R&D.

Our model assumes that countries maximise their national income, which includes the tax revenues and the dividends distributed by the firm to the residents. In designing the corporate income tax system consisting of the tax rate and the fraction of world-wide interest expenditures allowed for deduction, countries take the tax parameters in other countries as given, but also take into account the reaction curve of the multinational's capital decisions. The character and size of capital decisions

1 Under interest expenditures interest paid on debt used to finance capital is considered.
2 A piece of knowledge developed and applied at a certain location, can be applied somewhere else at little extra cost and without reducing the capacity available at the original site (Caves, 1996, p.4).

distortions in a country is determined by the interplay of the optimal tax system parameters in this and other world economies; these parameters are, in their turn, influenced by the location of the ownership of the multinational and by the degree of internationalisation of the company. In particular, the model shows that a country being a full owner of the multinational can enjoy a non-distortion of capital decisions in a country or have more capital than optimally would have been the case. At the same time, for symmetric countries with equal ownership of the company it is not optimal to allow for interest deductions after a certain degree of internationalisation is reached, this implies no correction of the initial distortions introduced by the corporate income tax.

The remainder of the paper is organised as follows. Section 2 presents the model set up and examines the optimal capital choice policy for the firm, together with the optimal national tax policies for the case of symmetric countries with no ownership of the multinational. Section 3 introduces ownership in the production countries and differences between these countries in the model. Section 4 discusses the results of the current model in comparison to those of the R&D expenditures model. Section 5 provides information on countries' practices concerning the treatment of interest expenditures deductions. Section 6 discusses possible extensions and presents a conclusion. Appendix A contains the relevant proofs, and Appendix B gives a numerical solution for a case not considered theoretically.

## 2. Model set up and symmetric world solution.

The model describes a single multinational firm operating $n\geq 2$ plants in $n$ countries. The output in every country is related to the quantity of capital employed in this country according to the production function $f(K_i)$, such that $f'>0$, $f''<0$, $f(0) = 0$, $f'(0) = \infty$, $f'(\infty) = 0$. The price of output is set to be unity. The firm finances its capital with debt and equity, the share of capital financed with debt is given by $\alpha$. Debt financing is provided by country $n+1$, where no production is located[3], at a given interest rate $r$, $r>0$[4]. The interest to be paid on this debt equals $Int = rD = r\alpha K = r\alpha(\Sigma_{l=1..n}K_l)$. Equity financing can be provided by any of the $n+1$ countries, the distribution of equity capital among countries is given exogenously. The firm maximises its profit (output net of taxes and interest payments) and makes a decision on the quantity of overall capital employed ($K$) and the allocation of production among the $n$ countries ($K_i$, $i=1..n$).

3 Such a set up reflects the fact that financing and production decisions of a multinational company are being taken independently.

Countries $1$ to $n$ maximise their national incomes, which consist of corporate income tax revenues and dividends received by the citizens of the country on the equity owned. The tax systems are assumed to be territorial, i.e. countries only tax the multinational's income generated within their borders. Country $i$ taxes the income of the multinational at a rate $\tau_i$, $0 \leq \tau_i \leq 1$, and allows for the deduction of a certain fraction $\theta_i$, $0 \leq \theta_i \leq 1$ of world-wide interest expenditures incurred by the company (i.e. the apportionment method is used). In modelling the apportionment rule, the main feature of deduction allowances we want to account for is that deductions are connected to the world-wide interest expenditures, what implies that a more generous deduction rule in one country influences production world-wide, and has indirectly an impact on production in other countries. Introducing a fixed parameter $\theta_i$ presents the simplest way to incorporate this feature in the model.

The taxable income of the multinational is defined as output net of the deduction for interest expenditures. Country $i$ maximises its national income, and decides upon the values of $\tau_i$ and $\theta_i$. Each country models its tax system (including tax rates and the deduction policy) taking into account that the multinational world-wide benefits from the favourable treatment of the interest expenditures, and, consequently, treasuries of other countries benefit too. The main purpose of the tax system is to capture profits that would otherwise go to foreign treasuries.

Below the basic-case version of the model is presented with all equity provided by country $n+1$, and the $n$ countries being symmetric, i.e. being the same with respect to all the parameters. Later ownership in production countries will be introduced, together with the differences between these countries.

## 2.1 Optimisation problem of the firm

The multinational chooses the overall quantity of capital employed $K$ and the allocation of production $K_i$ between the countries so as to maximise its after-tax profits world-wide $\pi$:

$$\pi = \Sigma_{l=1..n}(1-\tau_l)f(K_l) - (1 - \Sigma_{l=1..n}\,\tau_l\,\theta_l)rD - rE$$
$$= \Sigma_{l=1..n}(1-\tau_l)f(K_l) - (1 - \alpha\Sigma_{l=1..n}\,\tau_l\,\theta_l)r\Sigma_{l=1..n}K_l \qquad (1)$$

4 Country $n+1$ stands for a number of small world economies which provide financing without hosting production. Due to their small size they are not able to exercise any influence on world variables such as e.g. the interest rate.

The optimality condition for the firm's plant in country $i$ looks as follows:

$$(1-\tau_i)f'(K_i) - (1 - \alpha \Sigma_{l=1..n}\ \tau_l \theta_l) r = 0 \quad (2)$$

Expression (2) states that the quantity of capital $K_i$ employed in country $i$ is chosen so as to equalise the net-of-tax marginal product of capital in country $i$ and the marginal cost of capital net of the value of the world-wide interest deductions.

Below will be shown how the tax parameters $\tau_i$ and $\theta_i$ in each of the countries affect the firm's production decisions. Straightforward total differentiation of (2) gives the following relationships between the quantity of capital employed in a country and the tax policies of this and other countries:

$$\frac{dK_i}{d\tau_i} = \frac{f'(K_i) - \alpha\theta_i r}{(1-\tau_i) f''(K_i)} \leq 0, \geq 0 .........(3)$$

where $i = 1,..,n$.

$$\frac{dK_j}{d\tau_i} = \frac{-\alpha\theta_i r}{(1-\tau_j) f''(K_j)} \geq 0 .........(4)$$

where $j \neq i$.

$$\frac{dK_j}{d\theta_i} = \frac{-\alpha\tau_i r}{(1-\tau_j) f''(K_j)} \geq 0 .........(5)$$

where $i = 1,..,n$.

According to (3) a higher tax rate in country $i$ leads to more capital in country $i$ if $f'(K_i) < \alpha\theta_i r$, i.e. the share of world-wide costs of capital deductible from taxable income in country $i$ exceeds the marginal product of capital at the plant in this country. Equation (4) shows that a higher tax rate in country $i$ always leads to more capital in country $j$, $j \neq i$. From (5) follows that allowing for more generous interest deductions in country $i$ leads to a larger production at the multinational's plants not only in this country, but also world-wide.

2.2 Optimisation problem of the country. National tax policies

In a cooperative world countries will choose their tax parameters so as to avoid distorting the firm's capital decisions. Non-distortion leads in other words to the same capital choice as in the world without taxes. FOC without taxes is: $f'(K_i)=r$ (marginal product of capital equals its marginal cost), FOC with taxes is given by (2). Thus, the non-distortion condition yields:

$$1-\tau_i = 1 - \alpha \sum_{l=1..n} \tau_l \theta_l \text{ or } \tau_i = \alpha \sum_{l=1..n} \tau_l \theta_l .$$

If $\tau_i > \alpha \sum_{l=1..n} \tau_l \theta_l$ then the quantity of capital is too small in comparison with the no-tax case, and the tax system provides a net tax on capital. If $\tau_i < \alpha \sum_{l=1..n} \tau_l \theta_l$ then there is a net capital subsidy. Further will be shown that in a non-cooperative world without ownership the deductibility parameters are set such that the tax system implies a net tax on capital, while in a country owning the multinational fully, a net subsidy on capital or no distortion of capital decisions are possible.

Country $i$ designs its tax system (decides upon the values of $\tau_i, \theta_i$) so as to maximise its national income, which equals the tax income:

$$N_i = T_i = \tau_i f(K_i) - \tau_i \theta_i r \alpha \Sigma_{l=1..n} K_l \ (6)$$

Note that since the national income consists only of the tax income, it is never optimal for a country to set $\tau_i$ equal to zero. Every country is assumed to act in Cournot-Nash fashion, i.e. taking the tax parameters of the other countries as given. In this setting $\theta_i = 0$ will be not optimal, if a marginal increase in production brought about by a marginal increase in $\theta_i$ will be larger than the share of world-wide interest expenditures allowed for deduction at the new value of $\theta_i$. Moreover, countries will set their tax system parameters in such a way that $1-\alpha\Sigma_{l=1..n}\tau_l\theta_l > 0$ (otherwise it will be optimal for the company to increase capital to infinity; to prevent this countries will set their deduction parameters to zero).

The Cournot-Nash assumption implies that the tax parameters are set so that:

$$f(K_i) + \tau_i [f'(K_i) - \theta_i r \alpha] \frac{dK_i}{d\tau_i} - \theta_i r \alpha \sum_{l=1..n} K_l - \tau_i \theta_i r \alpha \sum_{l \neq i} \frac{dK_l}{d\tau_i} = 0 \text{.........}(7)$$

$$\tau_i [(f'(K_i) - \theta_i r \alpha) \frac{dK_i}{d\theta_i} - r \alpha \sum_{l=1..n} K_l - \theta_i r \alpha \sum_{l \neq i} \frac{dK_l}{d\theta_i}] = 0 \text{.........}(8)$$

Equations (7) and (8) implicitly define optimal tax parameters from the perspective of country $i$, as functions of foreign and domestic tax parameters $\tau_l, \theta_l$, $l=1..n$. Thus, (7) and (8) present the international Nash equilibrium in the tax parameters.

Proposition 1 shows a number of implications of (7) and (8) for the optimal values of $\tau_i$ and $\theta_i$, $i=1..n$:

Proposition 1 (proof: see appendix A)

*(i)* $dK_i/d\tau_i < 0$

*(ii)* $\exists N$ such that $\theta_i=0,\ i=1..n,\ n \geq N$

(iii) $\tau_i > \alpha \sum_{l=1..n} \tau_l \theta_l$

Part (i) states that increasing the tax rate in country $i$ leads to less capital employed by the multinational in this country. Part (ii) says that the optimal deduction parameter for the countries is equal to zero if the number of plants is larger than a certain value $N$. In other words, when internationalisation reaches a certain level, it becomes optimal not to allow for the deductions of interest expenditures. The intuition behind this statement is that at a certain degree of internationalisation the capital world-wide becomes so large that a marginal increase in production due to a marginal increase in $\theta_i$ does not compensate for the loss in tax revenues brought about by allowed deductions. Part (iii) states that the tax system imposes a net tax on capital in countries under consideration.

## 3. Asymmetric world with ownership differences

In this section the ownership in the production countries and the differences among these countries are introduced. The ownership $\rho_i$ ($\Sigma_{l=1..n+1} \rho_l = 1$) of country $i$ is defined as a fraction of equity of the multinational owned by the citizens of country $i$, $i=1..n+1$ and is considered as a proxy for the size of the country. We assume that the total of the company's profit is distributed to the equityholders, consequently, citizens of country $i$ receive a fraction $\rho_i$ of the multinational's profits, this yield is included in the national income of the country. All other assumptions stay the same.

### <u>3.1 Optimisation problem of the firm</u>

The optimisation problem of the multinational described by the equations (1) and (2) does not change. Nevertheless, as will be shown below, in this case we cannot exclude the zero value of the tax rate parameter.

Notice, that from (2) follows that $\boldsymbol{t}_i > \boldsymbol{t}_j$ leads to $K_i < K_j$, what means that the deduction policy cannot change the sign of $K_i - K_j$, only its size.

3.2 Optimisation problem of the country. National tax policies

The optimisation problem of the country takes now the following form: to maximise

$$N_i = T_i + r_i p = f(K_i)[\ t_i + r_i\ (1-t_i\ )] + r_i\ S_{i^1 l}\ (1-t_l\ )f(K_l) - rS_{l=1..n}K_l\ [a t_i q_i + r_i (1 - a\ S_{l=1..n}\ t_l\ q_l\ )] \quad (9)$$

The following equations present the international Nash equilibrium for each of the $n$ countries, implicitly defining optimal tax parameters from the perspective of country $i$, as functions of foreign and domestic tax parameters $\boldsymbol{t}_l, \boldsymbol{q}_l, l\ ^1\ i$:

$$(1-\boldsymbol{r}_i)[f(K_i)-\boldsymbol{q}_i r\boldsymbol{a}\sum_{l=1..n}K_l]+\boldsymbol{t}_i[f'(K_i)-\boldsymbol{q}_i r\boldsymbol{a}]\frac{dK_i}{d\boldsymbol{t}_i}-\boldsymbol{t}_i\boldsymbol{q}_i r\boldsymbol{a}\sum_{l\neq i}\frac{dK_l}{d\boldsymbol{t}_i}=0.........(10)$$

$$\boldsymbol{t}_i[(1-\boldsymbol{r}_i)r\boldsymbol{a}\sum_{l=1..n}K_l-(f'(K_i)-\boldsymbol{q}_i r\boldsymbol{a})\frac{dK_i}{d\boldsymbol{q}_i}+\boldsymbol{q}_i r\boldsymbol{a}\sum_{l\neq i}\frac{dK_l}{d\boldsymbol{q}_i}]=0.........(11)$$

where use is made of (2).

Substitution of the equations (3), (4) and (5) into (10) and (11), correspondingly, yields:

$$(1-\boldsymbol{r}_i)[f(K_i)-\boldsymbol{q}_i r\boldsymbol{a}\sum_{l=1..n}K_l]+\frac{\boldsymbol{t}_i}{1-\boldsymbol{t}_i}\frac{f'(K_i)}{f''(K_i)}[f'(K_i)-2\boldsymbol{q}_i r\boldsymbol{a}]+\boldsymbol{t}_i(\boldsymbol{q}_i r\boldsymbol{a})^2\sum_{l=1..n}\frac{1}{(1-\boldsymbol{t}_l)f''(K_l)}=0..(12)$$

$$\boldsymbol{t}_i[(1-\boldsymbol{r}_i)\sum_{l=1..n}K_l+\frac{\boldsymbol{t}_i}{1-\boldsymbol{t}_i}\frac{f'(K_i)}{f''(K_i)}-\boldsymbol{t}_i\boldsymbol{q}_i r\boldsymbol{a}\sum_{l=1..n}\frac{1}{(1-\boldsymbol{t}_l)f''(K_l)}]=0.........(13)$$

$$(1-\boldsymbol{r}_i)f(K_i)+\frac{\boldsymbol{t}_i}{1-\boldsymbol{t}_i}\frac{f'(K_i)}{f''(K_i)}[f'(K_i)-\boldsymbol{q}_i r\boldsymbol{a}]=0..........(14)$$

Under the assumption $\boldsymbol{t}_i\ ^1\ 0$ substituting (13) into (12), we get:

The implications of (10) and (11) for the optimal values of the tax system parameters are discussed below. The insights of the case of equal ownership $\boldsymbol{r}_i = (1-\boldsymbol{r}_{n+1})/n$ are similar to those of the case of no ownership discussed in section 2; we will not go into this case further.

Proposition 2 deals with the case $\rho_i = 1$, $\rho_j = 0$ for $j \neq i$, i.e. the multinational is wholly owned by country *i*.

Proposition 2 (proof: see appendix A)

*(i) The equilibrium is:*

$\tau_i = 0$, *$\theta_i$ can take any value;* $\tau_j > 0, j \neq i$

*(ii)* $dK_j/d\tau_j < 0, j \neq i$

*(iii)* $\tau_i = \alpha \sum_{l=1..n} \tau_l \theta_l$ *if* $\theta_l = 0$

$\tau_i < \alpha \sum_{l=1..n} \tau_l \theta_l$ *if* $\theta_l > 0$

Part (i) states that the equilibrium in case one country owns the multinational completely, is a zero tax rate in that country (since there is no tax, the deduction parameter becomes not relevant) and positive tax rates in all the other countries. Part (ii) is the condition that the increasing tax rate in a country having no stake in the multinational leads to less capital in this country. Part (iii) says that the case under consideration results in a no distortion of capital decisions of the multinational in the country-owner if deduction parameters in other countries are zero, and in a net subsidy if deduction parameters in other countries are positive.

## 4 Discussion of results

In this section we discuss the intuition behind the result that distortions may differ per country both, in size and in character. While the net tax outcome corresponds with the results of the analysis of comparable kind of expenditures, R&D expenditures of the multinationals (analysed by Huizinga, 1992), the possibility of the net subsidy and non-distortion is in contrast with them.

Let us first consider why a net subsidy on capital can appear. In a closed economy (i.e. if we consider each country individually) capital at the margin is taxed if the tax rate is larger than zero:

$$\frac{dT_i}{dK_i} = \tau_i (f'(K_i) - \theta_i r \alpha) > 0 \quad \text{...(15)}$$

since $f'(K_i) - \theta_i r\alpha > 0$ (see (i) of Proposition 1 and (ii) of Proposition 2).

However, in an open economy the effect can be opposite due to the existence of a negative externality on the foreign treasuries:

$$\frac{dT_j}{dK_i} = -t_i q_i r a \leq 0 \ldots(16)$$

In case of country *i* having a large ownership of the multinational, (15) becomes small, and a marginal increase in the capital in country *i* leads to a marginal decrease in the world-wide tax revenues: $dT/dK_i<0$. The situation is opposite in case of no ownership in the producing countries: marginal increase in tax revenues of country *i* as a result of a marginal increase in capital in this country overweighs the marginal decrease in tax revenues of other countries. Thus, per saldo we have a marginal increase in the world-wide tax revenues $dT/dK_i>0$ as a result of the marginal increase in capital in country *i*. (Note, that effects on the world-wide tax revenues described above, are pure effects of the marginal change in capital, and do not account for the influence of changes in tax system parameters, through which this change has occurred).

In the case of R&D, however, a marginal change in R&D results in a marginal change in the same direction of tax revenues in all the countries, which implies a net tax on R&D. The intuition behind this is based on the fact that, in contrast to capital assets, R&D assets are, at least to some degree, a public good. Consequently, no country can capture all the benefits from increasing R&D and make others pay for it. In terms of the model, the different nature of capital and R&D assets is reflected in the production function specification. Thus, in the model described above production in a country depends on the amount of capital employed in this particular country, while in the R&D model production in a country depends on the overall amount of R&D.

## 5. Actual tax treatment of interest expenditures: some international evidence

The share of interest expenditures of multinationals that can be allocated to the production costs world-wide depends on the income tax provisions and interest deductibility rules of countries where the multinational operates[5]. Most countries allow for the deduction of interest on borrowed funds used for the purpose of earning income within the country[6]. Two fundamental approaches to attributing interest expenditures to geographic sources of income are tracing and apportionment. While the former involves tracing the use of the borrowed funds to prove their

5 The information in this paragraph is from IFA (1994).
6 IFA (1994) analysed policies regarding interest expenditures deductions of 29 OECD countries; only Singapore was found not to allow interest expenditure deductions when calculating the taxable profits of resident multinationals.

connection with a particular source of income; the latter implies allocation of these funds to taxpayer's sources of income according to a certain rule. The tracing approach has up to now been used by the majority of OECD countries, with several of them requiring apportionment when tracing is not feasible. However, in many cases the apportionment requirement is not supported with providing an explicit formula for calculating the fraction of total interest expenditures incurred, that is allowed for deduction within a country. Thus, most EU countries apart from Italy do not have statutory apportionment rules. Where present, statutory apportionment formulae used differ considerably per country and may be based on the value of the taxpayers income-earning assets (USA, Norway), but also on other criteria such as e.g. gross revenues (Italy, Japan, Korea). Of all countries the USA has the most explicitly described apportioning formula and detailed statutory rules for determining the geographic source of revenue and expenses.

The interplay between interest deduction rules of various countries hosting the multinational determines the overall interest deductibility. As an example we consider the tax treatment of interest expenditures of an American multinational, since the USA has the most developed policy in this respect. The country taxes the world-wide income of domestic corporations but allows for a foreign tax credit in order to avoid double taxation. The issue of interest allocation is crucial for American corporations since interest allocated to foreign source income reduces the maximum amount of the foreign tax credit. The foreign permanent establishments, which are taxed territorially, need to determine the amount of the interest expense attributable to their USA income for the corporate income tax purposes. A three-step procedure introduced in 1980 is generally applicable up to now, and acts as follows[7]. First, the U.S. assets of the company are determined and valued in accordance with the existing statutory rules. Second, the total amount of US-connected liabilities is calculated by multiplying the US-connected assets by either the corporation's 'actual ratio' of world-wide liabilities to world-wide assets or an elective 'fixed ratio', which amounts to 95% for banks and 50% for other taxpayers. Finally, the amount of interest expense attributable to the US liabilities is calculated by adjusting the actual interest paid by the US branch on its book liabilities, to reflect the difference between the US branch liabilities and US-connected liabilities.

The tax treatment of the overall interest expenditures of the American multinational will, however, depend on the part of the world it operates in. In quite a few countries the multinational's interest expenditures will be treated according to the tracing approach (most of the EU countries use this approach) [8]. Apportionment is required, e.g. by Italy, Japan, Norway. However, since the apportionment rules differ per country, the full deduction of world-wide interest expenditures will not necessarily occur. In other countries (e.g. some Eastern-European countries), however, the situation is possible that no part of interest expenditures is allowed for deduction or the deduction is allowed only within a special range leading to less than full deduction of the world-wide interest expenditures. Thus, for example, in the Russian Federation up to recently only interest payments on bank loans (as opposed to inter-company loans) were allowed for deduction, with interest rate limited to the official rate established by the Central Bank of Russia. However, Russian current legislation provisions establish the priority of international agreements over the provisions of domestic tax law, which results in more relaxed rules for loans obtained by non-resident entities[9].

As shown above, the uncoordinated tax policies of individual countries with respect to the interest expenditures of multinationals generally allow for debt shifting and can result in a less than full deduction of interest paid world-wide. The outcome depends on the particular countries where the multinational operates. Moreover, the policies of countries are not necessarily optimally designed, what leads to large divergences not only in the tax system parameters as predicted by the model, but also in tax system approaches, and creates distortions. Some steps to optimise countries' policies have been done by the OECD Model Tax Convention: Attribution of Income to Permanent Establishments (OECD, 1994). Thus, most of bilateral treaties between countries conform to this convention.

## 6. Conclusions and possible extensions

This paper has analysed the tax treatment by national governments of interest expenditures of multinational firms under the apportionment approach. The following conclusions can be drawn from the analysis. First, uncoordinated national tax policies generally result in a distortion of the capital decisions of the multinational. Depending on the size of the ownership of the country in the multinational and the degree of internationalisation of the company, the distortion of capital decisions in a country can vary in form (from a net tax on capital to a net subsidy on capital or a

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7 This description is based on Rienstra (1996).
8 The information in this paragraph is from IFA (1994), Almakaeva (1997).

non-distortion) and in size. This possibility of countries' differences in distortions faced may have implications both, for the incentives different countries have to using the apportionment approach, and, once the approach is used, for countries' willingness to cooperate with each other in order to eliminate the distortion. Second, the different nature of capital and R&D assets influences the optimal tax treatment of related expenditures as shown by the difference of the current results from those for the optimal tax treatment of R&D expenditures of multinationals. Finally, the present tax systems are far from being optimal with respect to the treatment of the interest expenditures of multinationals. As a consequence, multinationals possess at the moment considerable opportunities of manipulating the amount of the corporate income tax to be paid world-wide, by means of debt shifting.

The current model uses the ownership parameter as a proxy for the size of the country (large countries are more likely to have a larger ownership of the multinational). Another proxy for the size (as suggested by Huizinga (1992)) can be the number of plants that the multinational operates in a country (this number can differ per country). Let $m_i$ be the number of plants in country *i*, such that $m = \Sigma_{l=1..n} m_l$ and $m > n$. Then for country *i* (8) becomes:

$$\tau_i[m_i f'(K_i)\frac{dK_i}{d\theta_i} - r\,D - r\theta_i \sum\nolimits_{l=1..n} \frac{dK_l}{d\theta_i}] = 0.........(8')$$

Equation (8’) implies that in the world with no ownership and symmetric tax rates the deductibility parameter will be positively related to the number of plants in a country. Large countries with many production facilities, such as the US, will consequently have bigger incentives to allow for the deduction of interest expenditures.

Another possible extension has to do with the fact that countries usually value tax revenues higher than the revenues received by individuals in the form of dividends. Consider introducing a parameter $\lambda \geq 1$ showing the weight a country attaches to its tax revenues, when the dividends received by the residents are taken with the weight one. The national income will look then as follows: $N_i = \lambda T_i + \rho_i \pi$. The general pattern of results will, however, not change considerably in this case.

In general the results obtained in the model suggest a scope for international cooperation with respect to the rules for apportioning the interest expenses of the multinationals between their

9 Such agreements exist, e.g. with almost all the EU members.

income sources, but warn that countries might have different incentives to cooperate. To reach the efficiency in the capital decisions of the multinational it is necessary that the corporation be able to exactly expense the total of its interest expenditures world-wide.

## Appendix A

*Proof of Proposition 1*

(i) Substituting (5) into (8) and taking into account that the countries are symmetric, we get:

$$f'(K_i) = \boldsymbol{q}_i r \boldsymbol{a} n - f''(K_i)\frac{1-\boldsymbol{t}_i}{\boldsymbol{t}_i}\sum_{l=1..n} K_l \quad ...(A1)$$

from where follows: $f'(K_i) > \boldsymbol{q}_i r \boldsymbol{a} n > \boldsymbol{q}_i r \boldsymbol{a}$. (This inequality also implies $f(K_i) > \boldsymbol{q}_i r \boldsymbol{a} n K_i = \boldsymbol{q}_i r \boldsymbol{a} \boldsymbol{S}_{l=1..n} K_l$). Consequently,

$$\frac{dK_i}{d\boldsymbol{t}_i} = \frac{f'(K_i) - \boldsymbol{a}\boldsymbol{q}_i r}{(1-\boldsymbol{t}_i) f''(K_i)} < 0$$

(ii) Two last terms of expression (7) are negative and they increase with the increase in the number of plants $n$. When $n$ exceeds a certain value $N$, expression (7) becomes negative, and to preserve the equality the optimal value of $\boldsymbol{q}_i$ should be put equal to zero.

(iii) From (A1) the following expression for $\boldsymbol{q}_i$ is obtained:

$$\boldsymbol{q}_i = \frac{f'(K_i) + f''(K_i)\frac{1-\boldsymbol{t}_i}{\boldsymbol{t}_i}\sum_{l=1..n} K_l}{n r \boldsymbol{a}}$$

Rewriting the expression for $\boldsymbol{S}_{l=1..n}\boldsymbol{q}_l = n\boldsymbol{q}_i$ and substituting the expression for $f'(K_i)$ from (2):

$$\sum_{l=1..n}\theta_l = \frac{1}{\alpha} + \left(\frac{1-\tau_i}{\tau_i}\right)^2 f''(K_i)\sum_{l=1..n}K_l < \frac{1}{\alpha}$$

since $f''(K_i)<0$. Now $\tau_i > \alpha\tau_i \sum_{l=1..n}\theta_l = \alpha\sum_{l=1..n}\tau_l\theta_l$.

*Proof of Proposition 2*

(i) If $\rho_i = 1$, (10) and (11) become:

$$\tau_i[(f'(K_i) - r\theta_i)\frac{dK_i}{d\tau_i} - r\theta_i\sum_{l\neq i}\frac{dK_l}{d\tau_i}] = 0.........(10.A)$$

$$\tau_i[-(f'(K_i) - r\theta_i)\frac{dK_i}{d\theta_i} + r\theta_i\sum_{l\neq i}\frac{dK_l}{d\theta_i}] = 0.........(11.A)$$

$\tau_i = 0$, $\theta_i$ - *any* presents a feasible solution.

Assuming $\tau_i \neq 0$, from (14) we get: $f'(K_i) = r\theta_i$. Substituting this result into (11) yields $\theta_i$=0, any $\tau_i \neq 0$ as a solution. This solution does not however lead to an equilibrium world-wide ($f'(K_i) = r\theta_i = 0$, what implies $K_i = \infty$; this is not a feasible solution as can be checked by substituting it in optimisation problems of other countries).

(i) Analogous to Proposition *1(i)* above

(ii) Follows from $\tau_i=0, \theta_j=0$ and $\tau_i=0, \theta_j>0$.

**Appendix B.**

In this appendix we provide a numerical example based on the model simulation for a case with countries differing with respect to the ownership in the multinational, and this ownership lying between 0 and 1. The simulation proceeds as follows: 2 countries are considered with ownership parameters changing from 0 to 0.49 and from 0.51 to 0.99, correspondingly. The production function is taken to be $ln(K_i+1)$, the other exogenous parameters are set to $r=0.45$, $\alpha=0.3$. Countries can choose tax system parameters from a discrete set: $\tau_i \in [0;0.9]$, $\theta_i \in [0;1]$ with an interval of 0.1. The optimal tax systems parameters for both countries are calculated as an outcome of the Nash game in pure strategies.

Table 1 presents outcomes of the Nash game for 17 pairs of ownership parameters and is to be read as follows. Ownership shares for countries 1 and 2 are given in the first two columns, correspondingly; changes are taken with an interval of 0.03. Four next columns present values of optimal tax system parameters for countries (note that due to the discrete character of the game, in several cases more than 1 Nash solutions are possible). The last three columns consider the character of distortions of capital decisions the tax systems yield (see discussion of possible distortion outcomes in section 2.2). Thus, column $a\Sigma$ reports the values of $aS_{l=1,2}t_lq_l$ which can be compared with the values of the tax rates in countries ($t_i>aS_{l=1,2}t_lq_l$ implies a net tax on capital in country *i*, $t_i<aS_{l=1,2}t_lq_l$ implies a net subsidy on capital in country *i*, $t_i=aS_{l=1,2}t_lq_l$ implies non-distortion). The next two columns present proxies for how much the value of capital employed in country *i* deviates from its optimal value in this country (the term calculated in the column for country *i* equals *f'(Ki)/r*, and should be equal to 1 in the optimal situation).

The value of a country's ownership of the multinational does indeed influence the distortive character of the world tax system with respect to capital in this country. Thus, as we could expect on the basis of the theoretical results, in a country having a larger ownership of the company the distortion of capital and production decisions will generally be smaller than in a country having a smaller ownership of the multinational. However, the current results should be treated carefully and account should be taken of the influence of the discrete character of the game on the outcomes.

Table 1. Simulation results.

| $\rho_1$ | $\rho_2$ | $\tau_1$ | $\theta_1$ | $\tau_2$ | $\theta_2$ | $a\Sigma$ | $(1-\tau_1)/(1-a\Sigma)$ | $(1-\tau_2)/(1-a\Sigma)$ |
|---|---|---|---|---|---|---|---|---|
| 0.49 | 0.51 | 0.7 | 0.4 | 0.7 | 0.4 | 0.168 | 2.773 | 2.773 |
| 0.49 | 0.51 | 0.8 | 0.5 | 0.8 | 0.4 | 0.216 | 3.92 | 3.92 |
| 0.49 | 0.51 | 0.8 | 0.4 | 0.8 | 0.5 | 0.216 | 3.92 | 3.92 |
| 0.46 | 0.54 | 0.7 | 0.4 | 0.7 | 0.4 | 0.168 | 2.773 | 2.773 |
| 0.46 | 0.54 | 0.8 | 0.4 | 0.8 | 0.5 | 0.216 | 3.92 | 3.92 |
| 0.43 | 0.57 | 0.7 | 0.4 | 0.7 | 0.4 | 0.168 | 2.773 | 2.773 |
| 0.43 | 0.57 | 0.8 | 0.4 | 0.7 | 0.5 | 0.201 | 3.995 | 2.663 |
| 0.4 | 0.6 | 0.7 | 0.4 | 0.7 | 0.4 | 0.168 | 2.77 | 2.773 |
| 0.4 | 0.6 | 0.8 | 0.4 | 0.7 | 0.5 | 0.201 | 3.995 | 2.663 |
| 0.37 | 0.63 | 0.8 | 0.4 | 0.7 | 0.5 | 0.201 | 3.995 | 2.663 |
| 0.34 | 0.66 | 0.8 | 0.4 | 0.7 | 0.5 | 0.201 | 3.995 | 2.663 |
| 0.34 | 0.66 | 0.8 | 0.3 | 0.7 | 0.6 | 0.198 | 4.01 | 2.673 |
| 0.31 | 0.69 | 0.8 | 0.3 | 0.7 | 0.6 | 0.198 | 4.01 | 2.673 |
| 0.28 | 0.72 | 0.8 | 0.4 | 0.7 | 0.5 | 0.201 | 3.995 | 2.663 |
| 0.28 | 0.72 | 0.8 | 0.3 | 0.7 | 0.6 | 0.198 | 4.01 | 2.673 |
| 0.25 | 0.75 | 0.8 | 0.4 | 0.7 | 0.5 | 0.201 | 3.995 | 2.663 |
| 0.25 | 0.75 | 0.8 | 0.3 | 0.7 | 0.6 | 0.198 | 4.01 | 2.673 |
| 0.22 | 0.78 | 0.8 | 0.3 | 0.7 | 0.6 | 0.198 | 4.01 | 2.673 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0.22 | 0.78 | 0.8 | 0.4 | 0.7 | 0.5 | 0.201 | 3.995 | 2.663 |
| 0.19 | 0.81 | 0.8 | 0.3 | 0.6 | 0.6 | 0.18 | 4.1 | 2.05 |
| 0.16 | 0.84 | 0.8 | 0.3 | 0.6 | 0.6 | 0.18 | 4.1 | 2.05 |
| 0.13 | 0.87 | 0.8 | 0.3 | 0.6 | 0.6 | 0.18 | 4.1 | 2.05 |
| 0.13 | 0.87 | 0.8 | 0.2 | 0.6 | 0.7 | 0.174 | 4.13 | 2.065 |
| 0.1 | 0.9 | 0.8 | 0.2 | 0.5 | 0.6 | 0.138 | 4.31 | 1.724 |
| 0.07 | 0.93 | 0.8 | 0.2 | 0.5 | 0.7 | 0.153 | 4.235 | 1.694 |
| 0.07 | 0.93 | 0.7 | 0 | 0.4 | 0.7 | 0.084 | 3.053 | 1.527 |
| 0.04 | 0.96 | 0.8 | 0.1 | 0.4 | 0.7 | 0.108 | 4.46 | 1.487 |
| 0.04 | 0.96 | 0.7 | 0 | 0.3 | 0.7 | 0.063 | 3.123 | 1.339 |
| 0.04 | 0.96 | 0.8 | 0 | 0.4 | 0.8 | 0.096 | 4.52 | 1.507 |
| 0.01 | 0.99 | 0.7 | 0 | 0.1 | 0.7 | 0.021 | 3.263 | 1.088 |

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