Optimal Tax Policy when Firms are Internationally Mobile

Johannes Becker
Clemens Fuest

OXFORD UNIVERSITY CENTRE FOR BUSINESS TAXATION
SAÏD BUSINESS SCHOOL, PARK END STREET
OXFORD OX1 1HP

WP 09/07

Optimal Tax Policy when Firms are Internationally Mobile[1]

by

Johannes Becker* and Clemens Fuest‡,

Centre for Business Taxation, University of Oxford

This version:
5th June 2009

[1] We thank J. Wilson, G. Schjelderup and participants at various research workshops for very helpful comments. All remaining errors are our own.We gratefully acknowledge financial support from the Deutsche Forschungsgemeinschaft (DFG), Grant No. FU 442/3-1, and the ESRC, Grant No RES -060-25-0033.

*Centre for Business Taxation, Saïd Business School, University of Oxford, Park End Street, Oxford OX1 HP, UK. E-Mail: johannes.becker2@sbs.ox.ac.uk

‡Centre for Business Taxation, Saïd Business School, University of Oxford, Park End Street, Oxford OX1 HP, UK. E-Mail: clemens.fuest@sbs.ox.ac.uk

Abstract

The standard tax theory result that investment should not be distorted is based on the assumption that profits are locally bound. In this paper we analyze the optimal tax policy in a model where firms are internationally mobile. We show that the optimal policy response to increasing firm mobility may be taxation, subsidization or non-distortion of the marginal investment, depending on whether the mobile firms are more or less profitable than the average firm in the economy. Our findings may contribute to understanding recent tax policy developments in many OECD countries.

JEL Codes: H25, H21, F23

Keywords: Corporate taxes, Optimal Tax Policy, Multinational Firms

1 Introduction

Standard optimal tax theory recommends that small open economies should not levy source-based taxes on the normal return to capital if capital is internationally mobile, see Gordon (1986) and Sinn (1990). If capital is taxed at source, investment is distorted and national welfare declines. The literature has therefore proposed a whole class of investment-neutral tax systems in which (pure) profits can be taxed without distorting the investment decision. The main characteristic of these investment-neutral corporate tax systems is that tax payments are zero if the project return merely equals the cost of capital. In technical terms, this implies depreciation allowances of 100 per cent of the purchase price of the capital good[1], full deduction of research and development expenditures, full loss-offsets etc.

In 1982, the present value of depreciation allowances (PVDA) for an investment in plant and machinery (unweighted average) across a large number of OECD countries was 81 per cent, the PVDA for industrial buildings 48 per cent, see Devereux, Griffith & Klemm (2002). With the exception of Ireland, no country allowed for immediate depreciation or an equivalent in present value terms, i.e. a PVDA of 100 per cent . Since then, the opening of capital markets and increasing economic integration among these countries should have increased the cost of distorting investment. In sum, we should have expected countries to reform their tax system lowering the taxation of the normal return, i.e. increasing the PVDA.

However, empirical observations do not support the view that governments pursued this kind of tax policy strategy. Twenty-one years later, in 2003, the unweighted average of the PVDA has dropped to 75 per cent for plant and machinery and to 33 per cent for industrial buildings. At the same time, loss-offsets which are hard to quantify have been increasingly limited, as several empirical studies report, see e.g. Auerbach (2007). This means that, on average, countries seem to have taken the opposite direction of what standard optimal tax theory suggests.

In this paper, we present an argument which contributes to explaining this empirically observable development as part of an optimal tax policy. In the presence

[1] Under residence based taxation of capital income, investment neutrality requires tax depreciation to equal economic depreciation. We focus on source based tax systems as does a large part of the literature on international taxation because residence based taxes are difficult to implement.

of mobile firms, it may be optimal under certain circumstances to broaden the tax base, thus distorting investment, when this allows to reduce statutory tax rates, i.e. to pursue a *tax rate cut cum base broadening* strategy.

Using the Corporate Tax Data Base provided by the Institute for Fiscal Studies (IFS) and described and analyzed in Devereux, Griffith & Klemm (2002), figure 1 depicts each change in the statutory tax rates and the PVDA of the OECD countries enumerated in footnote 2 in the years 1982-2003. The x-axis measures changes of the tax rate, the y-axis the variation in the tax base. Data points which are not on the axes present a simultaneous change of the tax rate and the tax base. Thus, we get four quadrants among which two are (potentially) revenue-neutral, because the variation of one tax parameter is "financed" by the variation of the other one. In addition, as long as the tax system is on the increasing part of the Laffer curve, tax reforms in quadrant II are clearly revenue-decreasing and those in quadrant IV are revenue-increasing.

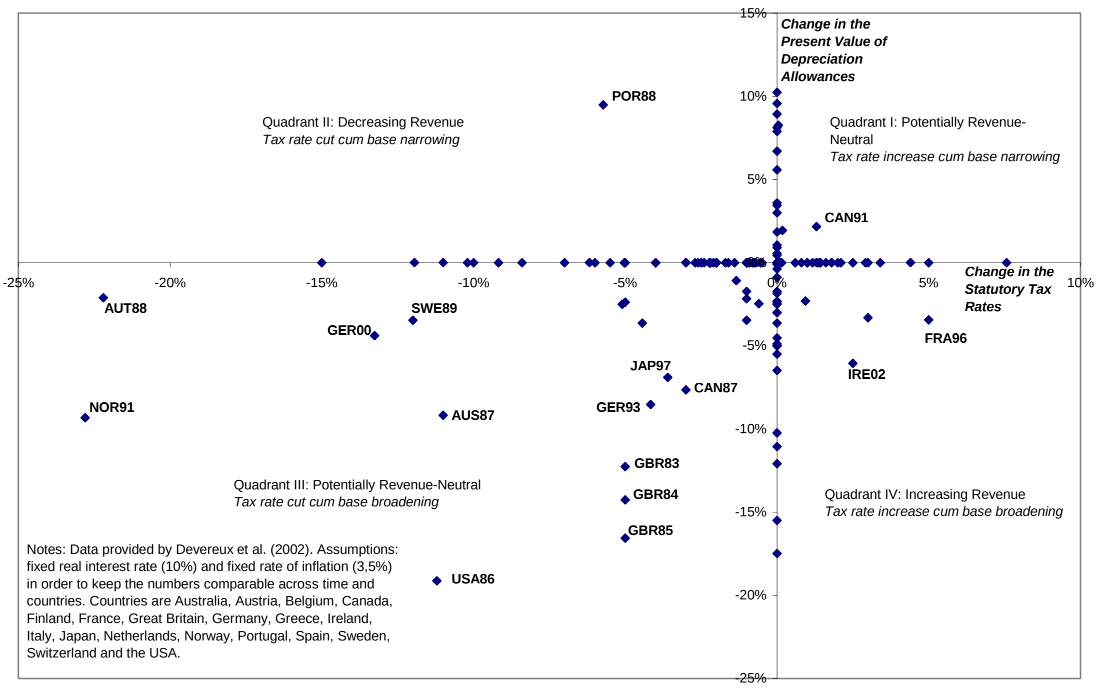

Figure 1: Tax reforms in different OECD countries 1982-2003.

As the figure shows, most tax policy reforms consist of a variation of either the tax rate or the tax base, i.e. the data points are located on the axes. Among the tax reforms which changed the tax rate and the tax base at the same time, only the Canadian tax reform of 1991 followed the pattern predicted by the standard theory; however, it just reversed the reform of 1990 to the same extent and may therefore be interpreted as a mere correction. The only country to implement a revenue decreasing tax reform of both the tax rate and base is Portugal in 1988, whereas the United States (1992), Finland (1995), France (1996) and Ireland (2002) implemented revenue increasing tax reforms (quadrant IV).

Most tax reforms which changed tax rate and base simultaneously were of the *tax rate cut cum base broadening* kind. Among those are tax reforms in Great Britain, Germany and Japan, and - probably known best - the US tax reform of 1986. It is striking that even the larger countries, which could be expected to be relatively autonomous in their tax policy, pursued this kind of strategy. To be precise, the puzzle is *not* why these countries lowered the overall tax burden under conditions of tax competition. The puzzle is rather why they did not choose to firstly allow for efficient levels of investment by setting the effective marginal tax rate to zero, before reducing the average tax burden. The former goal would have required to narrow the tax base instead of broadening it. The question arises how this development can be explained. There are basically two approaches to explain this trend.

A first approach is based on the idea of 'policy learning', which is extensively discussed in the political science literature (see e.g. Steinmo, 2003, and Swank & Steinmo, 2002): Inspired by the fundamental reforms in Great Britain and the US, policymakers around the world followed their example and adjusted their tax system to the new model (e.g. see Whalley, 1990, and Gordon, 1992). The underlying assumption is that policymakers do not have an explicit model of the economy in mind and no clear efficiency goals, but they do observe other policymakers and try to copy their strategies when they observe successful ones.[2] The US tax reform of 1986 was considered to be a success in historic dimensions and could have triggered

[2] Another aspect here is that the US was an important supplier of foreign direct investment at the time. The foreign tax credit system enables the host country to increase tax rates on US multinationals up to the US statutory rate without increasing the effective tax rate for these firms. When the US lowered the tax rates fundamentally, other countries were forced to do the same if they did not want to push the US firms out of the country (Slemrod, 2004).

similar reforms in other countries (see diagram 1).

The second approach explains *tax rate cut cum base broadening* policy as an optimal response to a changing economic environment. Within this approach, Devereux, Griffith & Klemm (2002) identify two possible reasons: income shifting and the presence of highly profitable multinational firms. Income shifting is analyzed by Haufler & Schjelderup (2000) who show that, if multinational firms earn supernormal profits and if the shifting of these profits to low tax countries via transfer pricing is possible, it is optimal to reduce tax rates and broaden tax bases, despite the distortion of investment caused by this policy. Fuest & Hemmelgarn (2005) show that a *tax rate cut cum base broadening* policy may be optimal in the presence of income shifting through thin capitalization even if there are no pure profits. The second argument is first provided by Bond (2000) who proposes to interpret the *tax rate cut cum base broadening* to be the optimal tax policy reaction to the existence of mobile and highly profitable firms. Without using a formal model, he suggests a setting in which multinational companies are assumed to be very sensitive to the effective *average* tax rate whereas investment by immobile firms is relatively insensitive to the effective *marginal* tax rate. Bond concludes that a government then might increase domestic investment by lowering the statutory tax rate and accepting a broader tax base, even though this results in a higher cost of capital.

In this paper, we contribute to the second approach to explaining the trend towards low tax rates and broad tax bases. Surprisingly, the literature on optimal corporate tax policy in the presence of internationally mobile firms is very small. Of course, firm mobility as such has been extensively analyzed in the literature on foreign direct investment, e.g. Lipsey (2001) and the new economic geography, see Ottaviano & Thisse (2003) for a survey. There are also several contributions analyzing intergovernmental competition in corporate tax rates[3] with firm mobility, see e.g. Richter & Wellisch (1996), Boadway, Cuff & Marceau (2002) and Fuest (2005). But, to the best of our knowledge, the only contribution which analyzes the optimal structure of the corporate tax system in the presence of firm mobility in a formal model is Osmundsen, Hagen & Schjelderup (1998). These authors consider a model where firms differ in mobility costs and tax policy is constrained by

[3] See Wilson & Wildasin (2004) for a survey of general tax competition issues.

problems of asymmetric information. Their results and the relation to our analysis will be dicussed further in section 4.

We analyze the optimal tax policy in the presence of mobile firms in a framework with mobile and immobile firms which may differ in profitability. The government may use the tax base and the tax rate as policy parameters. In contrast to Osmundsen et al. (1998), the government cannot use nonlinear taxes to implement a separating equilibrium where firms reveal their type. Instead, a linear tax system is considered, which gives rise to a pooling equilibrium. We show that the mobility of firms across borders does create incentives for governments to deviate systematically from investment neutrality. The optimal policy depends on how profitable mobile firms are, relative to immobile firms. Essentially, changing the combination of tax rates and tax bases may be interpreted as a form of price discrimination. If the marginal mobile firm is more profitable than the average firm in the country, a *tax rate cut cum base broadening* policy is optimal. The reason is that this policy redistributes the tax burden from mobile to immobile firms. Thus, mobile firms can be prevented from leaving the country without sacrificing too much tax revenue. But if the marginal mobile firm is less profitable than the average firm in the economy, a *tax rate cut cum base broadening* policy reduces welfare. In this case, the optimal tax policy consists of subsidizing the normal return to capital and increasing the statutory tax rate.

The remainder of the paper is organized as follows: In section 2, we present our argument in the framework of a stylized model. In section 3 we discuss how our results relate to the findings in the literature and conclude.

2 The model

In this section, we proceed as follows. The next subsection presents the setup of the model. Subsection 2.2 describes the capital market equilibrium. section 2.3. derives the optimal tax policy without firm mobility. This serves as a benchmark for the subsequent analysis. Subsections 2.4 and 2.5 analyse the optimal tax policy in the presence of firm mobility for the domestic (firm-exporting) government and the foreign (firm-importing) government, respectively.

2.1 Setup

Consider a pair of asymmetric countries, domestic and foreign, which are linked through cross-border migration of firms and a common capital market. The world consists of a certain number M of these identical country pairs. If M is small, the countries' tax policies have a significant effect on the world market interest rate. If M is very large, then this impact approaches zero.

2.1.1 Firms

There are two types of firms in the model which are denoted by an index $i = 1, 2$. Firstly, there are internationally immobile firms. The immobile firms have identical production technologies $Q = Q(K_1)$ and $Q^* = Q^*(K_1^*)$ and their number per country is normalized to unity. The superscript $*$ denotes the foreign location. In addition, there is a given number n of internationally mobile firms which are initially located in the domestic country. They are owned by the domestic household. These firms have identical production technologies denoted by $F = F(K_2)$ if the firm locates in the domestic country and $F^* = F^*(K_2^*)$, if the firm locates abroad.

Internationally mobile firms can choose the foreign location *instead* of the domestic location.[4] If the firm decides to produce abroad, it faces a mobility cost denoted by c^*. Moving abroad thus changes output from $F(K_2)$ to $F^*(K_2^*) - c^*$. Mobile firms differ with respect to their mobility costs. We assume that the cost parameter c^* is uniformly distributed over the interval $\{c^{*-}, c^{*+}\}$. Each mobile firm draws a mobility cost from this distribution.

The sequence of decisions made by firms is as follows. In the first period, internationally mobile firms firstly choose their location. Given the location, they determine the size of the capital stock. Immobile firms by definition only make the second decision. In the second period, production takes place and profits are distributed to the owners. We assume that, at the end of the second period, all investment goods have lost their value. This corresponds to full economic depreciation. Profits are taxed at a domestic rate τ or at the foreign rate τ^*,

[4] It is often observed that firms invest in more than one country. The reader may think of production units which are shifted from the domestic to the foreign location but stay within a multinational firm.

depending on the location of the firm. In addition, a tax allowance α (α^*) as a fraction of the initial investment K (K^*) is granted.

Omitting the firm index, since all immobile firms are identical, the market value of this type of firm is equal to the net present value of cash flows generated by the firm and can be expressed as

$$V_1 = -K_1 + \frac{(1-\tau)\, Q\,(K_1) + \tau\alpha K_1}{1+r} \tag{1}$$

where r is the interest rate in the international capital market.[5] The optimal choice of K_1 is implied by

$$Q_{K_1} = \frac{1+r-\tau\alpha}{1-\tau} \tag{2}$$

Note that, at $\alpha = 1+r$, the tax system is neutral with respect to the choice of the capital stock. Thus, neutrality requires that the full purchase price in present value terms is deductible from the tax base. Equation (1) then becomes $V_1 = (1-\tau)\,(-K_1 + Q\,(K_1)\,/\,(1+r))$. Equivalent expressions can be derived for the immobile firms in the foreign country, replacing τ by τ^*, α by α^* etc.

If the internationally mobile firm j locates domestically, it has a market value of

$$V_{2j} = -K_{2j} + \frac{(1-\tau)\, F\,(K_{2j}) + \tau\alpha K_{2j}}{1+r} \tag{3}$$

which implies an optimal investment level at $F_{K_2} = \frac{1+r-\tau\alpha}{1-\tau}$. Note that the cost of capital which corresponds to the right hand side expression of the above equation is the same for both types of firms, internationally mobile and immobile firms.

If the firm chooses the foreign location its market value is given by

$$V_{2j}^* = -K_{2j}^* + \frac{(1-\tau^*)\left(F^*\left(K_{2j}^*\right) - c_j^*\right) + \tau^*\alpha^* K_{2j}^*}{1+r} \tag{4}$$

Since c_j^* is an output loss, it is deductible from the corporate tax base. Optimal investment level is given at $F^*_{K_2^*} = \frac{1+r-\tau^*\alpha^*}{1-\tau^*}$.

Firm allocation is determined by the migration cost c_j^*. A firm is indifferent

[5] Equation (1) implies that there are no residence based taxes on capital income. This will be discussed further below.

between the domestic and the foreign location, if the firm values are equal in both locations, $V_2 = V_2^*$. This yields the critical value $\tilde{c}^*$:

$$\tilde{c}^* = \frac{[(1-\tau^*) F^* - (1 + r - \tau^* \alpha^*) K_2^*] - [(1-\tau) F - (1 + r - \tau\alpha) K_2]}{1-\tau^*} \quad (5)$$

All firms with a migration cost of $c^* < \tilde{c}^*$ choose the foreign location. Firms with $c^* \geq \tilde{c}^*$ choose the domestic location. Increasing domestic tax rates increases $\tilde{c}^*$, $\frac{d\tilde{c}^*}{d\tau} = \frac{F-\alpha K_2}{1-\tau^*}$, and thus reduces the number of firms in the domestic location (note that K_2 as well as K_2^* are chosen to maximize V_2 and V_2^*, respectively; given this, the envelope theorem implies that the impact of τ on K_2 cancels out). Increasing allowances α increases the number of firms, $\frac{\partial \tilde{c}^*}{\partial \alpha} = -\frac{\tau}{1-\tau^*} K_2 < 0$. A variation in the foreign policy parameters τ^* and α^* has opposite effects, $\frac{d\tilde{c}^*}{d\tau^*} = -\frac{F^*-\tilde{c}^*-\alpha^* K_2^*}{1-\tau^*} < 0$ and $\frac{\partial \tilde{c}^*}{\partial \alpha^*} = \frac{\tau^*}{1-\tau^*} K_2^* > 0$.

2.1.2 Households

Each country is populated by a representative household who lives for two periods. The utility function of the representative domestic household is given by $U(C_1, C_2) = u(C_1) + C_2 + h(G)$, where C_1 and C_2 are consumption levels in the first and the second period and G is a public consumption good provided in period 2.[6] For notational convenience, we omit the country index unless misunderstandings may arise. The functions $u(C_1)$ and $h(G)$ are strictly concave, with $u' > 0$, $u'' < 0$ and $h' > 0$, $h'' \leq 0$.

In period 1, the household has an endowment of E units of a numeraire good. This numeraire good may be transformed into the private consumption good and the public consumption good on a one to one basis. Households may inject equity into their firms and borrow or lend in the international capital market at the interest rate r. There are no residence based taxes on capital income.

The first period budget constraint of the domestic household is given by

$$C_1 = E - S - [K_1 + n_c K_2 + (n - n_c) K_2^*] \quad (6)$$

[6] We use this quasilinear utility function because it eliminates income effects on savings which would complicate the analysis without adding further insights.

where $n = \int_{c^{*-}}^{c^{*+}} dc^*$ is the total number of internationally mobile firms and $n_c = \int_{\tilde{c}^*}^{c^{*+}} dc^*$ is the number of mobile firms which choose the domestic location. The second period constraint is

$$\begin{aligned} C_2 &= (1+r)\,S + ((1-\tau)\,Q + \tau\alpha K_1) + n_c\,((1-\tau)\,F + \tau\alpha K_2) \\ &\quad + (n-n_c)\,((1-\tau^*)\,(F^* - \bar{c}^*) + \tau^*\alpha^* K_2^*) \end{aligned} \tag{7}$$

with $\bar{c}^* = \frac{1}{n-n_c}\int_{c^{*-}}^{\tilde{c}^*} c^* dc^*$, which can be interpreted as the *average* mobility cost of all firms located abroad. Optimal private household savings imply $u' = 1+r$.

The budget constraints of the foreign private households are given by

$$C_1^* = E^* - S^* - K_1^*, \tag{8}$$

$$C_2^* = (1+r)\,S^* + (1-\tau^*)\,Q^*\,(K_1^*) + \tau^*\alpha^* K_1^*. \tag{9}$$

These budget constraints reflect that the foreign households are only endowed with immobile firms.

2.1.3 Governments

Finally, consider the two governments. The domestic government provides the public good G in period 2, which is financed by corporate taxes collected in period 2. Its budget constraint is given by

$$G = \tau\,[Q - \alpha K_1 + n_c\,(F - \alpha K_2)] \tag{10}$$

The foreign government's budget constraint is given by

$$G^* = \tau^*\,(Q^* - \alpha^* K_1^* + (n-n_c)\,(F^* - \bar{c}^* - \alpha^* K_2^*))\,. \tag{11}$$

2.2 Capital market equilibrium

The equilibrium on the world capital market requires that total investment, given by $\sum_{m=1}^{M}\left(K_{1,m} + n_c K_{2,m} + (n-n_c)\,K_{2,m}^* + K_{1,m}^*\right)$, equals total savings, given by $\sum_{m=1}^{M}\left(E_m - C_{1,m} + E_m^* - C_{1,m}^*\right)$. Using (6) and (8), this implies that the world capital market equilibrium satisfies

$$\sum_{m=1}^{M} (S_m + S_m^*) = 0 \tag{12}$$

i.e. a country can only lend if the other country borrows. As the above equation determines the world market interest rate, we can now derive the effects of tax policy on the interest rate. E.g., an increase in the domestic tax rate τ has the following effect on the equilibrium interest rate:

$$\frac{dr}{d\tau} = \frac{\frac{1+r-\alpha}{(1-\tau)^2}\left(\frac{1}{Q_{KK}} + n_c \frac{1}{F_{KK}}\right) + \frac{F-\alpha K_2}{1-\tau^*}\left(K_2^* - K_2\right)}{M\left(\frac{\partial S}{\partial r} + \frac{\partial S^*}{\partial r}\right)} \tag{13}$$

The denominator is unambiguously positive due to the quasi-linearity of the utility function. Therefore, domestic corporate taxes have a negative impact on the interest rate if $\frac{1+r-\alpha}{(1-\tau)^2}\left(\frac{1}{Q_{KK}} + n_c \frac{1}{F_{KK}}\right) + \frac{F-\alpha K_2}{1-\tau^*}\left(K_2^* - K_2\right) > 0$. This term is equal to zero if $\alpha = 1 + r$ and $K_2^* = K_2$. If M is very large, the impact of tax changes of individual countries on the world market interest rate is negligible. Similar expressions for τ^*, α and α^* are derived in appendix 1.

In the next subsection, we start by considering the optimal tax policy, assuming that mobile firms are not allowed to move to the foreign country. This will serve as a benchmark case for the subsequent analysis of tax policy in the presence of firm mobility.

2.3 Optimal tax policy without firm mobility

Assume that firms are not allowed to migrate to the foreign country, i.e. $n_c = n$. Under tax competition, the domestic government maximizes domestic welfare $W = u(C_1) + C_2 + h(G)$ subject to the constraints in (6)-(10) and takes the tax policy of the other country as given. The timing of decisions is as follows. Firstly, both governments simultaneously determine their tax policies. Secondly, the internationally mobile firms choose their location. Thirdly, all firms choose the optimal size of the capital stock.

The second and third stages are discussed above. We can therefore directly turn to the optimal tax policy choices. The first order condition for the optimal tax policy of the domestic country can be written as $\frac{\partial W}{\partial \tau} = 0$ or

$$\begin{aligned} 0 &= (h' - 1)\left((Q - \hat{\alpha}K_1) + n\left(F - \hat{\alpha}K_2\right)\right) \\ &\quad + h'\hat{\tau}\left((Q_K - \hat{\alpha})\frac{\partial K_1}{\partial \tau} + n\left(F_K - \hat{\alpha}\right)\frac{\partial K_2}{\partial \tau}\right) + \frac{\partial W}{\partial r}\frac{\partial r}{\partial \tau} \end{aligned} \tag{14}$$

where $\hat{\tau} = \arg\max_\tau W$. This equation determines the optimal level of τ for the optimally chosen level of α, denoted by $\hat{\alpha}$. The first term on the right hand side is the gain from reallocating resources from the private to the public sector. The second term captures the effect of a tax rate increase on the size of the firm capital stocks. The third term represents the tax policy effect via the interest rate channel, which is of minor importance if M is large.[7]

Optimal choice of α implies $\frac{\partial W}{\partial \alpha} = 0$ or

$$\begin{aligned} 0 &= -(h' - 1)\,\hat{\tau}\left(K_1 + nK_2\right) \\ &\quad + h'\hat{\tau}\left((Q_K - \hat{\alpha})\frac{\partial K_1}{\partial \alpha} + n\left(F_K - \hat{\alpha}\right)\frac{\partial K_2}{\partial \alpha}\right) + \frac{\partial W}{\partial r}\frac{\partial r}{\partial \alpha} \end{aligned} \tag{15}$$

where $\hat{\alpha} = \arg\max_\alpha W$, given the optimally chosen level of τ, denoted by $\hat{\tau}$. Using $\frac{\partial W}{\partial r} = S + h'\hat{\tau}\left((Q_K - \hat{\alpha})\frac{\partial K_1}{\partial r} + n\left(F_K - \hat{\alpha}\right)\frac{\partial K_2}{\partial r}\right)$, we show in appendix 2, that the optimal level of α can be expressed as

$$\hat{\alpha} = 1 + r + \frac{S}{\Omega_0 M} \tag{16}$$

where $\Omega_0 > 0$ is a scale factor defined in the appendix. Consider firstly the case of small open economies where M is very large, so that each individual country has a negligible impact on the world market interest rate. Then, the optimal depreciation allowance is the full purchase price in present value terms, $\hat{\alpha} = 1 + r$, which implies that investment is not distorted and the provision of public goods is efficient, as follows from (14) and (15).

If M is low and asymmetries between countries yield $S, S^* \neq 0$, the picture changes. If we assume that the domestic country imports capital ($S < 0$), the

[7] The expression in (14) allows for tax effects on the interest rate. However, it also includes case in which the country is price-taker on the international capital market, i.e. if $M \to \infty$.

domestic country sets $\hat{\alpha} < 1 + r$ in order to drive down the interest rate, and vice versa. For the same reason, the foreign government may also have incentives to deviate from investment neutrality.

We can summarize this in

Proposition 1 ***Benchmark result:*** *Without firm mobility, a small open economy has no incentive to distort investment. Instead, optimal tax policy implies zero taxation of the marginal investment and efficient provision of public goods. If the economy has some market power on the international capital market, it taxes marginal investment if $S < 0$ and subsidizes it if $S > 0$.*

2.4 Optimal tax policy in the domestic country with firm mobility

Under tax competition, the domestic government maximizes domestic welfare $W = u(C_1) + C_2 + h(G)$ subject to the constraints in (6)-(10) and takes the tax policy of the other countries as given. The first order condition for the optimal tax policy of the domestic country can now be written as $\frac{\partial W}{\partial \tau} = 0$ or

$$\begin{aligned} 0 &= (h' - 1)\left[(Q - \hat{\alpha}K_1) + n_c\left(F - \hat{\alpha}K_2\right)\right] + h'\hat{\tau}\left[\left(Q_K - \hat{\alpha}\right)\frac{\partial K_1}{\partial \tau} + n_c\left(F_K - \hat{\alpha}\right)\frac{\partial K_2}{\partial \tau}\right] \\ &\quad - h'\hat{\tau}\left(F - \hat{\alpha}K_2\right)\frac{\partial \tilde{c}^*}{\partial \tau} + \frac{\partial W}{\partial r}\frac{\partial r}{\partial \tau} \end{aligned} \tag{17}$$

where $\hat{\tau}$ and $\hat{\alpha}$ are the optimally chosen levels of τ and α, respectively. The first term on the right hand side is the gain from reallocating resources from the private to the public sector. The second term captures the effect of a tax rate increase on the size of the firm capital stocks. The third term is the main difference to the case without firm mobility, see (14), and captures the tax effect on the number of firms. The fourth term represents the welfare effect of an interest rate change in response to a tax rate increase. Again, the expression in (17) allows for both assumptions, the big country (small M) and the small open economy as a price-taker on the world capital market (large M and $\frac{\partial r}{\partial \tau} \approx 0$).

Optimal choice of α implies $\frac{\partial W}{\partial \alpha} = 0$ or

$$\begin{aligned} 0 &= -\left(h' - 1\right)\hat{\tau}\left[K_1 + n_c K_2\right] + h'\hat{\tau}\left[\left(Q_K - \hat{\alpha}\right)\frac{\partial K_1}{\partial \alpha} + n_c\left(F_K - \hat{\alpha}\right)\frac{\partial K_2}{\partial \alpha}\right] \\ &\quad -h'\hat{\tau}\left(F - \hat{\alpha}K_2\right)\frac{\partial \tilde{c}^*}{\partial \alpha} + \frac{\partial W}{\partial r}\frac{\partial r}{\partial \alpha} \end{aligned} \tag{18}$$

The first term depicts the welfare loss due to redistribution of resources from the public sector to the private sector in the form of higher depreciation allowances. As above, the second, third and fourth term capture the allowance effect on capital stock size, firm population and interest rates. The interest rate affects welfare according to

$$\begin{aligned} \frac{\partial W}{\partial r} &= S + h'\hat{\tau}\left(\left(Q_K - \hat{\alpha}\right)\frac{\partial K_1}{\partial r} + n_c\left(F_K - \hat{\alpha}\right)\frac{\partial K_2}{\partial r}\right) \\ &\quad -h'\hat{\tau}\left(F - \hat{\alpha}K_2\right)\frac{\partial \tilde{c}^*}{\partial r} \end{aligned} \tag{19}$$

Using (17), the optimal choice of α, denoted by $\hat{\alpha}$, can be expressed as

$$\hat{\alpha} = 1 + r - \Omega_1\left(\frac{F}{K_2} - \frac{Q}{K_1}\right) + \frac{S - h'\hat{\tau}\left(F - \hat{\alpha}K_2\right)\frac{\partial \tilde{c}^*}{\partial r}}{\Omega_2 M} \tag{20}$$

as appendix 3 shows, where $\Omega_1, \Omega_2 > 0$ are some positive factors defined in the appendix. How can (20) be interpreted? Consider firstly the case of the small economy, where the last term on the right hand side vanishes. In this case, $\hat{\alpha} = 1 + r$ only emerges if the term in round brackets is zero. The first term in the round brackets can be interpreted as the profitability of the marginal mobile firm which locates at home, whereas the second term stands for the profitability of the representative immobile firm.[8] Thus, if mobile firms are as profitable as immobile firms, optimal tax policy implies a non-distortion of investment. If, however, mobile firms are more profitable than immobile firms, as is suggested by the literature cited in the introduction, optimal tax policy implies $\hat{\alpha} < 1 + r$ which

[8]In the model, the profitability of the marginal mobile firm and the average mobile firm are identical. This is due to the assumption that mobile firms only differ in mobility costs, which implies that their profitability only differs if they locate abroad. Therefore, the difference between marginal and average mobile firms becomes more relevant when we consider the foreign country's optimal tax policy.

means taxation of the marginal investment. Of course, if immobile firms are more profitable on average, the optimal tax policy implies $\hat{\alpha} > 1 + r$

If the economy has some market power on the international capital market, the domestic government may have some interest in distorting the interest rate r. A marginal increase in the interest rate increases interest income or payments (first term in the numerator) and potentially affects tax revenue by changing the number of mobile firms in the economy (second term). The latter effect depends on the sign of $\frac{\partial \tilde{c}^*}{\partial r} = \frac{K_2 - K_2^*}{1 - \hat{\tau}^*}$, which itself depends on the levels of $\hat{\alpha}$ and $\hat{\alpha}^*$.

We can summarize the insights from (20) in

Proposition 2 *Non-distortion of investment is an optimal tax strategy of a small firm exporting country if the profitability of the mobile firms is equal to the average profitability in the economy. If mobile firms are more profitable than the average, then marginal investment is taxed,* $\hat{\alpha} < 1 + r$. *If, however, the marginal firm is less profitable, investment is subsidized in equilibrium,* $\hat{\alpha} > 1 + r$.

How can a distortion of investment lead to increasing welfare? By broadening the tax base, the government has room for a further reduction in tax rates (*tax rate cut cum base broadening*) and thus redistributes tax liabilities from the mobile and more profitable firms to the immobile and less profitable firms. The reason is that highly profitable firms gain more from a tax rate cut than less profitable ones. The government can thus increase overall tax revenues without losing some of the mobile firms, i.e. it implements a form of price discriminiation. This comes at the cost of distorting the investment of all firms. But the welfare cost of introducing a small investment distortion, departing from an equilibrium with undistorted investment, is negligible. The optimal policy would equalize the marginal welfare loss resulting from the investment distortion to the marginal gain resulting from raising more tax revenue.

The opposite case is possible, too. Assume that the representative immobile firm is more profitable than the (marginal) mobile firm. In this case, the government wants to redistribute tax liabilities from the less profitable firm to the more profitable one. It can do so by narrowing the tax base and increasing the tax rate, i.e. by subsidizing the marginal investment. Such a tax system hits the profitable and immobile firms harder than the non-profitable mobile ones. Essentially, deviations from investment neutrality may thus be understood as a form of price discrimination in a second best environment.[9]

In the next subsection, we ask whether the above derived results carry over to the case of a firm-importing country, i.e. the foreign country in our model.

2.5 Optimal tax policy in the foreign country with firm mobility

How does the optimal tax policy in the firm-importing country (here: the foreign country) look like? The optimal choice of τ^* is implied by $\frac{\partial W^*}{\partial \tau^*} = 0$ or

$$\begin{aligned} 0 &= \left(h^{*\prime} - 1\right)\left(Q^* - \hat{\alpha}^* K_1^*\right) + h^{*\prime}\left(n - n_c\right)\left(F^* - \bar{c}^* - \hat{\alpha}^* K_2^*\right) \\ &\quad + h^{*\prime}\hat{\tau}^*\left[\left(Q_K^* - \hat{\alpha}^*\right)\frac{\partial K_1^*}{\partial \tau^*} + \left(n - n_c\right)\left(F_K^* - \hat{\alpha}^*\right)\frac{\partial K_2^*}{\partial \tau^*}\right] \\ &\quad + h^{*\prime}\hat{\tau}^*\left(F^* - \tilde{c}^* - \hat{\alpha}^* K_2^*\right)\frac{\partial \tilde{c}^*}{\partial \tau^*} + \frac{\partial W^*}{\partial r}\frac{\partial r}{\partial \tau^*} \end{aligned} \tag{21}$$

with

$$\begin{aligned} \frac{\partial W^*}{\partial r} &= S^* + \tau^*\left(\left(Q_K^* - \hat{\alpha}^*\right)\frac{\partial K_1^*}{\partial r} + \left(n - n_c\right)\left(F_K^* - \hat{\alpha}^*\right)\frac{\partial K_2^*}{\partial r}\right) \\ &\quad + h^{*\prime}\hat{\tau}^*\left(F^* - \tilde{c}^* - \hat{\alpha}^* K_2^*\right)\frac{\partial \tilde{c}^*}{\partial r} \end{aligned} \tag{22}$$

In contrast to the domestic country, taxation of the internationally mobile firms does not reduce the household's consumption opportunities. It only increases tax revenue, see the third term on the right hand side. This is known as the foreign firm ownership effect, see Huizinga & Nielsen (1997). This effect implies that part of the tax burden is exported to the domestic country, which *ceteris paribus* gives an incentive to overtax corporate profits. As a consequence, it may be the case that public goods are provided efficiently, i.e. $h^{*\prime} = 1$.[10]

[9] Note that the introduction of a progressive corporate tax system would not solve the problem since it is the difference in *profitability* which is decisive not the difference in the *absolute amounts of profits*.

[10] We do not discuss the case of $h^{*\prime} < 1$ since this implicitly means that lump-sum transfers from the government to the household are not feasible, which - from our point of view - is not a plausible assumption.

The optimal choice of α^* is determined by

$$\begin{aligned}
0 &= -\hat{\tau}^* \left[\left(h^{*\prime} - 1 \right) K_1^* + h^{*\prime} \left(n - n_c \right) K_2^* \right] \\
&\quad + h^{*\prime} \hat{\tau}^* \left[\left(Q_K^* - \hat{\alpha}^* \right) \frac{\partial K_1^*}{\partial \alpha^*} + \left(n - n_c \right) \left(F_K^* - \hat{\alpha}^* \right) \frac{\partial K_2^*}{\partial \alpha^*} \right] \\
&\quad + h^{*\prime} \hat{\tau}^* \left(F^* - \tilde{c}^* - \hat{\alpha}^* K_2^* \right) \frac{\partial \tilde{c}^*}{\partial \alpha^*} + \frac{\partial W^*}{\partial r} \frac{\partial r}{\partial \alpha^*}
\end{aligned} \tag{23}$$

Appendix 4 shows that, using (21), this equation can be expressed as

$$\begin{aligned}
\hat{\alpha}^* &= 1 + r - \Omega_1^* \left(\gamma^* \left(\frac{F^* - \bar{c}^*}{K_2^*} - \frac{Q^*}{K_1^*} \right) + \frac{F^* - \bar{c}^*}{K_2^*} - \frac{F^* - \tilde{c}^*}{K_2^*} \right) \\
&\quad + \frac{S^* + h^{*\prime} \hat{\tau}^* \left(F^* - \tilde{c}^* - \hat{\alpha}^* K_2^* \right) \frac{\partial \tilde{c}^*}{\partial r}}{\Omega_2^* M}
\end{aligned} \tag{24}$$

where $0 \leq \gamma^* < 1$, $\Omega_1^*, \Omega_2^* > 0$ are some factors defined in the appendix. Again, consider firstly the case of a small open economy for which the last term on the right hand side can be ignored since it does not have any market power on the international capital market. The optimal choice of α^* then depends on the expression in round brackets (third term). As in the case of the firm-exporting country, $\hat{\alpha}^*$ depends on profitability differences between different types of firms. The first term is the profitability difference between the average mobile firm and the representative immobile firm, the second term captures the difference between the marginal mobile firm and the average mobile firm. The latter is unambiguously negative since $\bar{c}^* - \tilde{c}^* < 0$. As shown above, the firm-exporting domestic country chooses a non-distorting tax system with $\hat{\alpha} = 1 + r$ if the profitability difference between the mobile and the immobile firms is zero. If we apply the same assumption, $\frac{F^*}{K_2^*} = \frac{Q^*}{K_1^*}$, the expression in round brackets is reduced to $\frac{(1-\gamma^*)\bar{c}^* - \tilde{c}^*}{K_2^*}$ which is negative, too.[11] Thus, in these cases, the foreign country would choose to subsidize investment by setting $\hat{\alpha}^* > 1 + r$. The reason is that the marginal mobile firm is less profitable than the average firm (of both, immobile and mobile ones). Then, the government has an incentive to redistribute the tax burden from the marginal

[11] This is also true, if different concepts of 'equal profitability' are considered. Assuming $\frac{F^* - \bar{c}^*}{K_2^*} = \frac{Q^*}{K_1^*}$ yields $\frac{\bar{c}^* - \tilde{c}^*}{K_2^*} < 0$, assuming $\frac{F^* - \tilde{c}^*}{K_2^*} = \frac{Q^*}{K_1^*}$ yields $\frac{(1-\gamma^*)(\bar{c}^* - \tilde{c}^*)}{K_2^*} < 0$. If $h^{*\prime} = 1$, which is possible due to the above mentioned foreign firm ownership effect, $\gamma^* = 0$.

to the intramarginal firms, which can be achieved by narrowing the tax base and increasing the tax rate. As in the case of the firm-exporting economy, this policy should be interpreted as a means of price discrimination. If the foreign country has market power, i.e. if M is low, the foreign government may have the incentive to manipulate the interest rate, too.

We may summarize this in

Proposition 3 *The small open firm-importing economy has an interest to subsidize investment if mobile firms and immobile firms are of equal profitability. If mobile firms are more profitable than immobile firms, the optimal policy may tax or subsidize the marginal investment.*

3 Discussion and concluding remarks

The analysis in the preceding section has shown that, under simple assumptions on firm mobility, the efficiency property of a tax system which is neutral for investment vanishes. Depending on the relative profitability of different groups of firms, the optimal tax policy implies a positive tax rate on the marginal investment, or the opposite. How do our results relate to the findings of the existing literature?

Our model can be understood as part of the literature that explains distortionary elements in existing tax systems by the lack of appropriate tax instruments.[12] In the presence of internationally mobile firms the government would like to discriminate between mobile and immobile firms, if these types of firms differ in profitability. The government would set the firm specific tax rate so that each firm would receive its reservation profit (i.e. the profit it could earn abroad). There would be no reason to distort investment. However, in this paper we assume that the government faces informational or political constraints and has no means to do so directly. Given this, the tax base is used as an instrument for price discrimination.

[12] Other examples of this literature are the paper by Haufler & Schjelderup (2000) and Fuest & Hemmelgarn (2005), as discussed in the introductory section. Hong & Smart (2007) show that tax havens can be efficiency enhancing because they allow mobile firms to lower their effective tax rate without leaving the country in which they produce.

Of course, the basic idea that economic distortions are caused by a lack of tax instruments is not without issues. If there are informational constraints, in contrast, one could argue that the government might implement instruments to separate tax-payers according to the unobservable characteristic. This is the case in the model presented by Osmundsen et al. (1998). Here, the government cannot observe firm specific mobility. Therefore, if the government announces high taxes on immobile firms and low taxes on mobile firms, the immobile firms will mimick the mobile firms. However, the government can exploit the fact that firms with high location specific rents and low mobility want to invest more than firms with low location specific rents and high mobility. Therefore, the optimal tax policy will induce the mobile firms to invest less than in the first best. This reduces the incentives of immobile firms to mimick the mobile ones. One way of doing so would be to cut depreciation allowances for the mobile firms.

While in Osmundsen et al. (1998) the distortion of investment is used as a device to separate mobile from immobile firms, we show that the distortion of investment is equally optimal in a pooling equilibrium if mobile firms are more profitable than the average firm. In our model, the distortion of investment is used as a redistribution device between mobile firms and immobile ones. Our model thus relies on a fundamentally different mechanism than the one by Osmundsen et al. (1998).

The optimality of the tax rate cut cum base broadening strategy crucially depends on the relative profitability of mobile firms compared to immobile firms. Helpman, Melitz & Yeaple (2004) develop a model where heterogeneous firms invest abroad if the gain from avoiding trade costs outweighs the cost of maintaing multiple production plants (proximity-concentration trade-off). In their model, only the most productive firms in the export sector decide to invest abroad. They also find empirical support for their results. Devereux, Griffith & Klemm (2002) provide evidence for a positive correlation between profitability and the probability of producing in more than one country. Further evidence can be found in Barba Navaretti & Venables (2004). In terms of our model, this would suggest that the optimal tax policy predicted by our model would be consistent with the empirically observed policy.

Finally, one important assumption made in our analysis is the absence of residence based taxes. In a purely residence based system of capital income taxation, the domestic government would be able to tax firms owned by domestic residents irrespective of where they produce. The problem of firm mobility and tax competition would vanish. Existing tax systems, though, are a mixture of the source and the residence principle. Most taxes levied at the firm level are effectively source based taxes[13] whereas taxes levied at the household level are mostly residence based. The interaction between these taxes depends very much on assumptions on the prevailing system of dividend taxation and the identity of the marginal shareholder. If the marginal shareholder is an international investor, the results of the analysis in this paper continue to hold even in the presence of residence based taxation. If the marginal shareholder is a domestic resident, investment neutrality requires that tax depreciation equals economic depreciation, see Sinn (1990). The benchmark tax policy will thus be different but optimal deviations from investment neutrality are likely to be driven by the same forces as in our model. This is a point to be investigated in future research.

To conclude, the analysis in this paper departs from the observation that the *tax rate cut cum base broadening* reforms implemented by many countries are hard to reconcile with the traditional result from optimal tax theory that the effective tax rate on the marginal investment should be equal to zero. The analysis has shown that firm mobility may be a reason to deviate from investment neutrality. The direction of the deviation, though, is ambiguous. Our analysis confirms the proposition made by Bond (2000) that a *tax rate cut cum base broadening* policy may be optimal if mobile firms are highly profitable. However, if mobile firms are less profitable than the average in the economy, a tax rate increase cum base narrowing policy might be optimal, too. This could be true in the presence of high location-specific rents.

Thus, our model provides an economic rationale for the observed tax policy, which acts as a complementary explanation next to profit shifting and policy-learning. For empirical research, our analysis primarily raises the question of whether more profitable firms are more or less sensitive to tax differences across countries than less profitable firms.

[13] Note that, at the corporate level, most industrialised countries either exempt foreign profits of domestic firms from domestic taxation or defer domestic taxation until repatriation.

References

[1] Auerbach, A. J. (2007). Why Have Corporate Tax Revenues Declined? Another Look, CESifo Economic Studies 53(2): 153–171.

[2] Barba Navaretti, G. & Venables, A. J. (2004). Multinational Firms in the World Economy, Princeton University Press.

[3] Boadway, R., Cuff, K. & Marceau, N. (2002). Inter-Jurisdictional Competition for Firms, International Economic Review 43(3): 761–82.

[4] Bond, S. R. (2000). Levelling Up or Levelling Down? Some Reflections on the ACE and CBIT Proposals, and the Future of the Corporate Tax Base, in S. Cnossen (ed.), Taxing Capital Income in the European Union. Issues and Options for Reform, Oxford University Press, pp. 161–179.

[5] Devereux, M. P., Griffith, R. & Klemm, A. (2002). Corporate Income Tax Reforms and International Tax Competition, Economic Policy 17(2): 450–493.

[6] Fuest, C. (2005). Economic Integration and Tax Policy with Endogenous Foreign Firm Ownership, Journal of Public Economics 89(9-10): 1823–1840.

[7] Fuest, C. & Hemmelgarn, T. (2005). Corporate Tax Policy, Foreign Firm Ownership and Thin Capitalization, Regional Science and Urban Economics 35(5): 508–526.

[8] Gordon, R. H. (1986). Taxation of Investment and Savings in the World Economy, American Economic Review 76(5): 1086–1102.

[9] Gordon, R. H. (1992). Can Capital Income Taxes Survive in Open Economies?, Journal of Finance 47(3): 1159–1180.

[10] Haufler, A. & Schjelderup, G. (2000). Corporate Tax Systems and Cross Country Profit Shifting, Oxford Economic Papers 52(2): 306–325.

[11] Helpman, E., Melitz, M. J. & Yeaple, S. R. (2004). Export versus FDI with Heterogeneous Firms, American Economic Review 94(1): 300–316.

[12] Hong, Q. & Smart, M. (2007). In Praise of Tax Havens: International Tax Planning and Foreign Direct Investment, CESifo Working Paper No. 1942 .

[13] Huizinga, H. & Nielsen, S. B. (1997). Capital Income and Profit Taxation with Foreign Ownership of Firms, Journal of International Economics 42: 149–165.

[14] Lipsey, R. E. (2001). Foreign Direct Investment and the Operations of Multinational Firms: Concepts, History and Data. NBER Working Paper No. 8665.

[15] Osmundsen, P., Hagen, K. P. & Schjelderup, G. (1998). Internationally Mobile Firms and Tax Policy, Journal of International Economics 45(1): 97–113.

[16] Ottaviano, G. I. P. & Thisse, J.-F. (2003). Agglomeration and Economic Geography. CEPR Discussion Paper No. 3838.

[17] Richter, W. & Wellisch, D. (1996). The Provision of Local Public Goods and Factors in the Presence of Firm and Household Mobility, Journal of Public Economics 60: 73–93.

[18] Sinn, H.-W. (1990). Tax Harmonization and Tax Competition in Europe, European Economic Review 34(2-3): 489–504.

Appendix

Appendix 1

In this appendix, the capital market equilibrium is described more precisely. Equilibrium requires (12) or

$$\sum_{m} \left(E^* - C_1^* - K_1^* + E - C_1 - [K_1 + n_c K_2 + (n - n_c)\, K_2^*] \right) = 0$$

Total differentiation with respect to τ, α, τ^* and α^* yields

$$
\begin{aligned}
\frac{dr}{d\tau} &= \frac{\frac{1+r-\alpha}{(1-\tau)^2}\left(\frac{1}{Q_{KK}}+n_c\frac{1}{F_{KK}}\right)+\frac{F-\alpha K_2}{1-\tau^*}\left(K_2^*-K_2\right)}{M\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)} \\
\frac{dr}{d\alpha} &= \frac{-\frac{\tau}{1-\tau}\left(\frac{1}{Q_{KK}}+n_c\frac{1}{F_{KK}}\right)-\frac{\tau K_2}{1-\tau^*}\left(K_2^*-K_2\right)}{M\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)} \\
\frac{dr}{d\tau^*} &= \frac{\frac{1+r-\alpha^*}{(1-\tau^*)^2}\left(\frac{1}{Q^*_{K^*K^*}}+(n-n_c)\frac{1}{F^*_{K^*K^*}}\right)-\frac{F^*-\tilde{c}^*-\alpha^*K_2^*}{1-\tau^*}\left(K_2^*-K_2\right)}{M\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)} \\
\frac{dr}{d\alpha^*} &= \frac{-\frac{\tau^*}{1-\tau^*}\left(\frac{1}{Q^*_{K^*K^*}}+(n-n_c)\frac{1}{F^*_{K^*K^*}}\right)+\frac{\tau^*K_2^*}{1-\tau^*}\left(K_2^*-K_2\right)}{M\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)}
\end{aligned}
$$

where we have used

$$
\begin{aligned}
\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right) &= -\frac{1}{1-\tau}\left(\frac{1}{Q_{KK}}+n_c\frac{1}{F_{KK}}\right)-\frac{1}{1-\tau^*}\left(\frac{1}{Q^*_{K^*K^*}}+(n-n_c)\frac{1}{F^*_{K^*K^*}}\right) \\
&\quad +\frac{\left(K_2-K_2^*\right)^2}{1-\tau^*}-\frac{1}{u''}-\frac{1}{u^{*\prime\prime}}
\end{aligned}
$$

as well as $\frac{\partial n_c}{\partial r}=\frac{K_2^*-K_2}{1-\tau^*}$, $\frac{\partial n_c}{\partial \tau}=-\frac{F-\alpha K_2}{1-\tau^*}$, $\frac{\partial n_c}{\partial \alpha}=\frac{\tau K_2}{1-\tau^*}$, $\frac{\partial n_c}{\partial \tau^*}=\frac{F^*-\alpha^*K_2^*}{1-\tau^*}-\frac{\tilde{c}^*}{1-\tau^*}$, $\frac{\partial n_c}{\partial \alpha^*}=-\frac{\tau^*K_2^*}{1-\tau^*}$.

Appendix 2

This appendix derives equation (16) in the text.

The optimality condition for τ can be rewritten as

$$
\begin{aligned}
0 &= \left(h'-1\right)\left(\left(Q-\hat{\alpha}K_1\right)+n\left(F-\hat{\alpha}K_2\right)\right) \\
&\quad +h'\hat{\tau}\frac{1+r-\hat{\alpha}}{1-\hat{\tau}}\frac{1+r-\hat{\alpha}}{\left(1-\hat{\tau}\right)^2}\left(\frac{1}{Q_{KK}}+n\frac{1}{F_{KK}}\right)+\frac{\partial W}{\partial r}\frac{\partial r}{\partial \tau}
\end{aligned}
$$

the left hand side of which replaces the right hand side of the modified optimality condition for α:

$$\begin{aligned} 0 &= -(h'-1)\hat{\tau}(K_1+nK_2) \\ &\quad -h'\hat{\tau}\frac{1+r-\hat{\alpha}}{1-\hat{\tau}}\left(\frac{\hat{\tau}}{1-\hat{\tau}}\right)\left(\frac{1}{Q_{KK}}+n\frac{1}{F_{KK}}\right)+\frac{\partial W}{\partial r}\frac{\partial r}{\partial \alpha} \end{aligned}$$

from which follows

$$\begin{aligned} h'\hat{\tau}\frac{1+r-\hat{\alpha}}{1-\hat{\tau}}\left(\frac{1}{Q_{KK}}+n\frac{1}{F_{KK}}\right) &= -\frac{1-\hat{\tau}}{\hat{\tau}}(h'-1)\hat{\tau}(K_1+nK_2) \\ &\quad +\frac{1-\hat{\tau}}{\hat{\tau}}\frac{\partial W}{\partial r}\frac{\partial r}{\partial \alpha} \end{aligned}$$

Replace in the equation for τ and modify:

$$\begin{aligned} 0 &= (h'-1)(K_1+nK_2)\left[\frac{Q+nF}{K_1+nK_2}-F_K\right] \\ &\quad +\left(\frac{1}{\hat{\tau}}\frac{\partial r}{\partial \alpha}\frac{1+r-\hat{\alpha}}{1-\hat{\tau}}+\frac{\partial r}{\partial \tau}\right)\frac{\partial W}{\partial r} \end{aligned}$$

If $n_c = n$, the expressions in appendix 1 read $\frac{dr}{d\tau} = \frac{1}{M}\frac{1+r-\alpha}{(1-\tau)^2}\left(\frac{1}{Q_{KK}}+n_c\frac{1}{F_{KK}}\right)/\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)$ and $\frac{dr}{d\alpha} = -\frac{1}{M}\frac{\tau}{1-\tau}\left(\frac{1}{Q_{KK}}+n_c\frac{1}{F_{KK}}\right)/\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)$. It follows that the third term (expression in round brackets) becomes zero. This implies that public good provision is efficient: $h'-1$. Using this result in the optimality condition for α, we may write

$$\frac{\partial W}{\partial r}\frac{\partial r}{\partial \alpha} = h'\hat{\tau}\frac{1+r-\hat{\alpha}}{1-\hat{\tau}}\frac{\hat{\tau}}{1-\hat{\tau}}\left(\frac{1}{Q_{KK}}+n\frac{1}{F_{KK}}\right)$$

Using the expressions for $\frac{\partial W}{\partial r}$ and $\frac{\partial r}{\partial \alpha}$, this reads as

$$\hat{\alpha} = 1+r+\frac{S/M}{\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)\frac{\hat{\tau}}{1-\hat{\tau}}\left(1+\frac{\frac{1}{1-\hat{\tau}}\left(\frac{1}{Q_{KK}}+n\frac{1}{F_{KK}}\right)}{M\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)}\right)}$$

With $\Omega_0 = \left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)\frac{\hat{\tau}}{1-\hat{\tau}}\left(1+\frac{\frac{1}{1-\hat{\tau}}\left(\frac{1}{Q_{KK}}+n\frac{1}{F_{KK}}\right)}{M\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)}\right) > 0$ the equation in the text follows.

Appendix 3

This appendix derives equation (20) in the text.

The optimality condition for τ can be rewritten as

$$\begin{aligned} 0 &= (h'-1)\left[(Q-\hat{\alpha}K_1)+n_c(F-\hat{\alpha}K_2)\right]+h'\hat{\tau}\left[(Q_K-\hat{\alpha})\frac{\partial K_1}{\partial \tau}+n_c(F_K-\hat{\alpha})\frac{\partial K_2}{\partial \tau}\right] \\ &\quad +\frac{\partial W}{\partial r}\frac{\partial r}{\partial \tau}-h'\frac{\hat{\tau}}{1-\hat{\tau}^*}(F-\hat{\alpha}K_2)^2 \end{aligned}$$

Now consider the optimality condition for α. Multiplying both sides of the equation by $\frac{F-\hat{\alpha}K}{\hat{\tau}K}$ gives

$$\begin{aligned} 0 &= (h'-1)\left[K_1+n_cK_2\right]\frac{F-\hat{\alpha}K_2}{K_2}-h'\left[(Q_K-\hat{\alpha})\frac{\partial K_1}{\partial \alpha}+n_c(F_K-\hat{\alpha})\frac{\partial K_2}{\partial \alpha}\right]\frac{(F-\hat{\alpha}K_2)}{K} \\ &\quad -\frac{\partial W}{\partial r}\frac{\partial r}{\partial \alpha}\frac{F-\hat{\alpha}K_2}{\hat{\tau}K_2}-h'\frac{\hat{\tau}}{1-\hat{\tau}^*}(F-\hat{\alpha}K_2)^2 \end{aligned}$$

Now replace the last term on the right hand side with the corresponding expressions out of the above $\hat{\tau}$-equation: It follows:

$$\begin{aligned} &0=(h'-1)\left(\left[K_1+n_cK^2\right]\frac{F-\hat{\alpha}K_2}{K_2}-\left[(Q-\hat{\alpha}K_1)+n_c\left(F-\hat{\alpha}K^2\right)\right]\right) \\ &+h'\frac{1+r-\hat{\alpha}}{1-\hat{\tau}}\frac{\hat{\tau}}{1-\hat{\tau}}\left[\frac{F-\hat{\alpha}K_2}{K_2}-\frac{1+r-\hat{\alpha}}{1-\hat{\tau}}\right]\left[\frac{1}{Q_{KK}}+n_c\frac{1}{F_{KK}}\right] \\ &-\frac{\partial W}{\partial r}\left(\frac{\partial r}{\partial \alpha}\frac{F-\hat{\alpha}K_2}{\hat{\tau}K_2}+\frac{\partial r}{\partial \tau}\right) \end{aligned}$$

Using appendix 1, we can write

$$\frac{\partial r}{\partial \alpha}\frac{F-\hat{\alpha}K}{\hat{\tau}K}+\frac{\partial r}{\partial \tau}=-\frac{\frac{1}{1-\hat{\tau}}\left(\frac{F}{K}-F_K\right)\left(\frac{1}{Q_{KK}}+n_c\frac{1}{F_{KK}}\right)}{M\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)}$$

With the expression for $\frac{\partial W}{\partial r}$ in the text, it follows:

$$
\begin{aligned}
0 &= (h'-1)\left[K_1+n_c K^2\right]\left(\frac{F}{K_2}-\frac{Q+n_cF}{K_1+n_cK^2}\right) \\
&+h'\frac{1+r-\hat{\alpha}}{1-\hat{\tau}}\frac{\hat{\tau}}{1-\hat{\tau}}\left[\frac{1}{Q_{KK}}+n_c\frac{1}{F_{KK}}\right]\left[\frac{F}{K}-F_K\right]\left[\frac{M\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)-\frac{1}{1-\hat{\tau}}\left(\frac{1}{Q_{KK}}+n_c\frac{1}{F_{KK}}\right)}{M\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)}\right] \\
&+\left[S-h'\hat{\tau}\left(F-\hat{\alpha}K_2\right)\frac{\partial\tilde{c}^*}{\partial r}\right]\left(\frac{\frac{1}{1-\hat{\tau}}\left(\frac{F}{K}-F_K\right)\left(\frac{1}{Q_{KK}}+n_c\frac{1}{F_{KK}}\right)}{M\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)}\right)
\end{aligned}
$$

which can be transformed into

$$
\begin{aligned}
\hat{\alpha} &= 1+r+\left(\frac{h'-1}{h'}\right)\frac{K_1\left(\frac{F}{K_2}-\frac{Q}{K_1}\right)}{\frac{\hat{\tau}}{(1-\hat{\tau})^2}\left[\frac{1}{Q_{KK}}+n_c\frac{1}{F_{KK}}\right]\left[\frac{F}{K}-F_K\right]\left[\frac{M\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)+\frac{1}{1-\hat{\tau}}\left(\frac{1}{Q_{KK}}+n_c\frac{1}{F_{KK}}\right)}{M\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)}\right]} \\
&\quad+\frac{-h'\hat{\tau}\left(F-\hat{\alpha}K_2\right)\frac{\partial\tilde{c}^*}{\partial r}}{h'\frac{\hat{\tau}}{(1-\hat{\tau})}\left[M\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)+\frac{1}{1-\hat{\tau}}\left(\frac{1}{Q_{KK}}+n_c\frac{1}{F_{KK}}\right)\right]}
\end{aligned}
$$

We use

$$
\begin{aligned}
\Omega_1 &= -\frac{\left(\frac{h'-1}{h'}\right)K_1}{\frac{\hat{\tau}}{(1-\hat{\tau})^2}\left[\frac{1}{Q_{KK}}+n_c\frac{1}{F_{KK}}\right]\left[\frac{F}{K}-F_K\right]\left[\frac{M\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)+\frac{1}{1-\hat{\tau}}\left(\frac{1}{Q_{KK}}+n_c\frac{1}{F_{KK}}\right)}{M\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)}\right]} > 0 \\
\Omega_2 &= h'\frac{\hat{\tau}}{(1-\hat{\tau})}\left[\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)+\frac{1}{M(1-\hat{\tau})}\left(\frac{1}{Q_{KK}}+n_c\frac{1}{F_{KK}}\right)\right] > 0
\end{aligned}
$$

in order to show that

$$
\hat{\alpha} = 1+r-\Omega_1\left(\frac{F}{K_2}-\frac{Q}{K_1}\right)+\frac{S-h'\hat{\tau}\left(F-\hat{\alpha}K_2\right)\frac{\partial\tilde{c}^*}{\partial r}}{\Omega_2 M}
$$

Appendix 4

This appendix derives equation (24) in the text. The optimality condition for τ^* can be written as

$$\begin{aligned} 0 &= \left(h^{*\prime}-1\right)\left(Q^*-\hat{\alpha}^*K_1^*\right)+h^{*\prime}\left(n-n_c\right)\left(F^*-\bar{c}^*-\hat{\alpha}^*K_2^*\right) \\ &\quad +h^{*\prime}\hat{\tau}^*\frac{\left(1+r-\hat{\alpha}^*\right)^2}{\left(1-\hat{\tau}^*\right)^3}\left[\frac{1}{Q_{KK}^*}+\left(n-n_c\right)\frac{1}{F_{KK}^*}\right]+\frac{\partial W^*}{\partial r}\frac{\partial r}{\partial \tau^*} \\ &\quad -h^{*\prime}\frac{\hat{\tau}^*}{1-\hat{\tau}^*}\left(F^*-\tilde{c}^*-\hat{\alpha}^*K_2^*\right)^2 \end{aligned}$$

Multiplying the optimality condition for α^* by $\hat{\tau}^*\frac{\left(F^*-\tilde{c}^*-\hat{\alpha}^*K_2^*\right)}{K_2^*}$, it follows

$$\begin{aligned} 0 &= -\left[\left(h^{*\prime}-1\right)K_1^*+h^{*\prime}\left(n-n_c\right)K_2^*\right]\frac{\left(F^*-\tilde{c}^*-\hat{\alpha}^*K_2^*\right)}{K_2^*}+\frac{1}{\hat{\tau}^*}\frac{\partial W^*}{\partial r}\frac{\partial r}{\partial \alpha^*}\frac{\left(F^*-\tilde{c}^*-\hat{\alpha}^*K_2^*\right)}{K_2^*} \\ &\quad -h^{*\prime}\frac{\hat{\tau}^*}{1-\hat{\tau}^*}\frac{1+r-\hat{\alpha}^*}{1-\hat{\tau}^*}\left[\frac{1}{Q_{KK}^*}+\left(n-n_c\right)\frac{1}{F_{KK}^*}\right]\frac{\left(F^*-\tilde{c}^*-\hat{\alpha}^*K_2^*\right)}{K_2^*} \\ &\quad +h^{*\prime}\frac{\hat{\tau}^*}{1-\hat{\tau}^*}\left(F^*-\tilde{c}^*-\hat{\alpha}^*K_2^*\right)^2 \end{aligned}$$

The last term on the right hand side can be replaced by corresponding expression from the above $\hat{\tau}^*$-equation:

$$\begin{aligned} 0 &= -\left[\left(h^{*\prime}-1\right)K_1^*+h^{*\prime}\left(n-n_c\right)K_2^*\right]\frac{\left(F^*-\tilde{c}^*-\hat{\alpha}^*K_2^*\right)}{K_2^*} \\ &\quad +\left(h^{*\prime}-1\right)\left(Q^*-\hat{\alpha}^*K_1^*\right)+h^{*\prime}\left(n-n_c\right)\left(F^*-\bar{c}^*-\hat{\alpha}^*K_2^*\right) \\ &\quad -h^{*\prime}\frac{\hat{\tau}^*}{1-\hat{\tau}^*}\frac{1+r-\hat{\alpha}^*}{1-\hat{\tau}^*}\left[\frac{1}{Q_{KK}^*}+\left(n-n_c\right)\frac{1}{F_{KK}^*}\right]\frac{\left(F^*-\tilde{c}^*-\hat{\alpha}^*K_2^*\right)}{K_2^*} \\ &\quad +h^{*\prime}\hat{\tau}^*\frac{\left(1+r-\hat{\alpha}^*\right)^2}{\left(1-\hat{\tau}^*\right)^3}\left[\frac{1}{Q_{KK}^*}+\left(n-n_c\right)\frac{1}{F_{KK}^*}\right] \\ &\quad +\frac{\partial W^*}{\partial r}\frac{\partial r}{\partial \alpha^*}\frac{\left(F^*-\tilde{c}^*-\hat{\alpha}^*K_2^*\right)}{\hat{\tau}^*K_2^*}+\frac{\partial W^*}{\partial r}\frac{\partial r}{\partial \tau^*} \end{aligned}$$

Using appendix 1, we can write

$$
\begin{aligned}
&\frac{\partial r}{\partial \alpha^*}\frac{(F^*-\tilde{c}^*-\hat{\alpha}^* K_2^*)}{\hat{\tau}^* K_2^*}+\frac{\partial r}{\partial \tau^*} \\
=&\ -\left(\frac{1}{1-\hat{\tau}^*}\frac{1}{Q^*_{K^*K^*}}+(n-n_c)\frac{1}{1-\hat{\tau}^*}\frac{1}{F^*_{K^*K^*}}\right)\frac{\frac{F^*-\tilde{c}^*}{K_2^*}-F^*_{K^*}}{M\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)}
\end{aligned}
$$

Now, use the expression for $\frac{\partial W^*}{\partial r}$ in the text and rewrite

$$
\begin{aligned}
0 \;=\;& \left[\left(h^{*\prime}-1\right)K_1^*+h^{*\prime}\left(n-n_c\right)K_2^*\right]\left(\frac{(F^*-\tilde{c}^*)}{K_2^*}-\frac{\left(h^{*\prime}-1\right)Q^*+h^{*\prime}\left(n-n_c\right)\left(F^*-\bar{c}^*\right)}{\left(h^{*\prime}-1\right)K_1^*+h^{*\prime}\left(n-n_c\right)K_2^*}\right) \\
&+h^{*\prime}\left(1+r-\hat{\alpha}^*\right)\frac{\hat{\tau}^*}{\left(1-\hat{\tau}^*\right)^2}\left[\frac{1}{Q^*_{KK}}+\left(n-n_c\right)\frac{1}{F^*_{KK}}\right] \\
&\left(\frac{F^*-\tilde{c}^*}{K_2^*}-F^*_{K^*}\right)\left(1+\frac{\frac{1}{1-\hat{\tau}^*}\frac{1}{Q^*_{K^*K^*}}+\left(n-n_c\right)\frac{1}{1-\hat{\tau}^*}\frac{1}{F^*_{K^*K^*}}}{M\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)}\right) \\
&+\left(S^*+h^{*\prime}\frac{\hat{\tau}^*}{1-\hat{\tau}^*}\left(F^*-\hat{\alpha}^*K_2^*\right)\left(K_2-K_2^*\right)\right) \\
&\left(\frac{1}{1-\hat{\tau}^*}\frac{1}{Q^*_{K^*K^*}}+\left(n-n_c\right)\frac{1}{1-\hat{\tau}^*}\frac{1}{F^*_{K^*K^*}}\right)\frac{\frac{F^*-\tilde{c}^*}{K_2^*}-F^*_{K^*}}{M\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)}
\end{aligned}
$$

which can be expressed as

$$
\begin{aligned}
\hat{\alpha}^* \;=\;& 1+r+\frac{\left[\left(\frac{h^{*\prime}-1}{h^{*\prime}}\right)K_1^*+\left(n-n_c\right)K_2^*\right]\left(\frac{(F^*-\tilde{c}^*)}{K_2^*}-\frac{(h^{*\prime}-1)Q^*+h^{*\prime}(n-n_c)(F^*-\bar{c}^*)}{(h^{*\prime}-1)K_1^*+h^{*\prime}(n-n_c)K_2^*}\right)}{\frac{\hat{\tau}^*}{(1-\hat{\tau}^*)^2}\left[\frac{1}{Q^*_{KK}}+\left(n-n_c\right)\frac{1}{F^*_{KK}}\right]\left(\frac{F^*-\tilde{c}^*}{K_2^*}-F^*_{K^*}\right)\left(1+\frac{\frac{1}{1-\hat{\tau}^*}\frac{1}{Q^*_{K^*K^*}}+(n-n_c)\frac{1}{1-\hat{\tau}^*}\frac{1}{F^*_{K^*K^*}}}{M\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)}\right)} \\
&+\frac{S^*+h^{*\prime}\frac{\hat{\tau}^*}{1-\hat{\tau}^*}\left(F^*-\hat{\alpha}^*K_2^*\right)\left(K_2-K_2^*\right)}{h^{*\prime}\frac{\hat{\tau}^*}{1-\hat{\tau}^*}\left(M\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)+\left(\frac{1}{1-\hat{\tau}^*}\frac{1}{Q^*_{K^*K^*}}+\left(n-n_c\right)\frac{1}{1-\hat{\tau}^*}\frac{1}{F^*_{K^*K^*}}\right)\right)}
\end{aligned}
$$

We use

$$
\begin{aligned}
\Omega_1^* \;=\;& -\frac{\left[\left(\frac{h^{*\prime}-1}{h^{*\prime}}\right)K_1^*+\left(n-n_c\right)K_2^*\right]}{\frac{\hat{\tau}^*}{(1-\hat{\tau}^*)^2}\left[\frac{1}{Q^*_{KK}}+\left(n-n_c\right)\frac{1}{F^*_{KK}}\right]\left(\frac{F^*-\tilde{c}^*}{K_2^*}-F^*_{K^*}\right)\left(1+\frac{\frac{1}{1-\hat{\tau}^*}\frac{1}{Q^*_{K^*K^*}}+(n-n_c)\frac{1}{1-\hat{\tau}^*}\frac{1}{F^*_{K^*K^*}}}{M\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)}\right)}>0 \\
\Omega_2^* \;=\;& h^{*\prime}\frac{\hat{\tau}^*}{1-\hat{\tau}^*}\left(\left(\frac{\partial S}{\partial r}+\frac{\partial S^*}{\partial r}\right)+\frac{1}{M}\left(\frac{1}{1-\hat{\tau}^*}\frac{1}{Q^*_{K^*K^*}}+\left(n-n_c\right)\frac{1}{1-\hat{\tau}^*}\frac{1}{F^*_{K^*K^*}}\right)\right)>0
\end{aligned}
$$

in order to show that

$$\hat{\alpha}^* = 1 + r - \Omega_1^* \left(\frac{F^* - \tilde{c}^*}{K_2^*} - \frac{\left(\frac{h^{*\prime}-1}{h^{*\prime}}\right) Q^* + (n - n_c)(F^* - \overline{c}^*)}{\left(\frac{h^{*\prime}-1}{h^{*\prime}}\right) K_1^* + (n - n_c) K_2^*} \right) + \frac{S^* + h^{*\prime} \frac{\hat{\tau}^*}{1-\hat{\tau}^*} (F^* - \hat{\alpha}^* K_2^*)(K_2 - K_2^*)}{\Omega_2^* M}$$

or

$$\hat{\alpha}^* = 1 + r - \Omega_1^* \left(\frac{F^* - \tilde{c}^*}{K_2^*} - \frac{F^* - \overline{c}^*}{K_2^*} - \gamma^* \left(\frac{Q^*}{K_1^*} - \frac{F^* - \overline{c}^*}{K_2^*} \right) \right) + \frac{S^* + h^{*\prime} \frac{\hat{\tau}^*}{1-\hat{\tau}^*} (F^* - \hat{\alpha}^* K_2^*)(K_2 - K_2^*)}{\Omega_2^* M}$$

with $\gamma^* = \frac{\left(\frac{h^{*\prime}-1}{h^{*\prime}}\right) K_1^*}{\left(\frac{h^{*\prime}-1}{h^{*\prime}}\right) K_1^* + (n-n_c) K_2^*}$.

Oxford University Centre for Business Taxation Working Paper Series

---

WP09/07 Becker, Johannes and Clemens Fuest, Optimal Tax Policy when Firms are Internationally Mobile

WP09/06 de la Feria, Rita, Place Where the Supply/Activity is Effectively Carried Out as an Allocation Rule: VAT vs. Direct Taxation

WP09/05 Loomer, Geoffrey T., Tax Treaty Abuse: Is Canada responding effectively?

WP09/04 Egger, Peter, Loretz, Simon, Pfaffermayr, Michael and Hannes Winner, Corporate Taxation and Multinational Activity

WP09/03 Simpson, Helen, Investment abroad and adjustment at home: evidence from UK multinational firms

WP09/02 Becker, Johannes and Clemens Fuest, EU Regional Policy and Tax Competition

WP09/01 Altshuler, Rosanne and Harry Grubert, Formula Apportionment: Is it better than the current system and are there better alternatives?

WP08/30 Davies, Ronald B. and Johannes Voget, Tax Competition in an Expanding European Union

WP08/29 Pfaffermayr, Michael, Stöckl, Matthias and Hannes Winner, Capital Structure, Corporate Taxation and Firm Age

WP08/28 Desai, Mihir A. and Dhammika Dharmapala, Taxes, Institutions and Foreign Diversification Opportunities

WP08/27 Buettner, Thiess, Riedel, Nadine and Marco Runkel, Strategic Consolidation under Formula Apportionment

WP08/26 Huizinga, Harry, Voget, Johannes and Wolf Wagner, International Taxation and Takeover Premiums in Cross-border M&As

WP08/25 Barrios, Salvador, Huizinga, Harry, Laeven, Luc and Gaëtan Nicodème, International Taxation and Multinational Firm Location Decisions

WP08/24 Devereux, Michael P., Taxation of Outbound Direct Investment: Economic Principles and Tax Policy Considerations

WP08/23 Fuest, Clemens, The European Commission´s Proposal for a Common Consolidated Corporate Tax Base

WP08/22 de Mooij, Ruud A. and Sjef Ederveen, Corporate Tax Elasticities: A Reader's Guide to Empirical Findings

WP08/21 Loretz, Simon, Corporate taxation in the OECD in a wider context

WP08/20 Dharmapala, Dhammika, What Problems and Opportunities are Created by Tax Havens?

WP08/19 Zodrow, George R., Corporate Income Taxation in Canada

WP08/18 de la Feria, Rita and Michael Walpole, Options for Taxing Financial Supplies in Value Added Tax: EU VAT and Australian GST Models Compared

WP08/17 Maffini, Giorgia and Socrates Mokkas, Transfer-pricing and Measured Productivity of Multinational Firms

WP08/16 Becker, Johannes and Nadine Riedel, Cross-Border Tax Effects on Affiliate Investment - Evidence from European Multinationals

WP08/15 Haufler, Andreas and Marco Runkel, Firms' financial choices and thin capitalization rules under corporate tax competition

WP08/14 Freedman, Judith, Loomer, Geoffrey and John Vella, Alternative Approaches to Tax Risk and Tax Avoidance: Analysis of a face-to-face corporate survey

WP08/13 Keuschnigg, Christian, Corporate Taxation and the Welfare State

WP08/12 Devereux, Michael P. and Simon Loretz, Increased efficiency through consolidation and formula apportionment in the European Union?

WP08/11 Egger, Peter, Loretz, Simon, Pfaffermayr, Michael and Hannes Winner, Firm-specific Forward-looking Effective Tax Rates

WP08/10 Haufler, Andreas, Klemm, Alexander and Guttorm Schjelderup, Economic integration and the relationship between profit and wage taxes

WP08/09 Huizinga, Harry, Voget Johannes and Wolf Wagner, International Taxation and Takeover Premiums in Cross-border M&As

WP08/08 de la Feria, Rita, The EU VAT Treatment of Public Sector Bodies: Slowly Moving in the Wrong Direction

WP08/07 Freedman, Judith and Graeme Macdonald, The Tax Base for CCCTB: The Role of Principles

WP08/06 Crawford, Claire and Judith Freedman, Small Business Taxation

WP08/05 Heinemann, Friedrich and Eckhard Janeba, Viewing tax policy through party-colored glasses: What German politicians believe

WP08/04 Dourado, Ana Paula and Rita de la Feria, Thin Capitalization Rules in the Context of the CCCTB