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Roman Römisch and Markus Leibrecht

An Alternative Formulation of the Devereux-Griffith Effective Average Tax Rates for International Investment

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Roman Römisch and
Markus Leibrecht

An Alternative Formulation of the Devereux-Griffith Effective Average Tax Rates for International Investment

Roman Römisch is research economist at wiiw. Markus Leibrecht is Assistant Professor at the Institute of Public Sector Economics, Vienna University of Economics and Business Administration.

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Abstract

The paper originates from the casual observation that the application of the Devereux and Griffith methodology to calculate bilateral effective average tax rates (BEATRs) leads to results indicating that BEATRs for German outbound investment increased sharply from 1999 to 2001, despite a marked reduction of the statutory corporate tax rate in Germany and more or less unchanged tax systems in the other EU countries. In reviewing the Devereux and Griffith methodology we find that this inconsistent result is due to the way split-rate corporate tax systems are accounted for. Thus, in the original Devereux-Griffith framework only FDI home-country tax provisions are considered, while a possible existence of a split-rate system in the FDI host country is completely neglected.

Moreover we find that debt financing of an outbound investment is not correctly specified in the Devereux and Griffith methodology.

In this paper we propose a revised methodology which takes into account home- and host-country split-rate systems as well as international aspects of debt financing more thoroughly.

The application of the revised methodology to the original data yields more plausible results than does the original methodology. Most importantly, the observed increase in the German BEATRs due to abolition of the split-rate system is avoided under the revised methodology.

Keywords: *foreign direct investment, multinational enterprise, taxation, effective tax rates*

JEL classification: *H2, F21, F23*

Roman Römisch and Markus Leibrecht

An Alternative Formulation of the Devereux-Griffith Effective Average Tax Rates for International Investment

1 Introduction

This paper originates from the casual observation that from 1999 to 2001 the bilateral effective average tax rates (BEATRs) for Germany's outbound investment into other EU member states increased, despite a marked reduction of the statutory corporate tax rate in Germany and more or less unchanged tax systems in the other EU countries (EC, 2001). In reviewing the methodology underlying the BEATRs, which was developed by Devereux and Griffith (1999 and 2003), we find that the increase in the BEATRs is due to abolition of the split-rate system in 2001 (see also EC, 2001). Taking a closer look at the way split-rate systems are included in the Devereux-Griffith framework (DG-methodology) reveals that only the home-country split-rate is considered in the DG-methodology, which is also made explicit in EC (2001). Two methodological points arise from this. First, quite implausibly, the home-country split-rate determines the BEATR even in the case of the outbound investment being solely financed by retained earnings of the subsidiary. Second, the possibility of a host-country split-rate is not considered at all. We show that the first point in particular leads to the observed increase in the BEATR for German outbound investment despite the marked drop in the statutory tax rate.

Thus, although the DG-methodology works well under normal conditions, it fails to properly take into account situations in which a home or a host country applies a split-rate system in corporate taxation (such as Germany until 2001), with different statutory tax rates for distributed profits and retained earnings. Therefore, in this paper the original DG-methodology to calculate the tax burden on an international investment is reformulated so as to properly account for such cases.

Moreover, a closer examination of the original DG-methodology reveals a misspecification of the BEATRs in the case of an international investment being financed by debt – independent of whether a country applies a split-rate corporate tax system. This is also taken account of in this paper and an alternative methodology to correctly calculate BEATRs in the case of an investment being finance by debt is developed.

The application of the revised DG-methodology to the data on which our initial observation was built shows that our reformulated version yields more plausible results than the original DG-methodology. Specifically, the observed increase in the BEATR due to abolition of a split-rate is avoided.

The paper is structured as follows: Section 2 repeats the basic DG-model for the calculation of EATRs for domestic investment. Beyond the usual formulation of the model we explicitly derive the ‘opportunity costs’ of a split-rate corporate tax system, given that the investment can be financed via retained earnings, issuing new equity or raising new debt. This facilitates the derivation of an alternative to the original DG-methodology for international investment. Section 3 extends the approach of section 2 to international investment and develops an alternative methodology that correctly takes into account the application of a split-rate corporate tax system, as well as a proper formulation for BEATRs with respect to debt financing. In section 4 the German BEATRs for 1999 are calculated by the proposed alternative methodology as well as by the original DG-methodology. Following this, the impact of the German tax reform in 2001 on the BEATRs for German inbound and outbound investment are shown using both methodologies. Section 5 provides conclusions.

2 The EATR for domestic investment

The basic approach of Devereux and Griffith (further on: DG; 1999, 2003) to calculate the effective average tax rate (EATR) of an infra-marginal investment[1] with a given pre-tax rate of return is to assume a one-period perturbation in the capital stock K (i.e., a one-period investment) of a fully shareholder-owned firm, and to calculate the net present value (NPV) this investment generates for a shareholder before and after taxation.

More formally, in period t ($dI_t=1$), a firm invests one unit of capital, so that also $dK_t=1$; yet, since this is only a one-period perturbation in the capital stock, it reduces investment in period t+1 by $dI_{t+1} = -(1-\delta)(1+\pi)$, so that $dK_s=0$ (for all $s \neq t$), with δ being the economic depreciation rate and π being inflation. The increase in K generates an increase in output Q in period t+1 of $dQ_{t+1} = p+\delta$, with p representing the real financial return, and an increase of revenues of $(1+\pi)(p+\delta)$.

It follows that in absence of taxation and independently of how the investment is financed (see below) the NPV of this investment R* for a shareholder is given by (see DG, 1999 for the derivation):

$$R^* = \frac{p-r}{1+r} \tag{1}$$

with r being the real interest rate.

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[1] An infra-marginal investment earns after-tax pure profits, and is the basis for the calculation of EATRs, while a marginal investment only yields the minimum required rate of profit (i.e. after-tax profits are zero) and is the basis for the effective marginal tax rates (EMTR).

Defining R to be the NPV after taxation, the EATR on an investment is, according to DG, defined as

$$EATR = \frac{R^* - R}{\frac{p}{1+r}} \qquad (2)$$

In the DG model the post-tax R is affected by the way a firm finances an investment, which it could do either through retained earnings, or through accessing the capital market by issuing new equity or raising debt. In order to show the effects of the three ways of financing on R it is convenient to split R into two parts: (a) the NPV attributable to investment financed by retained earnings (R^{RE}), and (b) the additional cost of raising external finance by the domestic firm (F), which could be either through issuing new equity (N) or raising debt (D).

Consequently the NPV of the post-tax economic rent (R) of an investment project can be written as:

$R = R^{RE} + F$.

Starting with R^{RE}, the post-tax NPV of an investment financed by retained earnings is:

$$R^{RE} = -\gamma\underbrace{(1-A)}_{I} + \frac{\gamma}{1+\rho}\left\{\underbrace{(1+\pi)(p+\delta)(1-\tau^{RE})}_{II} + \underbrace{(1+\pi)(1-\delta)(1-A)}_{III}\right\} \qquad (3)$$

In this formula the expression above

I) is the NPV of the cost of investment, A being the net present value of depreciation allowances for tax purposes ϕ;

II) refers to the financial return of the investment in period t+1 taxed at the statutory corporate tax rate for retained earnings τ^{RE};

III) is the NPV of the reduction of investment in period t+1.

The terms γ and $\gamma/(1+\rho)$ respectively adhere to the shareholders' sphere, with γ measuring the tax discrimination between new equity and distributions (in other words, it is the shareholder's net income of a one-unit increase of the dividends). Thus, γ is defined as $\gamma = (1-m^d)/(1-c)(1-z)$, m^d being the personal income tax on dividends, z is the accruals equivalent capital gains tax rate and c is the net withholding tax rate imposed on cash dividends paid by the firm to the shareholder. Likewise, ρ is the shareholder's nominal discount rate and is given by $\rho = (1-m^i)i/(1-z)$, m^i being the personal tax rate on interest income, and i being the nominal interest rate.

In the empirical analysis of company taxation, the shareholders' sphere is usually neglected (as it is assumed that a firm wants to maximize the post-tax returns of an investment independently of personal taxation; furthermore, the inclusion of the shareholders' sphere would imply to pinpoint the 'median'-shareholder, whose personal sphere is relevant, but which is virtually impossible to do), so that γ and $(1+\rho)$ are mostly set to 1. However, there is one exception to that. If there is a split-rate corporate tax system in operation (such as in Germany until 2001 or in Estonia from 2000 onwards), which applies different tax rates to distributed profits and retained earnings, then γ can no longer be considered to be 1. In the absence of personal taxes and given the existence of a split-rate system, γ reduces to $\gamma = 1/(1-c)$, which is equal to $\gamma = (1-\tau^D)/(1-\tau^{RE})$ (EC, 2001). That is, γ reflects the tax wedge between the tax rate on distributed profits and the tax rate on retained earnings. Additionally, in absence of personal taxes, ρ reduces to i.

It can easily be shown that this is a quite sensible assumption. For example, looking at term II in (3) above, this represents the financial return of the investment which is paid out as a dividend to the shareholder, and initially is taxed with the tax rate for retained earnings (τ^{RE}). However, under a split-rate corporate tax system this financial return, if it is distributed, has to be taxed with the tax rate for distributed profits (τ^D). Applying γ corrects for this, so that the actual financial return that is paid out is: $(1+\pi)(p+\delta)(1-\tau^D)$.

For the terms I and III in (3) above the interpretation of γ is similar. Term I represents those earnings that have to be retained in order to finance the investment in period t (I). These retained earnings are assumed in the model to stem from previously incurred profits, which – as they have not been distributed – have been subject to the tax rate for retained earnings (τ^{RE}). Since in principle they could have been paid out (in the case of no investment), they would have been taxed with the tax rate for distributed profits (τ^D), so that the shareholder would have received

$$\frac{(1-A)}{(1-\tau^{RE})}(1-\tau^D) \tag{4}$$

with the left term $(1-A)/(1-\tau^{RE})$ corresponding to the original profits before taxation that have been retained in order to finance the investment. However, as the original profits are retained, the loss in the NPV (the opportunity costs of the investment) for the shareholder is equal to (4), which is in fact term I multiplied by γ.

In period t+1 it is assumed that the investment is reversed, the investment assets are sold and the cash amount distributed to the shareholder as dividends. Since this cash amount directly relates to the retained earnings in period t, they have previously been subject to the tax for retained earnings (τ^{RE}). However, as they are paid out in period t+1, they are now taxed with the tax rate for distributed profits (τ^D), assuming that the company can claim back the difference between the tax for retained earnings and distributed profits respectively, in order to avoid double taxation of its income. This is implemented in the model by the multiplication of term III by γ.

Importantly, in the case of a split-rate corporate tax system, financing an investment by retained earnings results – from a shareholder's perspective – in additional opportunity costs (in the form of higher or lower forgone dividends) compared to a tax system without a split rate.

Formally, this can be shown by calculating the difference of the NPV of the retained earnings in period t and t+1, i.e. taking the difference between term I and term III in (3). As already mentioned, in period t the NPV of the investment to the shareholder is reduced by (4) because profits are retained to finance the investment, while in t+1 the investment is reversed and basically distributed to the shareholder, indicated by term III. However, the amount paid to the shareholder in period t+1 is lower than the amount he would have received in period t as the investment asset has depreciated – indicated by $(1-\delta)$ in term III, using the common assumption that $\rho=i$, so that $(1+\pi)$ / $(1+\rho)$ equals $(1+r)$. Taking only terms I and III from (3) this difference can be written as:

$$\gamma(1-A)\frac{-r-\delta}{1+r} \tag{5}$$

In the absence of a split-rate system, $\gamma = 1$, and the difference between I and III would be the economic depreciation of the investment asset plus the discounted value of the dividends forgone in period t. In the case of $\gamma \neq 1$, though, different opportunity costs, in the form of forgone dividends, arise.

Assuming for the moment that $\tau^{RE} > \tau^{D}$, which corresponds to the German case to which we have referred in the introduction, τ^{RE} can also be defined as $\tau^{D} + a$, with a being the difference $\tau^{RE} - \tau^{D}$. Thus γ can be written as $(1 - \tau^{D}) / (1 - \tau^{D} - a)$, and can be readily transformed into $\gamma = 1 + (a / (1 - \tau^{D} - a))$. Using this expression in (5) then yields the full loss or gains of financing an investment via retained earnings:

$$-(1-A)\frac{r+\delta}{1+r}-\frac{1-A}{1-\tau^{RE}}\frac{r+\delta}{1+r}\left(\tau^{RE}-\tau^{D}\right) \tag{6}$$

Thus, in addition to the costs that would have been incurred if $\gamma = 1$, given that $\tau^{RE} > \tau^{D}$, higher opportunity costs (in the form of forgone dividends) arise because of the split rate system. In this case the last term in (6) can be viewed as a kind of depreciation tax levied upon the original profits before taxation (compare to (4)), since they have not been distributed in period t.

In the case of $\tau^{RE} < \tau^{D}$ the last term in (6) is positive, and thus represents the gain in the form of lower opportunity costs involved of not distributing profits in period t, but retaining them to finance an investment.

Before looking at the aspects of international investment, it is necessary to show how debt financing (D) and financing by new equity (N) change the post-tax NPV of an investment in the domestic case.

In the case of N, the firm issues in period t new equity of $1-\phi\tau$ to finance an investment of 1, since an immediate tax allowance of $\phi\tau$ can be claimed. It assumed that this new equity is bought by the original shareholder, so that in period t he has to contribute $1-\phi\tau$ in new equity. Yet, unlike in the case of retained earnings, he also receives dividends in period t of $\gamma(1-\phi\tau)$ as the investment is now financed through the resources obtained from the issuing of new equity instead of retained earnings. In period t+1 it is assumed that the firm repurchases the issued new equity at the original price. This reduces profits and the shareholder loses dividends. But, instead he receives funds from the repurchasing of new equity. Thus the effect on the post-tax NPV of an investment by raising finance through new equity F^N can be written as:

$R = R^{RE} + F^{N}$

with

$$F^{N} = -(1-\gamma)(1-\phi\tau^{RE}) + \frac{(1-\gamma)(1-\phi\tau^{RE})}{1+\rho} = -\rho\frac{(1-\gamma)(1-\phi\tau^{RE})}{1+\rho} \tag{7}$$

In the case of financing by debt, the firm borrows an amount of $1-\phi\tau$ in period t (from some third party) and repays this debt including interest of $(1-\phi\tau)i$ in period t+1. Since interest is usually deductible from firm profits, which reduces the corporate tax liability, this lowers the costs of debt financing by $(1-\phi\tau)i\tau$. As in the case of new equity, the shareholder does not have to give up dividends in period t but dividends in period t+1 are reduced in order to repay the debt. Therefore, the post-tax NPV of the investment, if it is financed by debt, is:

$R = R^{RE} + F^{D}$

with

$$F^{D} = \gamma(1-\phi\tau^{RE}) - \frac{\gamma(1-\phi\tau^{RE})(1+i(1-\tau^{RE}))}{1+\rho} = \frac{\gamma(1-\phi\tau^{RE})(\rho-i(1-\tau^{RE}))}{1+\rho} \tag{8}$$

Just as in the case of R^{RE}, the existence of a split-rate system induces additional opportunity costs upon an investment as it changes the level of F^N and F^D respectively. To show this it is useful to first look at the gains or losses involved in financing an investment with new equity or debt in the absence of a split-rate system.

In the case of new equity finance and in the absence of a split-rate system, γ is set to 1 in (7) and the resulting F^N is zero. Hence financing via new equity does not result in a different NPV than financing via retained earnings. Intuitively this is because in the absence of a split-rate system the shareholder in period t, although he has to invest an amount $(1-\phi\tau)$ in new shares, receives the same amount immediately back in the form of dividend payments, while in period t+1 he forgoes some dividends but again receives the amount of the forgone dividends in the form of a repurchasing of the shares he has bought in period t.

Setting $\gamma = 1$ in (8) yields the difference in the NPV between financing via retained earnings and debt financing (without a split rate). Given that ρ equals i, (8) is strictly positive and thus debt financing raises the NPV of the investment. Intuitively this is because the shareholder benefits from the deduction of the interest payments from the taxable profits (using the assumption that ρ equals i, that is all personal income taxes are set to zero).

Corresponding to R^{RE}, the opportunity costs of an investment financed by new equity or debt under a split-rate system can be shown formally to be:

$$F^N = 0 + \frac{\rho}{1+\rho}\frac{1-\phi\tau}{1-\tau^{RE}}\left(\tau^{RE}-\tau^D\right) \tag{9}$$

$$F^D = \frac{(1-\phi\tau)(\rho - i(1-\tau))}{1+\rho} + \frac{(\rho - i(1-\tau))}{1+\rho}\frac{(1-\phi\tau)}{1-\tau^{RE}}\left(\tau^{RE}-\tau^D\right) \tag{10}$$

Hence, both, in the case of new equity finance and in the case of debt financing, the resulting F^N and F^D is equal to F^N or F^D in the absence of a split-rate system (which is zero in the case of new equity finance) plus additional costs induced through the split-rate system.

From (9) it follows that, given $\tau^{RE} > \tau^D$, and hence $\gamma > 1$, F^N is larger than zero, and the NPV of the investment increases, while the NPV decreases if $\tau^{RE} < \tau^D$.

The effects of a split rate on F^D are more complicated. Thus, from (10) it follows that – unless $\tau^{RE} = 0$ and $\tau^D = 1$ (i.e. a tax rate of 100 per cent), resulting in F^D being 0 – F^D always stays positive under standard assumptions of positive tax rates and positive interest rates. Therefore, the size of τ^{RE} and τ^{D} and hence γ only affect the size of the gains of debt financing of an investment.

The intuition behind the positive F^N in case of $\gamma > 1$ is that in period t the shareholder receives a dividend of γ (1-$\phi\tau$) that is larger than the amount of (1-$\phi\tau$) he has to pay for the new equity. Hence in period t the shareholder has a net gain of ((γ-1) (1-$\phi\tau$)). On the other hand, in t+1 he receives (1-$\phi\tau$) in the form of the repurchased new equity, but at the same this reduces dividends worth γ (1-$\phi\tau$) to the shareholder, so that he incurs a net loss. Yet, as this net loss is discounted by (1+ρ) the overall net effect combining period t and period t+1 is positive – and vice versa for $\gamma < 1$.

The intuition for the effect of $\gamma \neq 1$ upon F^D is as follows. In period t the shareholder receives γ (1-$\phi\tau$) as dividends but has no expenses because the investment (1-$\phi\tau$) is financed by debt, and thus his net gain is equal to the amount of dividends. In t+1 the firm repays the debt plus interest. *Per se*, this reduces dividends by (1-$\phi\tau$)(1+i). For the shareholder the NPV of this reduction is equal to the net gain in period t, as the reduced dividends in t+1 are discounted by (1+ρ), given that ρ = i. However, as the interest on debt is deductible from the corporate tax base, the reduction in the dividends is less than (1-$\phi\tau$)(1+i), namely (1-$\phi\tau$)(1+i(1-τ)).

Hence, over both periods the overall net gain of debt financing in the NPV to the shareholder is only due to the tax deductibility of interest and is equal to γ (1-$\phi\tau$) (iτ). Consequently, and unless γ=0, the NPV is always positive, yet the net gains to the shareholder are higher if γ>1 and hence $\tau^{RE} > \tau^{D}$.

3 The EATR for international investment (BEATR)

The DG-methodology to calculate EATRs for domestic investment can readily be extended to the case of international investment (or foreign direct investment, FDI), with the assumption that a (fully shareholder-owned) parent firm in the home country j undertakes an investment through a fully-owned subsidiary in a host country n. In contrast to the domestic case, applying the DG-methodology to international investment requires the introduction of additional layers of taxation: the host-country tax code and international (and supranational) aspects of taxation, referring to the flow of income from the subsidiary to the parent, the straightforward cases being dividends and interest payments.

To account for international taxation, two parameters (σ, ω) are added to the model. Parameter σ refers to the total tax due to the repatriation of one unit of dividends from the subsidiary to the parent company and basically includes a withholding tax levied on dividends plus additional taxes levied by the home country j. Similarly, ω refers to a withholding tax on interest income levied by the host country n plus additional taxes imposed by the home country j. The actual size of σ and ω crucially depends on how the home country treats foreign-source dividend and interest income. There are three possible ways: (i) an exemption system, where foreign-source income is not taxed; (ii) a credit-with-limitation system, where the withholding tax on interest or dividends paid in the host country n can be credited against the tax liability in the home country j; and (iii) a deduction system, where the paid withholding tax in the host country n reduces the corporate tax base in the home country j.

According to DG (1999) σ, ω can be modelled for (i) - (iii) in the following way, with w_n being the withholding tax paid in the host country n:

$$\sigma = \begin{cases} w_n & \text{exemption} \\ \max\left(\frac{\tau_j - \tau_n}{1-\tau_n}, w_n\right) & \text{credit with limitation} \\ \tau_j(1-w_n) + w_n & \text{deduction} \end{cases}$$

and

$$\omega = \begin{cases} w_n - \tau_n & \text{exemption} \\ \max(\tau_j, w_n) - \tau_n & \text{credit with limitation} \\ \tau_j(1-w_n) + w_n - \tau_n & \text{deduction} \end{cases}$$

In the absence of taxation, the pre-tax economic rent R* of an international investment can be shown to be identical to the R* of the domestic case, with the exception that the real financial return p now refers to the host country n (indicated by the subscript n):

$$R^* = \frac{p_n - r}{1+r}$$

In order to calculate the post-tax NPV R of an international investment, not only the corporate tax code has to be taken into account, but also the way in which this investment is financed has to be considered, as this is different from the domestic case. This is because the subsidiary can finance its investment via retained earnings, or via issuing new equity to the parent or raising debt from the parent[2], while the parent retains its three options from the domestic case to finance this investment. This results in seven different ways to finance a FDI:

2 The subsidiary's possibility to raise debt in the host country n is excluded in the Devereux-Griffith methodology.

(a) financing by retained earnings; (b) financing by retained earnings (parent) and new equity (subsidiary); (c) financing by retained earnings (parent) and debt (subsidiary); (d) financing by new equity (parent) and new equity (subsidiary); (e) financing by new equity (parent) and debt (subsidiary); (f) financing by debt (parent) and new equity (subsidiary); (g) financing by debt (parent) and debt (subsidiary). Thus, in contrast to the domestic case, the post-tax NPV R of an international investment (R_n) can now be split into three parts: (i) the NPV attributable to the investment financed by retained earnings ($R^{RE}{}_n$); (ii) the additional cost of raising external finance by the parent firm in the home country (F_j); and (iii) the additionally cost of the subsidiary raising finance from the parent company (F_n).

R_n can be written as

$R_n = R^{RE}{}_n + F_j + F_n$

Starting with the post-tax NPV of an international investment financed only by retained earnings – case (a) above – it is given by:

$$R_n^{RE} = \gamma(1-\sigma)\left\{-(1-A_n)+\frac{E(1+\pi_n)(p_n+\delta)(1-\tau_n^{RE})+E(1+\pi_n)(1-\delta)(1-A_n)}{1+\rho}\right\} \tag{11}$$

In contrast to the NPV of a domestic investment financed by retained earnings (R^{RE}), the NPV of an international investment is adjusted for the tax on repatriated dividends (indicated by the term 1-σ)), and for the exchange rate, which in period t is normalized to 1 and in t+1 has the value E. Furthermore, since the investment is undertaken in the host country n, all variables with respect to taxation or the economic background now pertain to the host country n. This is indicated by the subscript n in (11).

The crucial point in (11) is γ. As stated above, γ reflects the tax wedge between taxes on distributed profits (τ^D) and taxes on retained earnings (τ^{RE}) in the absence of personal income taxes. In DG (1999, 2003), EC (2001) and Yoo (2003), γ is explicitly defined to reflect the home country's j tax wedge, thus γ is denoted there by γ_j. This definition is explicitly founded on the assumption that the parent company in country j pays its dividends to the shareholder from domestic profits (EC, 2001).

However, the definition of γ as γ_j. is not without problems, particularly for the base case shown in (11) – financing the FDI by retained earnings (case (a) above).

The definition of γ as γ_j implies that in the case of a split rate in the home country, the opportunity costs for the shareholder in the form of forgone dividends due to retained earnings is determined by the home-country tax rates. As already mentioned, this can only be the case if one assumes that all dividends to the shareholder are paid from domestic profits, as domestic profits are taxed by τ_j.

An alternative view is that the split-rate system of the home country is irrelevant for the opportunity costs, which accrue to the shareholder in period t due to financing the investment by retained earnings (case (a) above). Instead, these opportunity costs are determined by a possible split-rate system in the host country: if the subsidiary finances its investment by retained earnings, then – in period t – the parent company forgoes net dividends. If these (hypothetical) dividends are not additionally taxed[3] with the home-country corporate income tax rate, then the opportunity costs for the shareholder are exactly the same as for the parent company. Hence the net dividends forgone should not be multiplied with γ_j, which basically represents additional taxes upon foreign dividends. Only a possible γ_n, which determines the net dividends forgone, has to be considered. As, according to our understanding, foreign dividends are not additionally taxed by the corporate income tax of the home country, this alternative view seems to be more appropriate than that held in the original DG-methodology.

Therefore γ, which accounts for the tax discrimination between distributed profits and retained earnings, should in principle reflect the host country's n tax wedge between taxes on distributed profits ($\tau^D{}_n$) and taxes on retained earnings ($\tau^{RE}{}_n$). As a consequence, we define γ in (11) to pertain to the host country's tax discrimination, hence we write γ_n instead of γ_j as found in all other studies.

The re-interpretation of γ also has effects on the formulation of the changes in the NPV of an international investment, given the subsidiary's possibilities to finances this investment by raising debt from the parent or by issuing new equity to the parent instead of financing by retained earnings.

As far as new equity finance is concerned, the assumption is that in period t the subsidiary issues new equity to the parent company in order to finance an investment of 1 in the host country n. Thus, given that an immediate tax allowance of $\phi\tau$ can be claimed, the parent has to spend $(1-\phi_n\tau_n)$ in order to purchase the new equity, which the parent company finances either by debt, new equity or retained earnings. At the same time though, because the subsidiary's investment is financed via new equity and not via its retained earnings, the subsidiary distributes the latter as dividends to the parent. Hence the parent receives $(1-\sigma)(1-\phi_n\tau_n)$ as dividend payments, taking into account dividend taxation (σ) in the home and host country.

[3] This means that they are subject to neither withholding taxes (exemption system) nor to taxes according to the credit system. Put differently, foreign dividends are not part of the domestic tax base of a parent company, and hence are not subject to separate corporate income taxation.

To the shareholder the NPV of the investment in period t depends on how the parent finances the purchase of the new equity.

In case the parent used its retained earnings (case (b) above) the NPV to the shareholder in period t is derived as follows: In order to spend $(1-\phi_n\tau_n)$ on the new equity in period t, the parent company has to lower dividend payments to the shareholder by that amount. The important point here is that it is assumed that these forgone dividends would have been paid out of the home country's j profits. Thus the home-country tax wedge applies. Hence the value of the forgone dividends to the shareholder is $\gamma_j(1-\phi_n\tau_n)$.

At the same time the parent receives dividends from the subsidiary, which it passes on to the shareholder, so that to the shareholder the value of these dividends is $\gamma_n(1-\sigma)(1-\phi_n\tau_n)$. Importantly, γ pertains to the host country n – for the same reasons as in the case of dividends from retained earnings (as foreign dividends are not part of the domestic corporate tax base).

In period t+1 the new equity is repurchased by the subsidiary. Hence the parent company receives $E(1-\phi_n\tau_n)$ from the repurchasing of new equity by the subsidiary, but at the same time it loses dividends from the subsidiary (as the profits of the subsidiary are reduced by repurchasing of new equity) of $E(1-\sigma)(1-\phi_n\tau_n)$. Following the arguments above the value to the shareholder of these two items is $\gamma_j E(1-\phi_n\tau_n)/(1-\rho)$[4] for the repurchased new equity and $\gamma_n E(1-\sigma)(1-\phi_n\tau_n)/(1-\rho)$ for the forgone dividends.

Thus the total post-tax NPV of an international investment financed by the subsidiary through new equity and by the parent company through retained earnings (case (b) above) can be written as:

$R_n = R^{RE}_n + F_n^N$

with

$$F_n^N = (1-\phi_n\tau_n)\left(1-\frac{E}{1+\rho}\right)\{\gamma_n(1-\sigma)-\gamma_j\} \qquad (12)$$

In contrast to the DG-methodology, the effects of financing via new equity depend not only on the home country's tax wedge (γ_j), but also to the host country's tax wedge (γ_n). Thus, in correspondence to (9), this version takes into account that the mere existence of a split-rate system, either in the home or host country, has an additional effect on the NPV of an

4 Note that γ_j is used for the parent company's revenue from repurchased new equity as these payments are not taxed in the host country. Instead, they lower the corporate tax base in the host country. Hence, we assume that revenues from repurchased dividends are taxed in the home country.

investment, while in the absence of a split-rate system, ($\gamma_j=\gamma_n=1$) (12) reduces to the original DG- formula (DG, 2003).

In analogy to (9) the opportunity costs of financing via new equity are given by

$$F_n^N = (1-\phi\tau_n)\left(1-\frac{E}{1+\rho}\right)\left[-\sigma+\frac{\tau_n^{RE}-\tau_n^D}{1-\tau_n^{RE}}(1-\sigma)-\frac{\tau_j^{RE}-\tau_j^D}{1-\tau_j^{RE}}\right] \tag{13}$$

In (13) the first term within the square brackets ($-\sigma$) corresponds to the net effect of new equity finance on the NPV of an investment if neither the host nor the home country applies a split-rate system. Thus, unlike in the domestic case where in the absence of a split-rate system financing via new equity would have no effect on the NPV, the application of a home-country tax on international dividend payments lowers the NPV if the subsidiary raises new equity from the parent. The second term within the square brackets shows the impact a host country n split rate has on the NPV. Thus in principle the shareholder has the same advantages (or disadvantages) from new equity finance (depending on $\tau^{RE}_n > \tau^D_n$ or $\tau^{RE}_n < \tau^D_n$) as in the domestic case, only that they are reduced because of a dividend tax. The last term within the square brackets in (13) reflects the additional changes in the NPV due to a home-country split rate. Thus, in correspondence to (9), the NPV of the investment to the shareholder increases if $\tau^{RE}_n > \tau^D_n$, while it decreases if $\tau^{RE}_n < \tau^D_n$.

In the case of debt finance the subsidiary borrows from the parent the amount of ($1-\phi_n\tau_n$) in period t to finance an investment of 1. As in the case of financing by new equity, the parent company's dividends are lowered by that amount (as it is assumed that the parent finances again by retained earnings), so that the value of the reduced dividends to the shareholder is $\gamma_j(1-\phi_n\tau_n)$. Similarly, the parent company receives dividends from its subsidiary – these having a value of $\gamma_n(1-\sigma)(1-\phi_n\tau_n)$ to the shareholder. In period t+1 the subsidiary repays its debt with interest to the parent; accounting for (international) taxation on interest ω the value to the shareholder of this repayment is: $(\gamma_j(1-\phi_n\tau_n)+\gamma_j(1-\phi_n\tau_n)i(1-\omega))(E/(1+\rho))$. Simultaneously the dividends paid from the subsidiary to the parent are lowered by the repayment. Yet, since interest payments are assumed to be tax-deductible in the host country n the net-of-tax profits of the subsidiary are higher by $(1-\phi_n\tau_n)i\tau_n$. Thus the NPV of the forgone dividend payments to the shareholder is

$$-\gamma_n(1-\sigma)\{(1-\phi_n\tau_n) + i(1-\phi_n\tau_n) - (1-\phi_n\tau_n)\, i\tau_n\}(E/(1+\rho)).$$

The post-tax NPV of an international investment financed by debt financing of the subsidiary and by retained earnings of the parent company can be written as:

$$R_n = R^{RE}_n + F_n^B$$

with:

$$F_n^B = \frac{1-\phi_n\tau_n}{1+\rho}\left\{\left[\gamma_n(1-\sigma)-\gamma_j\right]\left[(1+\rho)-E(1+i)\right]+E\left(\gamma_j i\omega+\gamma_n i\tau_n^{RE}(1-\sigma)\right)\right\} \tag{14}$$

Formula (14) deviates from the original DG-methodology in two aspects. Firstly, not only the split-rate system of the home country j but also that of the host country n is taken into account. Secondly, in the original version Devereux and Griffith only account for the tax deductibility of interest payments with respect to taxation of dividend payments, thereby neglecting the fact that the actual dividend payments are higher because of the tax deductibility of interest. Thus in their formula only a term $-\sigma i\tau_n$ is included, which erroneously lowers the NPV of an international investment financed by debt. Following our derivation of F^D_n the additional term $+i\tau_n$ is added to the corresponding DG formula, which accounts for the raised profits because of the deduction of interest from the tax base.[5]

Equation (14) can be reformulated to show the opportunity costs that are involved in debt financing if a split rate is applied in the home or the host country. In correspondence to (10) the effect of debt financing on the NPV of an international investment can be reformulated as:[6]

$$F_n^B = \frac{(1-\phi\tau_n)}{1+\rho}\left\{\left[-\sigma(\rho-i)+i\tau_n^{RE}(1-\sigma)-i\omega\right]+\left[\left(\frac{\left(\tau_n^{RE}-\tau_n^D\right)}{1-\tau_n^{RE}}\left(\rho-i\left(1-\tau_n^{RE}\right)\right)\right)(1-\sigma)\right]-\left[\frac{\left(\tau_j^{RE}-\tau_j^D\right)}{1-\tau_j^{RE}}\left(i\omega+(\rho-i)\right)\right]\right\} \tag{15}$$

The first square brackets in (15) contain the effects of debt financing on the NPV in the absence of a split rate both in the home and the host country. The second square brackets contain the effects that arise if the host country applies a split rate. This term and its interpretation are identical to the second term in (10), with the exception that it now applies to the host country. Just as in the case of new equity finance any additional gains or losses because of the host country's split rate are again lowered because of the taxation of international dividend payments $(1-\sigma)$. The third square brackets in (15) reflect those changes in the NPV to the shareholder that arise because the parent company retains profits in order to lend money to the subsidiary in period t. Thus, given that $\tau^{RE}_n > \tau^D_n$, the

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5 For a comparison of the original DG formula and the corrected formula (15) we set E and γ as well as γ_n and γ_j to 1 in both formulas. Thus the DG formula is :

$$F_n^B = \frac{(1-\phi_n\tau_n)}{1+\rho}\left\{\sigma\left[\left(1+i(1-\tau_n)\right)-(1+\rho)\right]-i\omega\right\}$$

while our formula adds the term $i\tau_n$ and can be shown to be:

$$F_n^B = \frac{(1-\phi_n\tau_n)}{1+\rho}\left\{\sigma\left[\left(1+i(1-\tau_n)\right)-(1+\rho)\right]-i\omega+i\tau_n\right\}$$

6 The exchange rate E in period t+1 is set to 1 in (15). This does not change the main conclusions, yet keeps (15) in a relatively easily understandable format.

shareholder just as before would be better off if the parent distributes its profits in period t, the more so as the interest payments from the subsidiary are subject to taxation in the host and the home country.

Financing of the parent

As stated above, the parent firms also have three options to finance an international investment. The financing via retained earnings has been discussed above, as this type of financing is assumed in the derivation of the impact that different types of financing of the subsidiary have upon the post-tax NPV. However, the parent company also can raise capital via the financial market by borrowing or by issuing new equity. In principle these two ways of raising capital are identical to the domestic case, only the amount that has to be raised depends on the allowances ϕ in the host country. The impact of these two additional types of parent financing on the post-tax NPV is

$$F_j^N = -(1-\gamma_j)(1-\phi_n\tau_n) + \frac{(1-\gamma_j)(1-\phi_n\tau_n)}{1+\rho} = -\rho\frac{(1-\gamma_j)(1-\phi_n\tau_n)}{1+\rho} \tag{16}$$

for new equity and

$$F_j^B = \gamma_j(1-\phi_n\tau_n) - \frac{\gamma_j(1-\phi_n\tau_n)(1+i(1-\tau_j))}{1+\rho} = \frac{\gamma_j(1-\phi_n\tau_n)(\rho-i(1-\tau_j))}{1+\rho} \tag{17}$$

for debt financing. These terms are identical to (9) and (10), with all variables pertaining to the home country j, except for $(1-\phi_n\tau_n)$, which represents the amount invested in the host country.

Finally, the total post-tax NPV of an international R_n investment is the sum of all these elements:

$R_n = R^{RE}_n + F_j^N + F_j^B + F_n^N + F_n^B$

and the BEATR is then calculated as

$$BEATR = \frac{R_n^* - R_n}{\frac{p_n}{1+r}}$$

where R^*_n is defined similarly to the R^* in the domestic case, with the exception that the pre-tax rate of return (p) now pertains to the host country n.

4 Results

This section compares the BEATRs derived from the formulas given in section 3 with the BEATRs calculated with the original Devereux-Griffith methodology applied by the EC. As the results yielded by the formulas in section 3 and by the original DG-methodology respectively differ only if a country has a split-rate corporate tax system and thus applies different statutory tax rates to retained earnings and distributed profits, the analysis in this section focuses on the BEATRs for German outbound and inbound investment in the years 1999 and 2001. The basis of the analysis and the point of reference for the BEATRs calculated with the modified formulas are the BEATRs for German inbound and outbound investment given in the EC (2001) working paper 'Company Taxation in the Internal Market'. In order to make sure that the BEATRs based on the modified formulas correspond to the EC-BEATRs, the same assumptions as those underlying the EC-BEATRs have been used to calculate the alternative BEATRs.[7] Therefore all differences between the EC-BEATRs and the BEATRs derived from the modified formulas arise merely because of differences in the formulas and are not due to deviations in the assumptions.

Assumptions

Given the formulas, several assumptions have to be made in order to define the economic background conditions in which the hypothetical investment is made. The assumptions made for this analysis are identical to those of the EC:

- a real interest rate (a real rate of return on an alternative investment) r of 5%
- a common inflation rate π of 2%
- five different investment assets: buildings, machinery, intangibles (i.e. patents), financial assets and inventories. The actual investment is assumed to be an average over these five assets, with all five assets having the same weight.
- the true economic depreciation rate for buildings is assumed to be 3.1%, for machinery 17.5%, for intangibles 15.35%, and for financial assets and inventories zero per cent.
- three source of financing an investment: retained earnings, new equity and debt. When giving an average over these three forms of financing, they are not weighted equally: financing via retained earnings has a weight of 55%, new equity 10% and debt 35%.

Table 1 presents the results of a comparison of the BEATRs derived from the two different methodologies for German outbound investment to 13 EU countries in 1999. In this table the overall BEATRs are given, as well as the BEATRs for each of the three

[7] Most of the underlying assumptions are given in the EC (2001) working paper. However, to make sure that we follow the same line of reasoning as the EC, we first replicated the EC BEATRs (for domestic and international investment) by using the given assumptions and the Devereux-Griffith methodology. In some cases it was quite cumbersome to replicate the EU-BEATRs, as not all steps taken by the EC were clearly specified. However, we managed to exactly replicate the domestic BEATRs for 14 EU countries (excepting Italy), and as a consequence also the BEATRs for German international (inbound and outbound) investment from and in the other EU countries (again excepting Italy). Given this, we used these replicated BEATRs as a basis for our own estimates, which are thus identical to the EC-BEATRs except that modified formulas have been used.

forms of financing an investment that are available to the subsidiary, while for the parent company a weighted average form of financing is assumed (in the appendix more detailed data with respect to the alternative options of the parent's financing are given).

Given the above critique on the derivation of the formula of a subsidiary's debt financing, the BEATRs with respect to debt financing by the subsidiary are split into two groups, with the first group containing the BEATRs calculated with the original DG-formula and the latter containing the BEATRs calculated with the modified formula.[8]

Table 1

German outbound investment

		Römisch & Leibrecht						Devereux-Griffith - EU Commission					
	Parent			Overall						Overall			
	Subsidiary	Overall	Overall*	Retained earnings	New equity	Debt	Debt*	Overall	Overall*	Retained earnings	New equity	Debt	Debt*
AT		32.2	28.5	27.5	34.4	34.9	23.5	23.0	18.4	20.1	21.0	27.8	14.1
BE		36.6	32.3	32.8	39.5	37.6	24.5	28.4	23.1	26.4	27.2	31.5	15.7
DK		31.1	27.8	26.4	32.9	34.1	24.1	21.7	17.7	18.8	19.6	26.7	14.6
FI		28.1	25.0	22.5	29.4	32.3	23.0	17.9	14.1	14.3	15.1	24.3	13.0
FR		39.6	35.3	35.7	42.5	40.6	27.6	31.8	26.6	29.8	30.7	35.0	19.3
EL		36.7	32.6	31.9	41.3	36.9	24.6	28.8	23.5	25.4	29.2	31.9	15.8
IE		13.8	12.6	5.6	12.7	23.0	19.6	0.4	-0.9	-5.7	-4.8	11.7	7.7
LU		34.5	30.4	30.2	37.0	36.1	23.8	25.7	20.8	23.4	24.2	29.6	14.7
NL		33.3	29.5	28.7	35.6	35.7	24.1	24.3	19.6	21.6	22.4	28.9	14.8
PT		34.9	30.8	30.6	37.4	36.5	24.3	26.2	21.2	23.8	24.7	30.1	15.2
ES		33.4	29.5	28.8	35.7	35.7	24.1	26.2	21.1	23.8	24.7	30.1	14.9
SE		25.5	22.6	19.8	26.7	30.1	21.5	14.8	11.3	11.0	11.9	21.6	11.1
UK		30.7	27.4	25.5	32.3	34.4	24.5	21.1	17.1	17.7	18.6	26.9	14.9
Mean		**31.6**	**28.0**	**26.6**	**33.7**	**34.4**	**23.8**	**22.3**	**18.0**	**19.3**	**20.3**	**27.4**	**14.3**
DE	**domestic**	**38.0**	**38.0**	**46.1**	**40.1**	**27.7**	**27.7**	**38.0**	**38.0**	**46.1**	**40.1**	**27.7**	**27.7**

From Table 1 it is evident that the application of the modified methodology, instead of the original, clearly raises the BEATRs for German outbound investment. Thus the results are quite as they were expected to be *a priori*, since the German tax-wedge between taxes on retained earnings and taxes on distributed profits no longer is imposed on (potential) dividend payments from the subsidiary to the German parent.

8 Since the BEATRs for debt financing by the subsidiary calculated with the modified formula are not given in the EC working paper, we calculated these BEATRs on our own, applying the EU methodology. As this was a straightforward extension to the replication of the EU BEATRs, this newly calculated BEATRs should be identical to those BEATRs the EC would have arrived at if it had applied the modified formula.

Hence the application of the modified methodology instead of the original one raises the overall BEATRs by 9.2 percentage points on average (over the 13 EU host countries), with the increase in the BEATR in the case of the subsidiary financing the investment by retained earnings or debt being around 7.4 and 7.1 percentage points respectively. The strongest effects of the modified methodology are those on the BEATRs for a subsidiary financing an investment by new equity. In this case the reported BEATRs are on average 13.3 percentage points higher than those derived from the original methodology.

At the same time the BEATRs for debt financing by the subsidiary are lowered for both methodologies if the modified formula is applied, which takes account of full deductibility of interest payments from the corporate profits. Thus for both, the original and the modified methodology, the BEATRs for debt financing are lowered by 13.1 and 10.6 percentage points respectively. However, the basic difference between the original and the modified methodology remains as the application of the latter yields significantly higher BEATRs (by 9.5 percentage points on average).

As a consequence the application of the modified methodology raises the effective tax burden of German companies investing in the EU in 1999. Although the modified BEATR on German outbound investment is on average still lower than the BEATR for German domestic investment, implying that from a tax perspective foreign investment is more profitable for a German company than domestic investment, this gap is considerably smaller than in the case of the EC BEATRs. Hence Germany's position with respect to tax competition for international investment is, though still not being favourable, greatly improved by simply applying a different method in the calculation of the BEATRs.

Equally, using the modified formula for debt financing by the subsidiary has severe implications for the interpretation of the BEATRs. Without the modification, debt financing is clearly the least attractive way to finance an investment as the effective tax burden is higher than in the case of financing an investment via retained earnings or new equity. With the modification for the deductibility of interest, however, this form of financing becomes the most attractive way of financing, with the average BEATRs being three to ten percentage points lower than the BEATRs of the other options. Moreover, in the case of the modified formula the structure of the BEATRs corresponds to the case of domestic investment, where debt financing is also the most attractive option, which is not the case if the original version of the formula is used.

Interestingly though, in the case of German inbound investment, the EC seems to have taken into account the tax wedge between taxes on distributed profits and retained earnings. Thus, deviating from their original methodology, they corrected for the German split-rate system, which in effect results in the same BEATRs for German inbound investment as we arrive at if the modified formulas are applied. We assume, however, that the basic intention behind this approach was different from ours, otherwise the EC would have had corrected the BEATRs for German outbound investment as well. In any case, as EC BEATRs and our own BEATRs for German inbound investment are identical, they are neither shown nor discussed here.

Effects of the 2001 German tax reform on taxes on international investment

Referring to the casual observation mentioned in the introduction, this section analyses the effects of the 2001 German tax reform on the effective tax burden on German outbound and inbound investment. The 1999 BEATRs derived by the original Devereux-Griffith methodology and the alternative version are compared to the 2001 BEATRs.

Table 2 presents BEATRs for German outbound investment in 13 EU member states, showing the overall BEATRs as well as the BEATRs for each of the three forms of the subsidiary's financing, assuming a weighted average form of financing for the parent company.

Table 2

German BEATRs for outbound investment before and after the tax reform

Outbound	1999 Römisch & Leibrecht				1999 Devereux-Griffith				2001 Devereux-Griffith			
Subsidiary	**Overall**	Retained earnings	New equity	Debt	**Overall**	Retained earnings	New equity	Debt	**Overall**	Retained earnings	New equity	Debt
AT	**32.2**	27.5	34.4	34.9	**23.0**	20.1	21.0	27.8	**30.9**	30.0	30.7	32.1
BE	**36.6**	32.8	39.5	37.6	**28.4**	26.4	27.2	31.5	**35.5**	35.3	35.9	35.2
DK	**31.1**	26.4	32.9	34.1	**21.7**	18.8	19.6	26.7	**29.8**	28.8	29.4	31.3
FI	**28.1**	22.5	29.4	32.3	**17.9**	14.3	15.1	24.3	**26.6**	25.0	25.7	29.1
FR	**39.6**	35.7	42.5	40.6	**31.8**	29.8	30.7	35.0	**38.4**	38.2	38.9	38.2
EL	**36.7**	31.9	41.3	36.9	**28.8**	25.4	29.2	31.9	**33.9**	33.0	35.0	33.6
IE	**13.8**	5.6	12.7	23.0	**0.4**	-5.7	-4.8	11.7	**11.8**	8.2	8.8	18.4
LU	**34.5**	30.2	37.0	36.1	**25.7**	23.4	24.2	29.6	**33.2**	32.7	33.4	33.6
NL	**33.3**	28.7	35.6	35.7	**24.3**	21.6	22.4	28.9	**32.0**	31.3	31.9	33.0
PT	**34.9**	30.6	37.4	36.5	**26.2**	23.8	24.7	30.1	**33.6**	33.1	33.8	34.0
ES	**33.4**	28.8	35.7	35.7	**26.2**	23.8	24.7	30.1	**32.1**	31.3	32.0	33.0
SE	**25.5**	19.8	26.7	30.1	**14.8**	11.0	11.9	21.6	**24.0**	22.3	23.0	26.8
UK	**30.7**	25.5	32.3	34.4	**21.1**	17.7	18.6	26.9	**29.3**	28.0	28.6	31.3
	31.6	26.6	33.7	34.4	**22.3**	19.3	20.3	27.4	30.1	29.0	29.8	31.5

As far as the overall BEATRs are concerned, the 2001 German tax reform lowered the tax burden on German outbound investment when comparing the 1999 BEATRs derived from the alternative method with the 2001 BEATRs. Thus, in contrast to the changes from 1999 to 2001 suggested by the Devereux-Griffith model, this result is quite as it was expected in the introduction. However, a closer look at the results with respect to the subsidiary's forms of financing reveals that the BEATRs for retained earnings financing by the subsidiary rose from 1999 to 2001 even in the case of the alternative BEATRs. An explanation for this is found in (9) and (10) (or (16) and (17)). Since in 1999 the German tax rate for retained earnings (τ^{RE}) was higher than the tax rate for distributed profits (τ^{D}), German companies benefited from additional gains that arose because of the split-rate system. As the split-rate system was abolished by the 2001 tax reform, these additional gains disappeared and increased the tax burden. By contrast, the effects of the German tax reform on the BEATRs in the case of a subsidiary financing its investment via new equity or debt are as expected. Thus, the 1999 BEATRS calculated with the alternative methodology are – contrary to the BEATRs calculated with the original methodology – higher than the 2001 BEATRs. Although the same negative effects of the split rate abolishment on the NPV of the parent company are at work here, the drop in the taxation of international dividends as well as interest payments prevails.

5 Summary and conclusions

The contribution of this paper to the existing literature on the calculation of effective average tax rates is threefold.

First, the paper has modified the existing Devereux-Griffith methodology of calculating BEATRs for international investment (FDI). More specifically the paper shows how the original formulas change if one departs from the assumption that all dividends paid to the parent company's shareholder come from domestic profits. This modification has an impact upon the BEATRs in case the home and/or the host country apply a corporate split-rate system. In the absence of a split rate, the modified formulas in this paper yield exactly the same result as in the original Devereux-Griffith version. Thus the modifications could be seen as applying only to special cases in domestic and international corporate taxation. Yet, split-rate systems might become more attractive for governments to attract foreign direct investment in the future. Following the 'New view of corporate income taxation' (see e.g. Sinn, 1991), low or zero tax rates on retained earnings are efficiency-enhancing, whereas higher tax rates on distributed profits can be justified on distributional grounds. For instance, in the year 2000 Estonia introduced a corporate income tax system with a zero tax rate on retained earnings and (currently) a 26% tax rate on distributed profits. Other countries are likely to follow this example. Using the new formulas, the increase in the BEATR for FDI from Germany, despite the large drop in Germany's corporate tax rate in 2001, turns into a decrease.

Second, a closer examination of the original Devereux-Griffith methodology has revealed that the tax deductibility of interest from corporate profits has been erroneously specified in the case of international taxation. The correction presented in Table 1 results not only in lower BEATRs for international investment if the subsidiary finances an investment via raising debt, but also in lower overall BEATRs for international investment (as these are the average of the BEATRs with respect to the various forms of financing). Moreover, accounting for the proper deduction of interest turns debt financing into the most advantageous way of financing a foreign investment, corresponding to the domestic case. These changes impact on the level of BEATRs even in the absence of a split-rate system and thus are an improvement of the existing formulas.

Third, the paper has presented a clear formulation of the opportunity costs that are involved if a country applies a split-rate system in corporate taxation. It is shown that, independently of the absolute size of the tax rates, opportunity costs increase with an increase in the difference between the tax rate applied to distributed profits and the tax rate applied to retained earnings. Hence, the paper contributes to a better understanding of the mechanism behind the effective tax rates of Devereux and Griffith.

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Appendix: Table A1

Detailed results

German outbound investment

Römisch & Leibrecht

Parent	Overall				Retained earnings				New equity				Debt			
Subsidiary	Retained earnings	New equity	Debt	Debt*	Retained earnings	New equity	Debt	Debt*	Retained earnings	New equity	Debt	Debt*	Retained earnings	New equity	Debt	Debt*
AT	27.5	34.4	34.9	23.5	34.8	41.7	42.2	30.8	28.5	35.5	35.9	24.6	15.7	22.6	23.1	11.8
BE	32.8	39.5	37.6	24.5	39.9	46.7	44.7	31.6	33.8	40.6	38.6	25.5	21.3	28.1	26.1	13.0
DK	26.4	32.9	34.1	24.1	33.2	39.7	40.9	30.9	27.4	33.9	35.1	25.1	15.4	21.9	23.1	13.0
FI	22.5	29.4	32.3	23.0	29.8	36.7	39.6	30.3	23.6	30.5	33.4	24.0	10.8	17.7	20.6	11.2
FR	35.7	42.5	40.6	27.6	42.8	49.6	47.7	34.7	36.8	43.5	41.6	28.6	24.3	31.0	29.1	16.1
EL	31.9	41.3	36.9	24.6	39.2	48.6	44.1	31.8	33.0	42.4	37.9	25.7	20.2	29.6	25.2	12.9
IE	5.6	12.7	23.0	19.6	13.0	20.1	30.4	27.0	6.7	13.8	24.1	20.7	-6.4	0.7	11.0	7.6
LU	30.2	37.0	36.1	23.8	37.4	44.2	43.3	31.0	31.3	38.1	37.2	24.9	18.7	25.5	24.6	12.3
NL	28.7	35.6	35.7	24.1	36.0	42.9	42.9	31.3	29.8	36.7	36.7	25.1	17.0	23.9	24.0	12.3
PT	30.6	37.4	36.5	24.3	37.8	44.6	43.7	31.4	31.7	38.5	37.6	25.3	19.1	25.9	25.0	12.7
ES	28.8	35.7	35.7	24.1	36.0	42.9	42.9	31.4	29.8	36.7	36.8	25.2	17.1	24.0	24.0	12.5
SE	19.8	26.7	30.1	21.5	27.0	33.9	37.3	28.7	20.9	27.7	31.2	22.5	8.2	15.0	18.5	9.8
UK	25.5	32.3	34.4	24.5	32.7	39.6	41.6	31.7	26.5	33.4	35.5	25.5	13.8	20.7	22.7	12.8

German outbound investment

Devereux-Griffith - EU Commission

Parent	Overall				Retained earnings				New equity				Debt			
Subsidiary	Retained earnings	New equity	Debt	Debt*	Retained earnings	New equity	Debt	Debt*	Retained earnings	New equity	Debt	Debt*	Retained earnings	New equity	Debt	Debt*
AT	20.1	21.0	27.8	14.1	27.4	28.3	35.1	21.4	21.2	22.1	28.9	15.2	8.4	9.2	16.1	2.3
BE	26.4	27.2	31.5	15.7	33.5	34.3	38.6	22.8	27.4	28.2	32.5	16.7	14.9	15.7	20.0	4.2
DK	18.8	19.6	26.7	14.6	25.6	26.4	33.5	21.5	19.8	20.6	27.7	15.6	7.8	8.6	15.7	3.6
FI	14.3	15.1	24.3	13.0	21.5	22.4	31.6	20.3	15.3	16.2	25.4	14.1	2.5	3.4	12.6	1.3
FR	29.8	30.7	35.0	19.3	37.0	37.8	42.2	26.4	30.9	31.7	36.1	20.4	18.3	19.1	23.5	7.9
EL	25.4	29.2	31.9	15.8	32.6	36.4	39.1	23.1	26.4	30.2	32.9	16.9	13.7	17.5	20.1	4.1
IE	-5.7	-4.8	11.7	7.7	1.7	2.6	19.2	15.1	-4.6	-3.8	12.8	8.7	-17.7	-16.8	-0.2	-4.3
LU	23.4	24.2	29.6	14.7	30.5	31.3	36.7	21.9	24.4	25.2	30.6	15.8	11.8	12.7	18.0	3.2
NL	21.6	22.4	28.9	14.8	28.9	29.7	36.1	22.1	22.7	23.5	29.9	15.9	9.9	10.7	17.2	3.1
PT	23.8	24.7	30.1	15.2	31.0	31.8	37.2	22.4	24.9	25.7	31.1	16.3	12.3	13.1	18.5	3.7
ES	23.8	24.7	30.1	14.9	31.0	31.8	37.2	22.1	24.9	25.7	31.1	15.9	12.3	13.1	18.5	3.2
SE	11.0	11.9	21.6	11.1	18.2	19.1	28.8	18.3	12.1	12.9	22.7	12.2	-0.6	0.3	10.0	-0.5
UK	17.7	18.6	26.9	14.9	25.0	25.8	34.2	22.2	18.8	19.6	28.0	16.0	6.1	6.9	15.3	3.2

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